

Virtual International Scientific Conference on

"Applications of Chemistry in Nanosciences and Biomaterials Engineering"
NanoBioMat 2025 – Winter Edition

26–28 November 2025

Book of Abstracts

APPLICATIONS OF CHEMISTRY IN NANOSCIENCES AND BIOMATERIALS ENGINEERING

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Program

The preliminary program will be published on the official webpage of the conference as well as on the webpage of AOSR on 18.11.2025, as well as in the TEAMS Class. The link for the TEAMS Class will be provided in due time, on or before 24.11.2025.

The topics for the conference include, but are not limited to:

- novel materials;
- surface chemistry;
- air and soil bioremediation;
- composite materials and biomaterials;
- applications of natural compounds and chemical products;
- nanomaterials and bionanomaterials for the controlled release of biologically active molecules;
- bionanoproducts for tissue engineering and regeneration;
- advanced techniques for material processing.
- food science
- circular economy.

Deadlines:

1. Registration: 15.11.2025
2. Extended registration: 23.11.2025
3. Abstract submission: 23.10.2025
4. Extended Abstract Submission: 30.10.2025
5. Acceptance Notification: 03.11.2025
6. Final Program announcement: 24.11.2025
7. Conference: 26-28.11.2025

Registration:

Registration should be done using the link: https://nanobiomat.eu/registration/.
Registration is free for all students and postdoctoral researchers (or equivalent).

Abstract submission:

Abstract should be submitted in MS Word document using the link: https://nanobiomat.eu/registration/ on or before 30.10.2025. The abstract should be 150–300 words and it must contain the title, authors, and their full affiliation.

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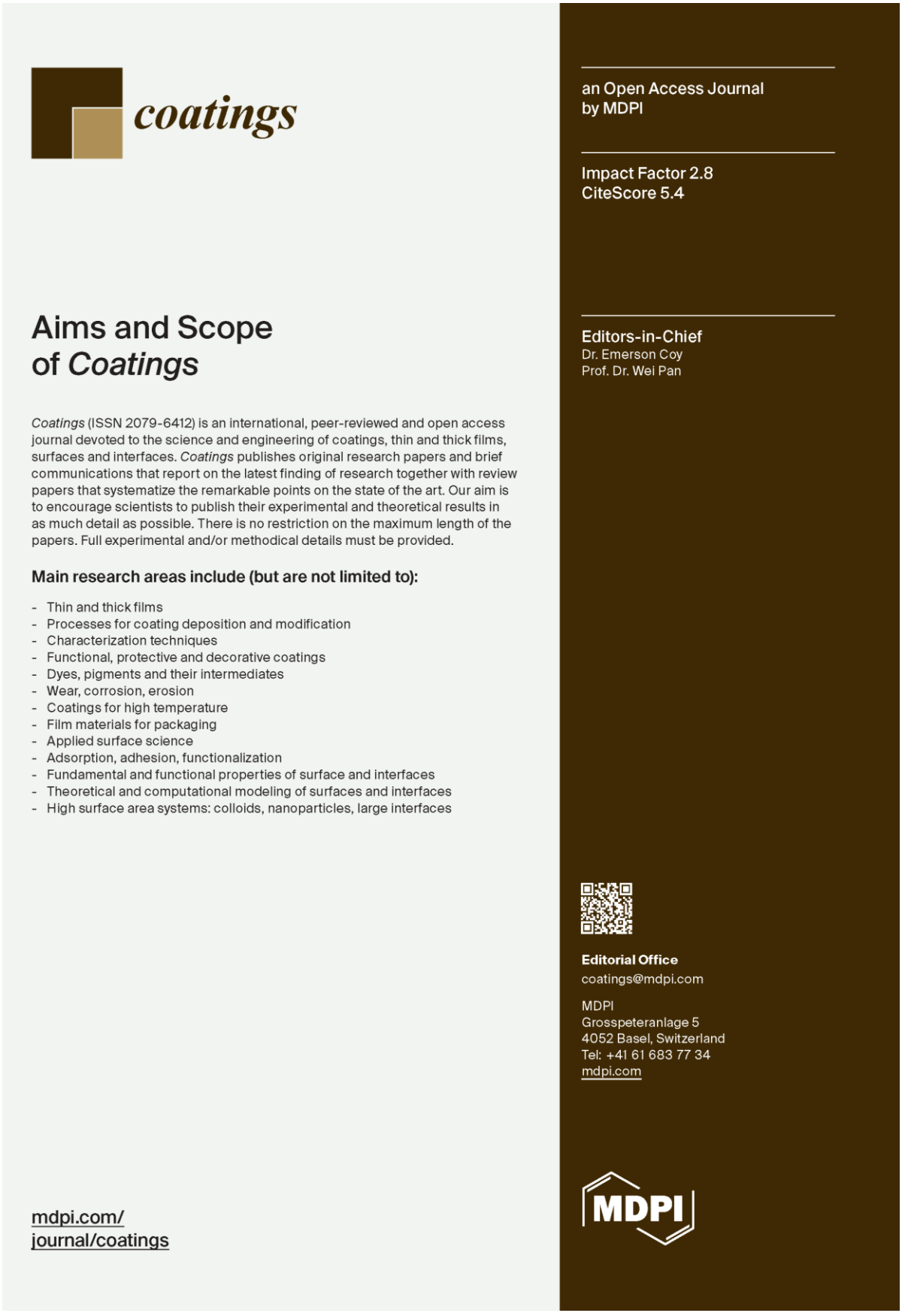

Program (UTC + 2 Bucharest time – winter time)

	Wednesday; 26.11.2025	Thursday; 27.11.2025	Friday; 28.11.2025
8:00-8:30			
8:30-9:00			
9:00-9:30	Registration	Session III Anca MAZARE, Andreea Cristiana DIDILESCU	Session VII Joan CERDA, Angela SPOIALA
9:30-10:00	**OPENING CEREMONY** **Chair: Ecaterina ANDRONESCU**		
	Plenary Session I: Jorg OPITZ, Anton FICAI		
10:00-10:30	*Carbon-Based Metal-Free Electrocatalysts for Clean Energy Conversion and Environmental Remediation;* **Liming DAI**		
10:30-11:00	*Nanoengineered and Coatings for Medicine and Beyond;* **Krasimir VASILEV**		
11:00-11:30	*Design of Calcium Phosphate Ceramics Incorporated into Bone Metabolism for Bone Regeneration;* **Masanobu KAMITAKAHARA**		
11:30-12:00	*Engineering Solutions for Advanced 3D Bioprinting of Microtissues and the Applications;* **Chin Fhong SOON**		
12:00-12:30	*Nanoengineering using Ultrashort Laser Pulses for Diverse Functional Materials;* **Venugopal Rao SOMA**	Plenary SESSION II. Chairs: Sergiu COSERI, Andreea Cristiana DIDILESCU	Plenary SESSION III. Chairs: Gianluca VISCUSI, Angela SPOIALA
12:30-13:00	*Co-Axial Bioprinting: Expanding the Biofabrication Window;* **Angel MATEOS-TIMONEDA**	*Nanostructuring of Valve Metals: Opportunities, Pitfalls, and Insights from TiO_2 Nanotube Case Studies;* **Anca MAZARE**	*Low Immunogenic Decellularized Bioactive Materials for Regenerative Medicine Applications;* **Huaqiong LI**
13:00-13:30	**Lunch Time**	*In Vitro and In Vivo Testing of Pulp Capping Agents based on Calcium Silicates;* **Andreea Cristiana DIDILESCU**	*Nano Anticancer Drugs Are the Need of the Future;* **Ali IMRAN**
13:30-14:00			**CLOSING CEREMONY** **Chair: Ecaterina ANDRONESCU**
14:00-14:30	Session I Viorel NACU; Liliana VERESTIUC	Session V Lluis Marsal; Victor FRUTH	Session VI Miguel Angel MATEOS-TIMONEDA; Lenuta PROFIRE
14:30-15:00			
15:00-15:30	Session II Ridha DJELLABI; Radu Claudiu FIERASCU		
15:30-16:00			
16:00-16:30			
16:30-17:00	Poster Sessions I Cem Bulent USTUNDAG; Denisa FICAI	Poster Sessions III Carlos MARQUES, Irina FIERASCU	Poster Sessions IV Luigi CALABRESE; Andreea IACOB
17:00-17:30	Poster Sessions II Ali IMRAN, Ovidiu OPREA		
17:30-18:00			

Wednesday, 26 November 2025

08:00-08:30		
08:30-09:00		
09:00-09:30	**Registration**	
09:30-10:00	**OPENING CEREMONY** **Chair: Ecaterina ANDRONESCU** **LINK 1**	
10:00-10:30	**PLENARY Session I. Advanced Functional Materials** **Chairs: Jorg OPITZ, Anton FICAI** **LINK 1** **Liming DAI;** *Carbon-Based Metal-Free Electrocatalysts for Clean Energy Conversion and Environmental Remediation*	
10:30-11:00	**Krasimir VASILEV***; Nanoengineered and Coatings for Medicine and Beyond*	
11:00-11:30	**Masanobu KAMITAKAHARA;** *Design of Calcium Phosphate Ceramics Incorporated into Bone Metabolism for Bone Regeneration*	
11:30-12:00	**Chin Fhong SOON;** *Engineering Solutions for Advanced 3D Bioprinting of Microtissues and the Applications*	
12:00-12:30	**Venugopal Rao SOMA;** *Nanoengineering using Ultrashort Laser Pulses for Diverse Functional Materials*	
12:30-13:00	**Miguel Angel MATEOS-TIMONEDA;** *Co-Axial Bioprinting: Expanding the Biofabrication Window*	
13:00-13:30	**LUNCH BREAK**	
13:30-14:00		
14:00-14:30	**SESSION I. Design and Fabrication of Biomaterials (I)** **Chairs: Viorel NACU; Lliliana VERESTIUC** **LINK 1**	**SESSION II. Sustainability and Environmental** **Chairs: Ridha DJELLABI; Radu Claudiu FIERASCU** **LINK 2**
14:30-15:00		
15:00-15:30		
15:30-16:00		
16:00-16:30		
16:30-17:00	**Poster Session I** **Chairs: Cem Bulent USTUNDAG; Denisa FICAI** **LINK 1**	**Poster Session II** **Chairs: Ali IMRAN, Ovidiu OPREA** **LINK 2**
17:00-17:30		
17:30-18:00		

Opening & Closing Ceremony; All Plenary Sessions; Session I, III, V, VII; Poster Session I, III: LINK 1
Session II, IV, VI, VIII; Poster Session II and IV: LINK 2

<table>
<tr><th colspan="3">Thursday, 27 November 2025</th></tr>
<tr><td>9:00-9:30</td><td rowspan="5">SESSION III. Design and Fabrication of Biomaterials (II)
Chairs: Anca MAZARE, Andreea Cristiana DIDILESCU
LINK 1</td><td rowspan="5">SESSION IV. Materials and Technologies for Miscellaneous Applications
Chairs: Herbert Ryan MARINI, Ioana DEMETRESCU
LINK 2</td></tr>
<tr><td>9:30-10:00</td></tr>
<tr><td>10:00-10:30</td></tr>
<tr><td>10:30-11:00</td></tr>
<tr><td>11:00-11:30</td></tr>
<tr><td>11:30-12:00</td><td colspan="2">PLENARY Session II
Chairs: Sergiu COSERI, Andreea Cristiana DIDILESCU
LINK 1</td></tr>
<tr><td>12:00-12:30</td><td colspan="2">Anca MAZARE. Nanostructuring of Valve Metals: Opportunities, Pitfalls, and Insights from TiO_2 Nanotube Case Studies</td></tr>
<tr><td>12:30-13:00</td><td colspan="2">Andreea Cristiana DIDILESCU; In Vitro and In Vivo Testing of Pulp Capping Agents based on Calcium Silicates.</td></tr>
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<tr><td>13:30-14:00</td></tr>
<tr><td>14:00-14:30</td><td rowspan="7">SESSION V. Design and Synthesis of Drugs And Drug Delivery Systems (I)
Chairs: Lluis MARSAL; Victor FRUTH
LINK 1</td><td rowspan="3">SESSION VI. Circular Approaches in Current and Emerging Applications
Chairs: Miguel Angel MATEOS-TIMONEDA; Lenuta PROFIRE
LINK 2</td></tr>
<tr><td>14:30-15:00</td></tr>
<tr><td>15:00-15:30</td></tr>
<tr><td>15:30-16:00</td><td rowspan="4">Poster Session III
Chairs: Carlos MARQUES, Irina FIERASCU
LINK 1</td><td rowspan="4">Poster Session IV
Chairs: Luigi CALABRESE; Andreea-Teodora IACOB
LINK 2</td></tr>
<tr><td>16:00-16:30</td></tr>
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<table>
<tr><th colspan="3">Friday, 28 November 2025</th></tr>
<tr><td>9:30-10:00</td><td rowspan="4">SESSION VII. Design and Synthesis of Drugs and Drug Delivery Systems (II)
Chairs: Joan CERDA, Angela SPOIALA
LINK 1</td><td rowspan="4">SESSION VIII. Natural Compounds and Biomimetic Approaches in Current and Emerging Applications
Chairs: Gianluca VISCUSI, Adrian SURDU
LINK 2</td></tr>
<tr><td>10:00-10:30</td></tr>
<tr><td>10:30-11:00</td></tr>
<tr><td>11:00-11:30</td></tr>
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<tr><td>12:00-12:30</td><td colspan="2">PLENARY Session III
Chairs: Gianluca VISCUSI, Angela SPOIALA
LINK 1

Huaqiong LI; Low Immunogenic Decellularized Bioactive Materials for Regenerative Medicine Applications;</td></tr>
<tr><td>12:30-13:00</td><td colspan="2">Ali IMRAN; Nano Anticancer Drugs Are the Need of the Future;</td></tr>
<tr><td>13:00-13:30</td><td colspan="2">CLOSING CEREMONY – LINK 1
Chair: Ecaterina ANDRONESCU</td></tr>
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Wednesday, 26 November 2025

09:00-09:30 – Registration

09:30-10:00 – OPENING CEREMONY – LINK 1

Chair: Ecaterina ANDRONESCU

Ecaterina ANDRONESCU – President of the Scientific Committee

Andrei ALEXANDRU – President of the Romanian National Research Authority

Doru DELION – President of the Bucharest Branch of Academy or Romanian Scientists

Tudor PRISECARU – President of the Senate of The National University of Science and Technology POLITEHNICA Bucharest and Vice-President of the Romanian National Research Authority

10:00-13:00 – Plenary SESSION I. Advanced Functional Materials – LINK 1

Chairs: Jorg OPITZ, Anton FICAI

10:00-10:30	***Liming DAI*;** Carbon-Based Metal-Free Electrocatalysts for Clean Energy Conversion and Environmental Remediation
10:30-11:00	***Krasimir VASILEV***; Nanoengineered and Coatings for Medicine and Beyond
11:00-11:30	***Masanobu KAMITAKAHARA*;** Design of Calcium Phosphate Ceramics Incorporated into Bone Metabolism for Bone Regeneration
11:30-12:00	***Chin Fhong SOON*;** Engineering Solutions for Advanced 3D Bioprinting of Microtissues and the Applications
12:00-12:30	***Venugopal Rao SOMA*;** Nanoengineering using Ultrashort Laser Pulses for Diverse Functional Materials
12:30-13:00	***Miguel Angel MATEOS-TIMONEDA*;** Co-Axial Bioprinting: Expanding the Biofabrication Window.
13:00-13:30 13:30-14:00	**LUNCH BREAK**

14:00-14:30 14:30-15:00 15:00-15:30 15:30-16:00 16:00-16:30	**SESSION I. Design and Fabrication of Biomaterials (I)** **Chairs: Viorel NACU; Lliliana VERESTIUC** **LINK 1**	**SESSION II. Sustainability and Environmental** **Chairs: Ridha DJELLABI; Radu Claudiu FIERASCU** **LINK**
16:30-17:00 17:00-17:30 17:30-18:00	**Poster Session I** **Chairs: Cem Bulent USTUNDAG; Denisa FICAI** **LINK 1**	**Poster Session II** **Chairs: Ali IMRAN, Ovidiu OPREA** **LINK**

14:00-16:30 – SESSION I. Design and Fabrication of Biomaterials (I) – LINK 1

Chairs: Viorel NACU; Lliliana VERESTIUC

14:00-14:15	***Yaren INAL;*** Determination of the Mechanical Behavior of PCL Tissue Scaffolds Produced by Different 3D Printing Techniques
14:15-14:30	***Mariana JIAN****, Tatiana MARIȚOI, Vitalie COBZAC, Andrei MOSTOVEI, Stella SAMSON, Ana-Maria NACU, Oleg SOLOMON, Viorel NACU*; Collagen Sponges Extracted from the Umbilical-Placental Complex: *In Vivo* Testing on Rats
14:30-14:45	***Valeriana PANTEA****, Ecaterina PAVLOVSCHI, Olga TAGADIUC;* Targeting Erythrocyte Endothelial Nitric Oxide Synthase: *In Vivo* Insights into Copper-Thiosemicarbazone Complex Activity
14:45-15:00	***Dian N KARIMAH****, Abdul WAFI, Fransiska I FEVRIASANTY, Dina DSL ISMAIL, Retno LESTARI;* Scientometric Analysis of Silver Nanoparticles (AgNPs) for Wound Healing Application
15:00-15:15	***Ahmet GÖKTUĞ TÜFEK****, Berkcan ŞENEL, Ayşe Betül BİNGÖL, Elif DURASI, Rabia ÇAKIR, Cem Bülent ÜSTÜNDAĞ, Mehmet Burçin PİŞKİN;* Development of a Bioactive Electrospun Wound Dressing Incorporating Recombinant Human-like Collagen and Ag-Zn Nanoparticles
15:15-15:30	***Zeynep GERGIN****, Aysegul TIRYAKI, Yeliz GOYUK, Elif Zehra ATAKUREN, Songul ULAG, Elif KAYA, Gulgun TINAZ, Ali SAHIN, Semra UNAL;* Fabrication of Biocompatible Polyurethane Foam for Wound Dressing Applications
15:30-15:45	***Saima Zulfiqar,*** *Ahmad Noman, Sana Saleem;* Copper selenide-containing hydrogel as a proactive therapeutic agent for the treatment of wound infections
15:45-16:00	***Alara Nur KIRMIZI****, Dilek Bilgiç ALKAYA, Serap Ayaz SEYHAN, Sümeyye CESUR, Oğuzhan GÜNDÜZ;* Production and Characterization Gamma-Aminobutyric Acid Loaded Composite Scaffold using 3D Printing Technique
16:00-16:15	***Mehmet Alperen ÖZDEMIR****, Ayşe Betül BINGÖL, Büşra OKTAY, Cem Bülent ÜSTÜNDAĞ, Azime ERARSLAN, Ali Can ÖZARSLAN;* Production of a Three-Layer Tissue Scaffold to Support Skin Wound Healing
16:15-16:30	***Sevda GURSOY****, Hilal YILMAZ, Shhd SARAJ, Alpay KOSE, Oguzhan GUNDUZ, Cem Bulent USTUNDAG*; A Potential Biofunctional Biomimetic Multilayer Scaffold for Tracheal Tissue Engineering

14:00-16:30 – SESSION II. Sustainability and Environmental – LINK 2

Chairs: Ridha DJELLABI; Radu Claudiu FIERASCU

14:00-14:20	***Sougata GHOSH***; Phytogenic Nanomedicine: A Sustainable Approach
14:20-14:40	*Nishant KUMAR;* Unlocking the Potential of Biopolymer Composite for Post Harvest Management

14:40-14:55	***Khalida BLOCH*** *and Sougata GHOSH;* Eco-Benign Nanocatalysts: Phytogenic Ag: ZnO Nanoparticles for Pollutant Detoxification
14:55-15:10	***Rania REMMANI*** *and Messaoud ROUMANI;* Visible-Light Biochar-Nanocatalysts for Wastewater Remediation: How Biochar and Iron-Doping Enhance TiO_2 Performance
15:10-15:25	***Gabriela-Mădălina OPRICĂ****, Cătălina-Diana UȘURELU, Cristian-Andi NICOLAE, Marinela Victoria DUMITRU, Valentin RĂDIȚOIU, Denis-Mihaela PANAITESCU, Radu-Claudiu FIERĂSCU, Adriana-Nicoleta FRONE;* Impact of Surface Treatments on Cellulose Nanofibers: A Comparative Study on their Interaction with a Sulfated Polysaccharide
15:25-15:40	***Maria Chiara IANNACO****, Stefania MOTTOLA, Iolanda De MARCO;* Production of Bio-Nanocarriers via Supercritical Emulsion Extraction for Enhanced Stability and Controlled Release of Waste-Derived Enzymes
15:40-15:55	***Hammadi El HARMOUCHI****, Fatima-Zahra JANANI, Safae ALAMI, Oumaima MOUMOUCHE, Noureddine BARKA, Mohamed HARCHARRAS;* Photocatalytic Degradation of Methyl Orange (MO) by $ZnCuP_2O_7$ Pyrophosphate under UV Irradiation
15:55-16:10	***Zineb EL KERDOUDI****, Nouredine EL MEJDOUB;* Study of the Adsorption Mechanisms of Zn(II) And Cu(II) by Red Clay from Morocco
16:1016:25	***Asma BARRAHI****, Mariam BARRAHI, Safaa RHAIMI, Nadia TIMOUDAN, Latifa CHAHIR, Hajar El HARTITI, Nabila CHAHBOUN, Mohamed El FAYDY, Abdelkader ZARROUK;* Adsorption and Inhibitive Properties of Elettaria Cardamomum on Carbon Steel Corrosion in Acidic Media: Experimental and Theoretical Studies

16:30-18:00 – Poster Session I – LINK 1

Chairs: Cem Bulent USTUNDAG; Denisa FICAI

1. ***Irina NEGUT****, Mihaela DINU, Bogdan BITA, Anca Constantina PARAU and Carmen RISTOSCU;* Functionalization of Titanium Implants with Melittin-Vitamin D3-Bioactive Glass Thin Films via Maple
2. ***Anita Ioana VISAN****, Carmen RISTOSCU, Gianina POPESCU-PELIN, Mihai SOPRONYI, Consuela Elena MATEI, Gabriel SOCOL, Mariana Carmen CHIFIRIUC, Coralia BLEOTU, David GROSSIN, Fabien BROUILLET, Sylvain Le GRILL, Ghislaine BERTRAND, Irina ZGURA, Rodica CRISTESCU, Ion N MIHAILESCU;* Bioactive Composites for Osseointegration: A Study Using MAPLE-Deposited Films
3. ***Camelia-Maria CIOBANU****, Veronica SARDARI, Delia MINCHEVICI, Olga TAGADIUC, Nadeja NEGARI, Noushad Juguma HAREES;* The Role of Vitamin D in Hepatorenal Syndrome

4. ***Noushad Juguma HAREES***, *Nadejda NEGARI, Delia MINCHEVICI, Silvia STRATULAT, Veronica SARDARI;* Nano-Assay Integration in Vitamin D and Endocrine Biomarker Profiling: A Biochemical Perspective
5. ***Alicja TOMASIAK***, *Szymon SMOŁKA, Katarzyna KRUKIWEICZ;* Integrating Cytotoxicity and Calcium Imaging Assays to Assess the Biocompatibility and Functional Performance of Neurotransmitter-Loaded Coatings
6. ***Khaoula MZIOUD***, *Nouhaila FERRAA, Sara RACHED, Amar HABSAOUI, Mohamed EBN TOUHAMI;* Enhancing Copper Corrosion Inhibition in Acidic Media Through Functionalized Inorganic–Organic Systems
7. ***Nouhaila FERRAA***, *Moussa OUAKKI, Mariam BARRAHI, Mohammed CHERKAOUI, Mounia Bennani ZIATNI;* Antibacterial and Antifungal Activities of Co-Doped Calcium Phosphate
8. ***Ianina GRAUR***, *Irina USATAIA, Vasilii GRAUR, Victor TSAPKOV, Carolina LOZAN-TIRSU, Greta BALAN, Aurelian GULEA;* Antibacterial Activity of 3D Metal Complexes with 3-(Morpholin-4-yl)Propane-2,3-dione 4-Phenylthiosemicarbazone against Bacillus Cereus
9. ***Vasilii GRAUR***, *Irina USATAIA, Ianina GRAUR, Carolina LOZAN-TIRSU, Aurelian GULEA;* Synthesis and Antifungal Activity of 2-Benzoylpyridine 4-Norbornylthiosemicarbazone and its 3D Metal Complexes
10. ***Szymon SMOŁKA***, *Abdullah ABDULLAH, Sara SHAKIBANIA, Katarzyna KRUKIEWICZ;* Modification of PEDOT by Curcumin: Influence on Surface, Electrochemical and Biological Properties
11. ***Victoria COGANOVSCHI***, *Ecaterina PAVLOVSCHI;* Endogenous Antioxidant Systems and Redox Imbalance in the Pathogenesis of Cataract
12. ***Nadejda NEGARÎ***, *Delia MINCHEVICI, Veronica SARDARI, Tudor BRANIŞTE, Viorel NACU, Vitalie COBZAC;* 4D Printing: Smart, Adaptive Solutions for Next-Gen Biomedical Engineering
13. ***Sara SHAKIBANIA***, *Peng DU, Alireza AKBARINEJAD, Yang HUI, Jadranka TRAVAS-SEJDIC, Katarzyna KRUKIEWICZ*; PEDOT Eutectogels as a Promising Conductive Material for Tissue Engineering
14. **Gheorghe GIURGIU**, Manole COJOCAR; Foods with a Double Role in Nutrition and Health

16:30-18:00 – Poster Session II – LINK 2

Chairs: Ali IMRAN, Ovidiu OPREA

1. ***Daniela C. CULITA,*** *Zdravka PETROVA, Teodora MOCANU, Rossen SPASOV, Radostina ALEXANDROVA, Gabriela MARINESCU;* Selective Cytotoxic Effects of Ru(III) – Schiff Base Complexes Against Human Tumor Cells
2. ***Evgheni GRUŞAC***, *Roman MUNTEANU, Valeriana PANTEA, Olga TAGADIUC, Veronica SARDARI;* The Role of Extracellular Matrix Glycation and Therapeutical Approaches in Cancer
3. ***Evgheni GRUŞAC***, *Roman MUNTEANU, Nadejda NEGARI, Delia MINCHEVICI, Veronica SARDARI*; The Role of Menaquinone in Colorectal Cancer

4. ***Abedulkadir ABUDALLEH**, Tanya ZHIVKOVA, Hristo HRISTOV, Lora DYAKOVA, Teodora MOCANU, Daniela C. CULITA, Augustin M. MADALAN, Gabriela MARINESCU, Radostina ALEXANDROVA;* Cytotoxic Evaluation of Novel Cu(II)–Schiff Base Complexes Derived from O-Vanillin and Amino Acids against Human Melanoma and Cervical Cancer Cells
5. ***Mihail PÎRȚAC;*** Advances in Bioresorbable Stent Technologies for Pancreatic Fluid Collections
6. ***Michaila Akathi PANTELAIOU**, Georgios ROTAS, Stergios PISPAS;* Supramolecular Nanostructures of Aggregation-Induced Emission (AIE) Dye and Amphiphilic Terpolymers
7. ***Mirela ENACHE**, Ana Maria TOADER, Izabella DASCALU;* Spectroscopic Studies of Molecular Interactions Between Quinizarin and Cucurbit [8] Uril Macrocycle
8. ***Maria DRĂGAN**, Cătălina Daniela STAN, Alin FOCȘA, Andreea IACOB, Oana CHIRLIU, Maria APOTROSOAEI, Ioana VASINCU, Alexandru SAVA, Ionuț LUNGU, Lenuța PROFIRE;* The Role of Thiazolidine-4-one Derivatives of Ferulic Acid in Acute and Chronic Inflammation
9. ***Tatiana BECU**, Veronica SARDARI;* The Hedgehog Molecular Signaling Pathway and its Role in The Initiation of Certain Types of Cancer.
10. ***Felicia CAZACU**, Daniela GHINDĂ, Silvia STRATULAT, Veronica SARDARI, Olga TAGADIUC;* Endothelins–MAPK/ERK Axis: A Synergistic Pathway in Tumor Progression
11. ***Alexandra DREMUH**, Beatricie-Marinela RUDIC, Veronica SARDARI;* The Mechanism of Action of Oxytocin on Uterus
12. ***Zakia ARIBOU**, Nidal KHEMMOU, Mohamed Ebn TOUHAMI;* Potential Health Risks Associated with Heavy Metal Leaching from Metallic Cookware
13. ***Camelia Elena TINCU (IURCIUC),** Vasile BURLUI, Marcel POPA, Daniela GHERGHEL, Gabriela VOCHIȚA;* Innovative Nanoparticles based on Human Serum Albumin, with Co-Encapsulated Active Principles that Have Synergistic Effects and Can Overcome the Blood-Brain Barrier
14. ***Anastasia AIRAPETOVA**, Valeriana PANTEA, Ala AMBROS, Silvia STRATULAT, Veronica SARDARI*; Biochemical mechanisms of apoptosis in cancer.

Thursday, 27 November 2025

09:00-12:00 – SESSION III. Design and Fabrication Biomaterials (II) − LINK 1

Chairs: Anca MAZARE, Andreea Cristiana DIDILESCU

9:00-9:20	***Andreea-Teodora IACOB**, Bianca-Ștefania PROFIRE, Maria APOTROSOAEI, Ioana-Mirela VASINCU, Oana-Maria CHIRLIU, Maria DRĂGAN, Alexandru SAVA, Dana BEJAN, Lenuța PROFIRE*; Bioactive Properties of Arginine Niosomes-Loaded Silk Fibroin–Chitosan Hydrogels
9:20-9:40	***Mircea NASUI**, Ramona Bianca SONHER, Ecaterina WARE, Traian PETRISOR, jr., Amalia MESAROS*; Epitaxial Growth of Complex Functional Oxide Thin Films by Chemical Solution Methods
9:40-9:55	***Tanveer ALAM**, Tuba TARAB and Sumit GUPTA*; Bridging the Chemical Profile and Biomedical Effects of Abelia Grandiflora's Essential Oil: A New Approach Toward Aromatherapy
09:55-10:10	***El abdali YOUNESS**;* Biological Activities of Essentials Oils
10:10-10:25	***Fatine EL FARHANI**, Moussa OUAKKI, Benzekri ZAKARIA, Ebn Touhami MOHAMED;* The Experimental Investigation of the Composite Compound of Pyrazole, Pyran, and Furan
10:25-10:40	***Peter I. EJIDIKE**;* Development of Nanomaterials for Various Applications
10:40-10:55	***Ebrar KESKIN**, Elif Zehra ATUKEREN, Guljemile DURDYYEVA, Songul ULAG, Semra UNAL;* Optimization and Fabrication of PVA- Hydrogel based Microneedles
10:55-11:10	***Veronica MANESCU** (PALTANEA), Adrian-Vasile DUMITRU, Gheorghe PALTANEA, Costel PAUN, Iosif Vasile NEMOIANU;* Magnetic Hydrogel: Synthesis and Apllications in Oncology
11:10-11:25	***Zeynep ERDAĞ**, Hale ÖZMERT, Serap Ayaz SEYHAN, Dilek Bilgiç ALKAYA, Sümeyye CESUR SATIÇ;* Green Synthesis and Characterization of Copper Nanoparticles using _ Rheum ribes L. root
11:25-11:40	***Serkan FILETA**, Ceren SIVRITEPE, Serap Ayaz SEYHAN, Dilek Bilgic ALKAYA, Sümeyye CESUR SATIC;* Revolution from Monometallic to Trimetallic Nanoparticles: Synthesis and Characterizations using Calendula Officinalis
11:40-11:55	***Christianah Adebimpe DARE**, Muneerah Iyabo MUHAMMAD, Amidat Olaide EDU, Damilola Sidikat YUSUF;* Influence of Solid-State Fermentation on the Green Synthesis and Properties of Silver Nanoparticles from Annona Muricata Seed Components

09:00-12:00 – SESSION IV. Materials and Technologies for Miscellaneous Applications – LINK 2
Chairs: Herbert Ryan MARINI, Ioana DEMETRESCU

9:00-9:15	***Said ELMOUSSAOUI**, Mohamed KHUILI, Isam ALLAOUID, El Houssine ATMANI, Nejma FAZOUAN;* Density Functional Theory Investigation of the Hydrogen Storage Capacity of Lithium-Decorated TiS_2 Two-Dimensional Material
9:15-9:30	***Radouane ASRI**, Isam ALLAOUI, Mohamed KHUILI, Kenza MAHER, El Houssine ATMANI, Nejma FAZOUAN;* Hydrogen Storage Performance of MXene Zr2CO2 Material Decorated with Li Atoms: A DFT Study
9:30-9:45	***T. SPITALSKA**, J. TOLASZ, A. KNAISLOVA, P. RYSANEK, T. HREBICEK, J. ORAVA;* Hybrid- and Electrospinning of Nanofibrous Membranes for Potential Applications as Battery Separators
9:45-10:00	***Hebat-Allah S. TOHAMY**;* Amylopectin Xerogel with Onion Carbon Dots as a Chemosensor for Chromium and Biosensor for Microbial Spoilage in Tomatoes
10:00-10:15	***Ștefan-Alexandru GAFTONIANU**, Carmen CHIFIRIUC, Alexandra-Cristina BURDUȘEL, Ecaterina ANDRONESCU;* The Evolving Landscape of Lipid-Based Nanoparticles: From Structural Diversity to Intelligent Therapeutic Platforms
10:15-10:30	***Dilara YASAROGLU**, Süheyla KAYA*; Evaluation of Cell Viability on a Three-Dimensional Scaffold Designed for Oral Mucosa
10:30-10:45	***Bogdan PURCĂREANU**, Manuela Diana ENE, Veronica DRUMEA, Mihai Alexandru FLOREA, Sabina Cristiana BĂDULESCU, Mariana Luiza TANASE, Laura OLARIU, Petre BADICA, Dan Eduard MIHAIESCU, Anton FICAI*; A new approach for Chamazulene extraction from Achillea Millefolium and Its antioxidant impact on epithelial models
10:45-11:00	***Sunita SINGH** and Avanish Chandra SHARMA*; The Antimicrobial Paradox of Moringa Oleifera Seed Essential Oil: Chemical Insights and Alternative Mechanisms
11:00-11:15	***Kayra Şimal ÇELIK**, Serap Ayaz SEYHAN, Dilek Bilgiç ALKAYA, Sümeyye CESUR SATIÇ*; Biogenic Synthesis and Antioxidant Activity of Vaccinium Corymbosum L. Based Cu/Zn/Ag Nanoparticles
11:15-11:30	***Duygu Esma OGEN**, Serap AYAZ SEYHAN, Dilek BILGIC ALKAYA, Sumeyye CESUR, Oguzhan GUNDUZ*; Development of γ-Aminobutyric Acid (GABA)-Loaded Nanofibers for Postoperative Adjuvant Therapy
11:30-11:45	***Yasemin Cemile ALTINSU**, Cem Bülent ÜSTÜNDAĞ, Selcen Arı YUKA, Kaan DANIŞ;* Design and Development of Cardiac Occluders with Enhanced Properties Using PLA-Based Biofunctional Structures
11:45-12:00	***Ioana ION,** Ciprian Mihai MITU, Emanuel Virgil MARINESCU, Andrei CUCOS, Alina Ruxandra CARAMITU, Cristina Antoanela BANCIU, Mihai MARIN, Nicoleta Oana NICULA*; Effect of Graphene Oxide on the Polymeric Hydrogel Properties

12:00-13:00 – Plenary SESSION II. Advanced Functional Materials − LINK 1
Chairs: Sergiu COSERI, Andreea Cristiana DIDILESCU

12:00-12:30 ***Anca MAZARE*.** Nanostructuring of Valve Metals: Opportunities, Pitfalls, and Insights from TiO_2 Nanotube Case Studies;

12:30-13:00 ***Andreea Cristiana DIDILESCU*;** *In Vitro* and *In Vivo* Testing of Pulp Capping Agents based on Calcium Silicates.

13:00-14:00 – LUNCH BREAK

14:00-16:30 – SESSION V. Design and Synthesis of Drugs and Drug Delivery Systems (I)− LINK 1
Chairs: Lluis Marsal; Victor FRUTH

14:00-14:15 ***Alexandr ZIBERT***, *Natalia BESHCHASNA, Jörg OPITZ, Anne BERHARDT;* Application of Hollow Mesoporous Hydroxyapatite Nanoparticles in Dental Tissue Engineering and Perspectives of Development

14:15-14:30 ***Ebru UYSAL***, *Gozde ENGUVEN, Hasan EGE, Fulya Dal YONTEM, Gokhan AGTURK, Oguzhan GUNDUZ, Cem Bulent USTUNDAG, Zeynep Ruya EGE;* Biofunctional Dual-Layered 3D-Printed PCL/Gelatin Biopatches Functionalized with Natural and Synthetic Antibacterial Agents

14:30-14:45 ***Tuğçe KÜÇÜKALI***, *Dilek Bilgiç ALKAYA, Serap Ayaz SEYHAN, Sümeyye CESUR SATIÇ, Oğuzhan GÜNDÜZ;* Characterization of Glucosamine/Chondroitin Sulphate Doped Hydroxyapatite for Bone Defect

14:45-15:00 ***Vitalie COBZAC***, *Mariana JIAN, Ludmila MOTELICA, Iana BARANEȚCHI, Ovidiu Cristian OPREA, Liliana VEREȘTIUC, Roxana TRUȘCA, Anton FICAI, Viorel NACU;* Bioactive ZnO Composite Scaffold for Tissue Regeneration

15:00-15:15 ***Melih Musa AYRAN***, *Muhammet Sefa IZGORDU, Zehra KANLI, Banu AYDIN, Oguzhan GUNDUZ, Songul ULAG;* Fabrication and Characterization of Magnetic Field Assisted 3D Printed Ferromagnetic Nanoparticle Loaded Scaffolds for Tissue Engineering

15:15-15:30 ***Anca TOMA***, *Isabella NACU, Liliana VEREȘTIUC*; 3D (Bio)Printing of Polymeric Scaffolds for Soft Tissue Regeneration

15:30-15:45 ***Vitalie COBZAC***, *Mariana JIAN, Igor CASIAN, Ana CASIAN, Iana BARANEȚCHI, Radu CAZACU, Liliana VEREȘTIUC, Viorel NACU*; Sequential Vacuum Loading of Demineralized Bone Matrix with Vancomycin and Human Albumin for Controlled Antibiotic Release

15:45-16:00 ***Akanksha SHRIVASTAVA*** *and Surendra Prakash GUPTA; In-silico* and *In-vitro* Study of Synthesized Imidazole-Halo Chalcones

14:00-16:30 – SESSION VI. Circular Approaches in Current and Emerging Applications – LINK 2

Chairs: Miguel Angel MATEOS-TIMONEDA; Lenuta PROFIRE

14:00-14:15	***Zakir HUSSAIN**, Thomas L. MADANU;* From Lab to Pilot Scale: Biomass Conversion with a Novel Sustainable Catalyst
14:15- 14:30	*Eda SALIH, Songul ULAG, Semra UNAL, **Omer Faruk YAVUZ**;* Coating of Marine Steel with Polyvinyl Alcohol//Chitosan/Graphene Oxide
14:30-14:45	***Safaa RHAIMI**, Mariam BARRAHI, Asmaa BARRAHI, Moussa OUAKKI;* Electrochemical Evaluation of Salvia officinalis L Essential Oil as a Green Corrosion Inhibitor for Mild Steel in Acidic Media
14:4515:00	***Raluca-Maria TABULEAC**, Tiberiu Vlad SIMION, Elena Diana UNGUREANU COMĂNIȚĂ, Maria GAVRILESCU;* Tourism Employment in the European Union: Structural Dynamics and Implications for the Circular Economy
15:00-15:15	***Radu NARTITA**, Florentina GOLGOVICI, Ioana DEMETRESCU;* Electrodeposition from NADES of a Naproxen-Loaded Polypyrrole Coating on a High-Entropy Alloy
15:15-15:30	***Maitri NANDASANA** and Sougata GHOSH;* Green Synthesis of Hybrid Zinc Oxide Nanoflowers from Leucophyllum frutescence for Enhanced Photocatalysis and Antibacterial Synergy
15:30-15:45	***Zainab Hussaina IBRAHIM**, Zulkarnain ZAINAL, Lim Hong NGEE, Adila Mohamad JAAFAR and Mohd Haniff WAHID;* Synergistic Photodegradation of Tetracycline and Direct Red 81 using ZnAl Layered Double Oxide: A Step toward Realistic Wastewater Remediation
15:45-16:00	***Mariam BARRAHI**, Asma Barrahi, Safaa RHAIMI, Hajar EL HARTIT, Nabila CHAHBOUN, Mohammed OUHSSINE;* Electrochemical Study of the Inhibitory Effect of Anise Seed Essential Oil on the Corrosion of Carbon Steel in 1M Hydrochloric Acid Medium
16:00-16:15	***Mohd Haniff WAHID**, Zulkarnain ZAINAL, Lim Hong NGEE, Adila Mohamad JAAFAR and Zainab Hussaina IBRAHIM;* Development of Cu–Fe Modified ZnAl Layered Double Hydroxide for Efficient UV-Assisted Dye Degradation

16:30-18:00 – Poster Session III – LINK 1

Chairs: Carlos MARQUES, Irina FIERASCU

1. ***Cezara-Marina BOLOCAN**, Vasile Adrian SURDU, Anton FICAI and Ecaterina ANDRONESCU;* Smart Biomaterials' Potential Applications in Tissue Engineering

2. ***Dana GINGASU**, Adelina-Carmen IANCULESCU, Bogdan Stefan VASILE, Vasile-Adrian SURDU, Gabriela MARINESCU, Roxana Doina TRUSCA, Constantin-Daniel NEGUT, Simona SOMACESCU, Jose Maria CALDERON MORENO, Silviu PREDA, Daniela C. CULITA;* Green Synthesis of Cobalt-Zinc Aluminates Using Plant-Based Extract
3. ***Angelika BANAŚ**, Jincymol KAPPEN, Katarzyna KRUKIEWICZ;* Engineering Graphene–Gold Nanoparticle Hybrids for Enhanced Biosensing Interfaces
4. ***Iuliana GLINSCHI**, Veronica SARDARI, Svetlana PROTOPOP;* Effects of the Ketogenic Diet on Microbiota Composition and Short-Chain Fatty Acids in Obesity
5. ***Pavel AFTINESCU**, Cristina MARTIN, and Svetlana PROTOPOP;* Gut Microbiota-derived Metabolites as Molecular Regulators of Appetite
6. ***Oxana FRUNZE**, Cristina MARTÎN, Svetlana PROTOPOP;* Compensatory Hyperinsilinemia: Consequences on Hepatic and Muscular Metabolism
7. ***Delia MINCHEVICI**, Nadejda NEGARÎ, Angela GÎLEA, Stela VUDU, Viorel NACU, Vitalie COBZAC, Alin BOUR, Veronica SARDARI;* Integrating Nanotechnology and Natural Compounds in Alternative Approaches for Thyroid Disorders
8. ***Lorina CIOBANU;*** Nanostructured Endovascular Materials for Durable Cerebral Aneurysm Repair
9. ***Andreea CASIAN**, Feodora TRIBOI, Nadejda NEGARI, Delia MINCHEVICI, Veronica SARDARI;* Dysfunction of the Glutation-Glutation Peroxidase 4 Antioxidant System Mediated by p53 and its Impact on Neuronal Ferroptosis in Aging
10. ***Daniela GHINDĂ**, Felicia CAZACU, Eugeniu SIMIONICĂ, Svetlana PROTOPOP, Veronica SARDARI;* The Role of Sirtuins in Molecular Anti-Aging Mechanisms: Biochemical and Therapeutic Perspectives
11. ***Andreea CASIAN**, Andreea GUZUN, Nadejda NEGARI, Delia MINCHEVICI, Veronica SARDARI;* Oxidative Stress – One of the Biochemical Mechanisms of Brain Aging
12. ***Marian RAȘCOV**, Angela SPOIALĂ, Ludmila MOTELICA, Ovidiu-Cristian OPREA, Roxana Doina TRUȘCĂ, Otilia-Ruxandra VASILE, Vasile-Adrian SURDU, Denisa FICAI, Anton FICAI, and Ecaterina ANDRONESCU*; Hybrid Chitosan – Gelatin Hydrogels Reinforced with 45S5 Bioactive Glass and Vancomycin for Bone-Targeted Applications
13. ***Muhtadi IDREES**, Luigi CALABRESE*; MOF – PVP Composite Coatings for Adsorption Heat Pump Applications
14. ***Mengistu GELAW**, Davide PALAMARA and Luigi CALABRESE*; Hydrothermal Aging of Silica Gel/Nexar Composite Coatings for Thermal Energy Storage.

16:30-18:00 – Poster Session IV – LINK 2

Chairs: Luigi CALABRESE; Andreea-Teodora IACOB

1. ***Khalid BOUAICHE**, Hamid LOULIJAT;* Enhancing Parabolic Trough Collector (PTC) Thermal Performance through Nanoparticle Integration: A Nanomaterial Approach for Sustainable Energy Solutions
2. ***Thomas L. MADANU**, Zakir HUSSAIN, Bao-Lian SU;* Harnessing Slow Light and Plasmonic Effects in Photonic Crystals for Unprecedented H2 Evolution
3. ***Daniela I. TOMA (SĂRDĂRESCU),** Radu C. FIERĂSCU, Diana E. VIZITIU, Irina FIERĂSCU, Anda M. BAROI;* The Influence of Extracts from Viticultural Waste and Phytosynthesized Silver Nanoparticles on the Phenolic Composition of Fetească Regală 72 ST. STUM
4. ***Cristina-Silvia STOICESCU,** Robert-Viorel ANCUCEANU, Stefan Claudiu MARIN, Mihaela DINU, Florinela SIRBU, Ioana Leontina GHEORGHE, Cornel MUNTEANU, Adriana-Iuliana ANGHEL*; Scanning Electron Microscopy (SEM) in a Comparative Study of *Sorbus domestica* Leaves from Different Geographical Regions of Romania
5. ***Andrei ZAHARIA**, Valentin NEDEFF;* Studies and Research on the Behavior of Polyamide Membranes in the Treatment of Wastewater from a Poultry Slaughterhouse
6. ***Raluca Florenta DOROFTEI**, Diana MIRILA, Mihaela SILION, Daniela ISTRATE, Ana-Maria ROSU, Gabriela MUNTIANU, Ana-Maria GEORGESCU, Ileana Denisa NISTOR;* Clays as Dual-Function Materials in TNT Adsorption and Catalysis
7. ***Maria Cristina VLADUT**, Crina ANASTASESCU, Silviu PREDA, Oana MOCIOIU, Simona PETRESCU, Jeanina PANDELE-CUSU, Dana CULITA, Veronica BRATAN, Ioan BALINT, Maria ZAHARESCU;* Solar photocatalysis using Mn–ZnO: Influence of sol-gel and microwave synthesis
8. ***Raluca Anca MEREU**, Radu LUPĂȘTEAN, Miuța FILIP;* Zinc Tin Oxide Composites for Advanced Battery and Optoelectronic Applications
9. ***Natalia GUZGAN**, Dorin GUZGAN, Pavel TOPALĂ, Adrian SURDU, Andrei PĂDURARU, Ecaterina ANDRONESCU;* Research on Cerium Oxides obtained by Sol-Gel and Coprecipitation Methods
10. ***Maryia KHAMENKA**, Anna RONOWSKA, Alicja STANISŁAWSKA*; Optimising the Purification of Scoby nanocellulose from Kombucha Fermentation to Biomaterial.
11. ***Cristina BANCIU**, Virgil MARINESCU, Ioana ION*; Synthesis of 3D Graphene-MnO_2 Hybrids using a Combination of Chemical Vapor Deposition and Hydrothermal Techniques
12. ***Muhtadi IDREES**, Luigi CALABRESE*; Development of MIL-00(Fe) based Composite Coatings for Adsorption Heat Pump Applications
13. ***Angela SPOIALĂ**, Ankit MAZUMDAR; Ludmila MOTELICĂ, Ovidiu-Cristian OPREA, Denisa FICAI, Natalia BESCHANOVSKA, Anton FICAI;* Evolution of Stents: From Bare-Metal to Highly Functional Stents
14. ***Surendra Prakash GUPTA***; In Silico Molecular Interaction of Exploring Indian Millets Phytochemicals as DPP-IV Inhibitors for Type II Diabetes Mellitus Treatment

Friday, 28 November 2025

09:00-12:00–SESSION VII. Design and Synthesis of Drugs and Drug Delivery Systems (II)–LINK 1

Chairs: Joan CERDA, Angela SPOIALA

9:00-9:15	***Georgiana Otilia PINTILII**, Isabella NACU, Liliana VERESTIUC*; 3D Printed Bone Scaffolds with Complex Architectures
9:15-9:30	***Veronica SARDARI**, Maharajan Satheswaran SUYAMBU, Riya Soji Sojimon Pawathil AUGUSTHY;* Ferroptosis in Cancer and Neurodegeneration: Mechanisms, Therapeutic Opportunities
9:30-9:45	***Keerthana JANAKIRAMAN**, Sasikumar SWAMIAPPAN;* A Dual-Action Bioceramic with Osteogenic, Antibacterial, and Anticancer Potentials.
9:45-10:00	***Hibe HARIRI**, Emine SELCUK, Tulin Ozbek, Murat TOPUZOĞULLARI;* Bacteriophage-Encapsulated Alginate Microspheres as a Controlled Delivery System
10:00-10:15	***Łukasz MISIAK***; NanoPROTAC Platforms for Targeted Protein Degradation: Toward Efficient Intracellular Delivery
10:15-10:30	***Guljemile DURDYYEVA**, Elif Zehra ATUKEREN, Ebrar KESKIN, Songul ULAG, Semra UNAL*; Intranasal Drug Delivery with Three-Dimensionally (3D) Produced Microneedle Loaded with Analgesic for the Treatment of Migraine
10:30-10:45	***Mohammad Yaman HABRA**, İsmail CANTÜRK, Cem Bülent ÜSTÜNDAĞ;* A Hybrid Bioprinter with an Integrated Electrospinner for Automatic Scaffolds Fabrication
10:45-11:00	***Sena Su TORUN**, Mehmet Murat BOZDAG, Sevval GUNES, Elif ILHAN, Oguzhan GUNDUZ, Cem Bulent USTUNDAG;* Biomimetic Scaffolds Fabricated by Direct Ink Writing for Osteochondral Tissue Regeneration
11:00-11:15	***Andreea-Isabela LAZĂR**, Alexa-Maria CROITORU, Lea Sleiman, Ludmila MOTELICA, Maria-Carina CARBABULEA, Ovidiu-Cristian OPREA, Roxana-Doina TRUŞCĂ, Denisa FICAI, Anton FICAI and Sorina Dinescu*; Electrospun Scaffolds for Peripheral Nerve Repair: Chitosan Enhanced with Graphene Oxide and Curcumin
11:15-11:30	***Beyza Nur TOPAL**, Dilek Bilgiç ALKAYA, Serap Ayaz SEYHAN, Pervin RAYAMAN*; Evaluation of the Activity of Biogenic Ag/Zn Bimetallic Nanoparticles Derived from Terminalia Chebula against Various Microorganisms
11:30-11:45	***Inga CHIRA**, Svetlana CAPCELEA*; Nanoparticles for Drug Delivery in Multiple Sclerosis

09:00-12:00 – SESSION VIII. Natural Compounds and Biomimetic Approaches in Current and Emerging Applications – LINK 2

Chairs: Gianluca VISCUSI, Adrian SURDU

9:00-9:15	***Azime ERARSLAN**, Elif EMEKDAR, Eylül Dila ÇARKCI, Selcen ARI YUKA, Sümeyye CESUR, Oğuzhan GÜNDÜZ*; Development of a 3D-Printed Alginate–Gelatin Scaffold Incorporating Supercritical CO_2-Extracted Grape Seed Extract for Postharvest Antifungal Food Packaging
9:15-9:30	***Sorin Viorel DOLANA**, Tanța Verona IORDACHE, Teodor SANDU, Anamaria ZAHARIA, Iulia Elena NEBLEA, Bianca Elena STOICA, Anton FICAI*; PET derived Polyamines for Foams based on Aza-Michael Reaction
9:30-09:45	***Ersilia Daniela COȘBUC**, Elena-Diana UNGUREANU-COMĂNIȚĂ, Raluca Maria ȚÂBULEAC, Paula Sânziana OPREA, Maria GAVRILESCU*; Cost–Benefit based Risk Modeling for Food Waste Management
09:45-10:00	***Elena-Diana UNGUREANU-COMĂNIȚĂ**, Raluca Maria ȚÂBULEAC, Ersilia Daniela COȘBUC, Paula Sânziana OPREA, Maria GAVRILESCU*; Multi-Criteria Decision Analysis for Waste-To-Resource Options: Conventional PVC vs PHA
10:00-10:15	***HIMANI HIMANSHU**, Nishant KUMAR*, Bio-Recovery of Tannin from Pomegranate (Cv. Bhagwa and Ganesh) Peel by Ultrasonic-Assisted Extraction
10:15-10:30	***HIMANI, HIMANSHU**, Nishant KUMAR*; Application of Edible Coatings Enriched with Plant Extracts for Shelf Life Extension of Fresh Produce
10:30-10:45	**Tanveer ALAM**, Lubna NAJAM; Extraction and Applications of Peru Balsam Absolute-Enriched Pectin/Gellan Gum Composite Films for Food Packaging
10:45-11:00	***Avanish Chandra SHARMA**, Sunita SINGH*; Senna siamea Leaf-derived Extract as a Sustainable Antimicrobial Agent in the Food Industry.
11:00-11:15	***Kaan DANIS**, Meryem Akkurt YILDIRIM, Oguzhan GUNDUZ, Cem Bulent USTUNDAG;* Development of Vanillic Acid and Tricalcium Phosphate Additive GelMA-Based Composites for Bone Tissue Engineering Applications and Investigation of Their Biological Properties
11:15-11:30	***Diana HANGANU,** Lidia FAVIER, Amalia Maria SESCU, Maria HARJA;* Synthesis and Characterization of Highly Reactive Mesoporous Catalytic Systems for the Enhanced UV-A Photocatalytic Oxidation of an Emergent Water Contaminant
11:30-11:45	***Aslı TAŞÇI,** Gizem GÜL, Tubanur AVCI, Canan DOĞAN;* Production of Bacterial Cellulose from Tea Waste Hydrolysates: Evaluation of Pretreatment Methods and Culture Performance

12:00-13:00 – Plenary SESSION III. APPLICATIONS – LINK 1

Chairs: Gianluca VISCUSI, Angela SPOIALA

12:00-12:30 ***Huaqiong LI*;** Low Immunogenic Decellularized Bioactive Materials for Regenerative Medicine Applications

12:30-13:00 ***Ali IMRAN*;** Nano Anticancer Drugs Are the Need of the Future.

13:00-14:00 – CLOSING CEREMONY – LINK 1

Chair: Ecaterina ANDRONESCU

Book of Abstracts Plenary Lectures

NANO ANTICANCER DRUGS ARE THE NEED OF THE FUTURE

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ABSTRACT

Advanced therapeutic approaches are desperately required due to the limitations of traditional chemotherapy, like systemic toxicity, poor absorption, and non-specific targeting. An encouraging platform for addressing these challenges is the development of nano-anticancer medications. This method uses nanomaterials, including liposomes, dendrimers, polymeric nanocarriers, and metallic nanoparticles, to encapsulate or anchor the organic molecules. The improved solubility, controlled and targeted drug release, and better tumor tissue targeting via active and passive processes are features of the new generation nano-anticancer drugs. These nano-drugs aggregate precisely in tumour tissues and decrease harm to healthy cells through better permeability and retention effect and ligand-mediated recognition. Also, new developments in stimuli-responsive nanoparticles and nanodrug conjugates increase the precision and efficacy of the treatment. With a stress on the significance as a game-changing treatment in contemporary oncology, this presentation will cover the current needs, developments, clinical translation challenges, mechanism of action, and prospects for the future of nano-anticancer drugs. Besides, the preparation and application of these smart nano-medicines may be safe, more effective, and patient-friendly cancer treatments.

Keywords: Cancer, Chemotherapy, Nano anticancer drugs, Mechanism of action, future perspectives.

ENGINEERING SOLUTIONS FOR ADVANCED 3D BIOPRINTING OF MICROTISSUES AND THE APPLICATIONS

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ABSTRACT

Advancements in three-dimensional (3D) bioprinting are critical for addressing current challenges in tissue engineering and regenerative medicine. This work presents a series of integrated engineering solutions developed to improve the precision, viability, and scalability of 3D cell microtissue fabrication. We highlight the design and implementation of microencapsulation of cells using an electronic aerosol atomisation system, microfluidic, and flicking techniques for 3D microtissues generation. Experimental studies demonstrate the successful encapsulation and sustained viability of human keratinocytes and oral cancer cells within uniformly sized microcapsules, with viability validated through live/dead assays and detailed histological analysis. Parametric studies on extrusion rates, airflow rates, and micromixer configurations were conducted to optimise microcapsule size distribution and mixing efficiency. Additionally, spectroscopic and morphological characterisations provide insight into the structural integrity of the encapsulated cells and hydrogels. The results show that these combined approaches enable the generation of reproducible, functional 3D microtissues, offering improved nutrient diffusion and cellular interactions compared to conventional two-dimensional cultures. The 3D spheroids were applied to evaluate the cytotoxicity of MXene. This platform has the potential to be adapted for high-throughput screening, disease modelling, and personalised medicine applications. Overall, the presented engineering strategies contribute to the development of robust bioprinting methodologies and serve as a foundation for future translational research in biofabrication and 3D cell culture.

References

1. Sheril Amira Othman, Chin Fhong Soon, Nyuk Ling Ma, Kian Sek Tee, Gim Pao Lim, Marlia Morsin, Mohd Khairul Ahmad, Alyaa Idrees Abdulmaged, Sok Ching Cheong, Alginate-gelatin bioink for bioprinting of hela spheroids in alginate-gelatin hexagon-shaped scaffolds, Polymer Bulletin, pp. 1–21, 2020.
2. Gim Pao Lim, Chin Fhong Soon, Agnieszka Maria Jastrzębska, Nyuk Ling Ma, Anita Rozmysłowska Wojciechowska, Aleksandra Szuplewska, Wan Ibtisam Wan Omar, Marlia Morsin, Nafarizal Nayan, Kian Sek Tee, Synthesis, characterization and biophysical evaluation of the 2D Ti2CTx Mxene using 3D spheroid-type cultures, Ceramics International, Volume 47, Issue 16, 15 August 2021, pp: 22567–22577.
3. Gim Pao Lim, Chin Fhong Soon, Nyuk Ling Ma, Marlia Morsin, Nafarizal Nayan, Mohd Khairul Ahmad, Kian Sek Tee, Cytotoxicity of Mxene-based nanomaterials for biomedical applications: A mini review, Environmental Research, Vol. 201, 2021, 111592.
4. Gim Pao Lim, Chin Fhong Soon, Sheril Amira Othman, Naznin Sultana, Mohd Khairul Ahmad, Nafarizal Nayan, Kian Sek Tee, Generation of HeLa spheroids in Ca-alginate-PEG microbeads using flicking technique as an improved three-dimensional cell culture system, Colloids and Surfaces A 599 (2020) 124885, pp. 1–12.

COAXIAL EXTRUSION BIOPRINTING: PUSHING THE BIOFABRICATION WINDOW

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ABSTRACT

Printability in 3D extrusion bioprinting encompasses extrudability, filament formation, and shape fidelity [1]. Rheological properties can predict the shape fidelity of printed hydrogels. In this talk, we will explore the effect of different parameters on tan(δ), and therefore the printability of methylcellulose (MC) hydrogels [2]. After, I will show how these results will help in the further development of more complex bioinks and structures, which can give rise to novel constructs for uses as 3D models and scaffolds for Tissue Engineering and Regenerative Medicine, using coaxial bioprinting. I will explain the development of a Do-It-Yourself (DIY) coaxial bioprinter and its validation using a well-know bioink [3]. Furthermore, an example will be given on the use of self-assembled peptides as bioink.

References

1. M. Jergitsch, M.A. Mateos-Timoneda. 3D extrusion bioprinting: rational bioink design and advanced fabrication techniques. Trends Biotechnol. In press (2025). https://doi.org/10.1016/j.tibtech.2025.06.008
2. M. Jergitsch, Z. Alluè-Mengual, R.A. Perez, M.A. Mateos-Timoneda. A systematic approach to improve printability and cell viability of methylcellulose-based bioinks. Int. J. Biol. Macromol. 253(7), 127461 (2023). https://doi.org/10.1016/j.ijbiomac.2023.127461.
3. M. Jergitsch, R. Soiunov, F. Selinger, M. Frauenlob, L.M. Delgado, S. Perez-Amodio, R.A. Perez, M.A. Mateos-Timoneda. Fabrication and validation of an affordable DIY coaxial 3D extrusion bioprinter. Sci Rep 15, 22978 (2025). https://doi.org/10.1038/s41598-025-06478-9.

DESIGN OF CALCIUM PHOSPHATE CERAMICS INCORPORATED INTO BONE METABOLISM FOR BONE REGENERATION

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ABSTRACT

Calcium phosphate ceramics, such as hydroxyapatite (HA, $Ca_{10}(PO_4)_6(OH)_2$) and β-tricalcium phosphate (β-TCP, $Ca_3(PO_4)_2$), are widely used as artificial bones for bone repair because of their high biocompatibility to bone tissues. However, the calcium phosphate ceramics with higher bone-regeneration ability are desired because the present artificial bones show lower bone-regeneration ability than the autografts which are normally used in orthopaedic surgery. It is expected that the material design to be incorporated in bone metabolism is important to achieve the bone regeneration. In this presentation, the design to obtain the calcium phosphate ceramics incorporated in bone methabolism is shown.

By controlling the composition and microstructures of calcium phosphate ceramics, their properties of can be improved. In the case of HA, creating a Ca-deficient composition can increase its solubility. Additionally, controlling the morphology of HA crystals can lead to differences in the exposed crystal faces, which is expected to result in the control of protein adsorption. Ioku *et al*. revealed that the hydrothermal treatment of α-tricalcium phosphate (α-TCP) compacts or porous bodies can provide porous ceramics composed of Ca-deficient HA rod-like particles [1]. The hydrothermal treatment is useful to control the microstructure of porous HA ceramics [2]. We examined the *in vivo* behaviors of porous ceramics composed of Ca-deficient HA rod-like particles, and revealed that the ceramics showed excellent osteoconductive properties and biodegradability when implanted into rabbit femurs [3]. It is speculated that the control of composition and microstructure activated osteoclasts, thereby promoting bone regeneration [4]. The activation of osteoclasts may be related with the specific protein adsorption [5]. The obtained ceramics were incorporated in the bone metabolism by the activation of osteoclasts. We also revealed that the porous granules composed of Ca-deficient HA rod-like particles are useful to reduce the amount of autograft needed for the regeneration of large bone defects by combining Masquelet's induced membrane technique [6]. In addition, the calcium phosphate cements with macropores and micropores can be obtained by binding these granules [7]. These calcium phosphate ceramics incorporated in bone metabolism are expected to be useful for bone regeneration.

References

1. K. Ioku, G. Kawachi, S. Sasaki, H. Fujimori, S. Goto, *J. Mater. Sci*., 41, 1341–1344 (2006).
2. M. Kamitakahara, C. Ohtsuki, G. Kawachi, D. Wang, K. Ioku, *J. Ceram. Soc. Japan*, 116, 6–9 (2008).
3. T. Okuda, K. Ioku, I. Yonezawa, H. Minagi, Y. Gonda, G. Kawachi, M. Kamitakahara, Y. Shibata, H. Murayama, H. Kurosawa, T. Ikeda, *Biomaterials*, 29, 2719–2728 (2008).
4. K. Morishita, E. Tatsukawa, Y. Shibata, F. Suehiro, M. Kamitakahara, T. Yokoi, K. Ioku, M. Umeda, M. Nishimura, T. Ikeda, *Acta Biomaterialia*, 39, 180–191 (2016).
5. T. Ikeda, M. Kasai, E. Tatsukawa, M. Kamitakahara, Y. Shibata, T. Yokoi, T.K. Nemoto, K. Ioku, *J. Cell. Mol. Med.*, 18, 170–180 (2014).

6. M. Suzuki, M. Kamitakahara, W. Kihara, C. Xie, H. Kato, Y. Fukawa, M. Hamagaki, K. Aoki, S. Ichihara, M. Ishijima, T. Ikeda, T. Okuda, *Scientific Reports*, 15, 8304 (2025).
7. M. Kamitakahara, K. Asahara, H. Matsubara, *J. Asian. Ceram. Soc.*, 10, 731–738 (2022).

LOW IMMUNOGENIC DECELLULARIZED BIOACTIVE MATERIALS FOR REGENERATIVE MEDICINE APPLICATIONS

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ABSTRACT

Tissue injury and repair has always been a cutting-edge scientific issue in the world. The tissue regeneration and repair barriers after damage seriously endanger human life and health. In order to solve the key problems of transplant-induced immune rejection, insufficient mechanical support, and poor biological functions in the process of tissue injury and repair, our research team has developed dECM (decellularized extracellular matrix) based composite hydrogels for tissue defect repair. Through constructing tissue engineered composite biomaterials, we can modulate tissue regeneration with an optimized microenvironment (such as multi-scale physical signal stimulation and biochemical signals), and precisely regulate the biological behavior of cells in the tissue injury site, thereby achieving regeneration and repair of damaged tissues (such as intervertebral discs, bone, cartilage, wound, etc.).

References:

1. J. Huang, I. Ullah, L. Chen, K. Peng, Y. Ou, Z. Gong, A. Wu, Z. He, W. Yin, H. Li.* H2O2 Self-Supplied MoS2/CaO2 Nanozyme Hydrogel with Near-Infrared Photothermal Synergetic Cascade Peroxidase-Like Activity for Wound Disinfection, Adv Healthcare Mater 14, 2402393, 2025.
2. W. Chen, M. Chen, S. Chen, S. Wang, Z. Huang, L. Zhang, J. Wu, W. Peng, H. Li*, F. Wen. Decellularization of fish tissues for tissue engineering and regenerative medicine application, Regen Biomater rbae138, 2024.
3. Y. Wang, X. Yang, Z. Yang, H. Xia, X. Si, J. Hao, D. Yan, H. Li, K. Peng, J .Sun, C. Shi, H. Li*, W. Li. Additive-free Absorbable Keratin Sponge with Procoagulant Activity for Noncompressible Hemostasis, Biomacromolecules 25, 3930, 2024.
4. L. Chen, K. Peng, H. Huang, Z. Gong, J. Huang, A.M. Mohamed, Q. Chen, W.T. Sow, L. Guo, K.Y.H. Kwan, B. Li, M.A. Khan, P. Makvnadi, M. Jones, S. Shen, X. Wang, C. Ma, H. Li*, A. Wu. Injectable Hydrogel Based on Enzymatic Initiation of Keratin Methacrylate for Controlled Exosome Release in Intervertebral Disc Degeneration Therapy, Adv Funct Mater 34, 2316545, 2024.
5. Y. Wang, F. Wen, X. Yao, L. Zeng, J. Wu, Q. He, H. Li,* L. Fang, Hybrid Hydrogel Composed of Hyaluronic Acid, Gelatin, and Extracellular Cartilage Matrix for Perforated Tympanic Membrane Repair, Front Bioeng Biotechnol 9, 811652, 2021.
6. Y. Wang, L.H. Koole, C. Gao, D. Yang, L. Yang, C. Zhang, H. Li.* The potential utility of hybrid photo-crosslinked hydrogels with non-immunogenic component for cartilage repair, npj Regen Med 6, 54, 2021.
7. C. Gao, W.T. Sow, Y. Wang, Y. Wang, D. Yang, B.H. Lee, D. Maticic, L. Fang, H. Li,* C. Zhang, Hydrogel composite scaffold with attenuated immunogenicity component for bone tissue engineering application, J Mater Chem B 9, 2033, 2021.
8. Q. Pan, C. Gao, Y. Wang, Y. Wang, C. Mao, Q. Wang, S.N. Economidou, D. Douroumis, F. Wen, L.P. Tan, H. Li.* Investigation of bone reconstruction using an attenuated immunogenicity xenogenic composite scaffold fabricated by 3D printing, Bio-Des Manuf 3, 396, 2020.

NANOENGINEERING USING ULTRASHORT LASER PULSES FOR DIVERSE FUNCTIONAL MATERIALS

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ABSTRACT

Ultrashort (femtosecond/picosecond) laser pulses have demonstrated a strong potential in ablation/processing/nanofabrication of various materials, including metals, semiconductors, polymers, etc. We have utilized the ultrashort pulse laser ablation (in air/liquids) technique for creating diverse nanoparticles/nanostructures of Ag, Au, Ag-Au, Au-Cu, Ag-Au-Cu, Si, Ge, GaAs, SiC, InP, high-entropy alloys, two-dimensional materials (TMDCs, MXenes, few-layer graphene), along with hybrid nanomaterials (e.g., Ag-Au/Si, Ag-Au/Ge nanostructures, etc.) [1–21]. We could engineer several surface nanostructures and achieve diverse nanocolloids using these short pulses by varying the focusing conditions (Gaussian, Bessel, Vortex, etc.), surrounding atmosphere, pulse duration, input energies, and the number of incident pulses. We have also investigated the utility of these versatile nanostructures for detecting trace explosives (AN, PA, RDX, HMX, NTO, TNT, etc.), biomolecules, pesticides (thiram, thiabendazole), and organic dyes using the surface-enhanced Raman scattering (SERS) technique. We will discuss the physics of these processes also present other potential applications of these versatile nanomaterials in photonics, optoelectronics, wetting, etc.

References

1. B.K. Singh, D. Banerjee, A. Mangababu, Y. Shadangi, N. K. Mukhopadhyay, R. Rawat, A. P. Pathak, V.R. Soma, A. Tiwari, A. Tripathi, Journal of Materials Science, 60, 1689–1704 (2025).
2. J. Rathod, S.S.B. Moram, V.R. Soma, J. Phys. D: Appl. Phys., 58, 025104 (2025).
3. A. Das, M. Akkanaboina, J. Rathod, R.S.P. Goud, K.R. Kumar, R.C. Reddy, R. Ratheesh, K. Vutova, S.V.S. Nageswara Rao, V.R. Soma, Beilstein Journal of Nanotechnology, 15, 1639–1653 (2024).
4. K.R. Kumar, J. Rathod, M.S.S. Bharati, R.S.P. Goud, V.R. Soma, S.V.S.N. Rao, Optics Express, 32(21), 37394 (2024).
5. S.S.B. Moram, C. Byram, V.R. Soma, Beilstein Journal of Nanotechnology, 15, 1054–1069 (2024).
6. D. Banerjee, M. Akkanboina, K.R. Kumar, B. Ghose, V.R. Soma, J. Phys. Chem. C., 128, 4655–4665 (2024).
7. D. Banerjee, M. Akkanaboina, V.R. Soma, Optical Materials, 154, 115668 (2024).
8. K.R. Kumar, D. Banerjee, M. Akkanaboina, R.S.P. Goud, A. Anjum, A.P. Gnana Prakash, A.P. Pathak, V.R. Soma, and S.V.S. Nageswara Rao, J. Phys. C: Cond. Matter, 36, 235702 (2024).
9. B.K. Singh, D. Banerjee, A. Mangababu, Yagnesh Shadangi, N.K. Mukhopadhyay, Rajesh Rawat, A.P. Pathak, S. Venugopal Rao, Archana Tiwari, Ajay Tripathi, J. Alloys and Compounds, 968, 172238 (2023).
10. G. Ravi Kiran, G. Srikanth, C. Byram, Md Abu Taher, S.G. Acharyya, V.R. Soma, Tarak Nath De, IEEE Transactions on Nanotechnology, 22, 252–259 (2023).
11. A. Mangababu, D. Banerjee, K.R. Kumar, R.S.P. Goud, V.R. Soma, S.V.S.N. Rao, Opt. Lett., 48(21), 5539–5542 (2023).
12. D. Banerjee, A. Mangababu, R.K. Kanaka, V.R. Soma, Appl. Surf. Sci., 616, 156561 (2023).
13. A. Mangababu, D. Banerjee, R.K. Kanaka, R.S.P. Goud, V.R. Soma, S.V.S.N. Rao, Surf. & Interf., 36, 102563 (2023).
14. D. Banerjee, M. Akkanboina, S. Ghosh, V.R. Soma, Materials (MDPI), 15, 4155 (2022).
15. K.R. Kumar, D. Banerjee, A. Mangababu, R. Sai Prasad Goud, V.R. Soma, and S.V.S. Nageswara Rao, J. Phys. D: Appl. Phys., 55, 405103 (2022).

16. R. Rawat, B.K. Singh, A. Tiwari, N. Arun, A.P. Pathak, Y. Shadangi, N.K. Mukhopadhyay, S.R. Nelamarri, S. Venugopal Rao, A. Tripathi, J. Alloys & Compounds, 927, 166905 (2022).
17. C. Byram, J. Rathod, S.S.B. Moram, A. Mangababu, and V.R. Soma, Nanomaterials (MDPI), 12(13), 2150 (2022).
18. T.K. Naqvi, A. Bajpai, S.S.B. Moram, M.M. Kulkarni, A.M. Siddiqui, S. Venugopal Rao, P.K. Dwivedi, J. Hazard. Mater., 407, 124353 (2021).
19. A. Mangababu, R.S.P. Goud, C. Byram, J. Rathod, D. Banerjee, V.R. Soma, and S.V.S. Nageswara Rao, Applied Surface Science, 589, 152802 (2022).
20. M.S.S. Bharathi, S. Abdul Kalam, B. Chandu, S. Hamad, S. Venugopal Rao, Anal. Chim. Acta, 1101, 157–168 (2020).
21. T.K. Naqvi, M.S.S. Bharati, A.K. Srivastava, M.M. Kulkarni, A.M. Siddiqui, S. Venugopal Rao, P.K. Dwivedi, ACS Omega, 4, 17691–17701 (2019).

NANOENGINEERED AND COATINGS FOR MEDICINE AND BEYOND

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ABSTRACT

In my talk, I will give an overview of recent progress from my lab on development of plasma polymer facilitated nanoengineered surfaces that benefit many areas of application. Over the years, we developed a range plasma based methods with allows us to control that entire spectrum of surface properties, including chemical, physical, mechanical and topographical. The main focus of our research is the surface modification of medical devices and biomaterials for applications in areas such as cell therapies, tissue engineering, controlling inflammation and infections as well as medical diagnostics. However, our surface modification technologies are not limited to medicine. We have demonstrated the utility of nanoengineered plasma polymers for solving problems in other areas such as environmental science and remediation, organic electronics, water treatment and wine making. I will present the engineering and chemical concepts underpinning "nanoengineering of plasma polymers" and give a range of examples of application of the technology in various fields.

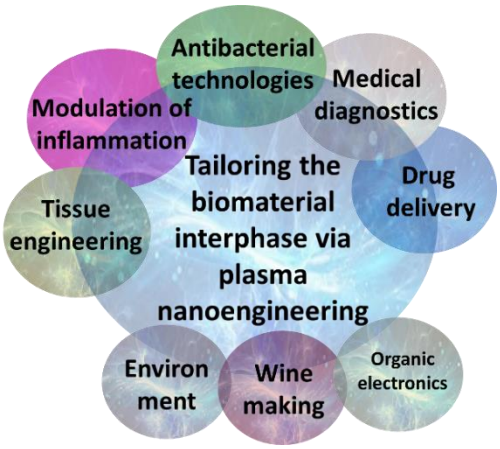

Figure 1. Applications of Plasma Nanoengineering.

References

1. Visalakshan et al. *Advanced Functional Materials* 29 (14), 1970088 (2019).
2. Chen et al. *ACS Nano* 11 (5), 4494–4506 (2017).
3. Mierczynska-Vasilev et al. *Food Chemistry* 275, 154–160 (2019).
4. Bright et al. *Nano Letters* 22, 16, 6724–6731 (2022).
5. Truong et al. *ACS Nano* 17 (15), 14406–14423 (2023).
6. Hayles et al. *npj Biofilms and Microbiomes* 9 (1), 90 (2023).
7. Nguyen et al. *Advanced Functional Materials* 34 (31), 2310539 (2024).
8. Pham et al. *Small* 20 (39), 2470290 (2024).

CARBON-BASED METAL-FREE ELECTROCATALYSTS FOR CLEAN ENERGY CONVERSION AND ENVIRONMENTAL REMEDIATION

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ABSTRACT

Since our discovery of the first carbon-based metal-free electrocatalyst (C-MFEC, i.e., N-doped carbon nanotubes) for oxygen reduction in fuel cells in 2009, the field of C-MFEC has grown enormously. C-MFECs, as alternatives to noble metal-based electrocatalysts, have been widely demonstrated for efficient oxygen reduction, oxygen evolution, hydrogen evolution, carbon dioxide reduction, nitrogen reduction, and many other electrocatalytic reactions. Recent worldwide research effort has shown great potential for applications of C-MFECs in fuel cells for clean energy conversion, metal-air batteries for energy storage, water splitting for hydrogen fuel generation, and other electrochemical processes for value-added chemical production to reduce or even eliminate greenhouse emissions. Further research and development of C-MFECs could revolutionize clean energy and environmental remediation technologies. In this talk, I will summarize some of our work on the development of C-MFECs for clean energy conversion and environmental remediation, along with an overview of recent advances, current challenges, and future perspectives in this exciting field.

NANOSTRUCTURING OF VALVE METALS: OPPORTUNITIES, PITFALLS, AND INSIGHTS FROM TiO_2 NANOTUBE CASE STUDIES

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ABSTRACT

Nanostructuring of valve metals such as Ti, Zr, and Ta enables the fabrication of ordered oxide architectures with tunable geometry, chemistry, and functionality. These nanostructures underpin applications in catalysis, sensing, and biomedicine, yet reproducibility and accurate surface interpretation remain persistent challenges.

This contribution discusses both the opportunities and pitfalls in the anodic growth and modification of valve-metal oxide nanostructures, drawing on extensive work with TiO_2 nanotube (TNT) arrays and spaced TNT architectures [1–4]. Case studies demonstrate how electrolyte composition, intertube spacing, and post-anodization annealing influence morphology, crystallinity, and performance. Particular attention is given to subtle factors such as electrolyte aging, contamination, and misinterpretation in morphological assessment or surface spectroscopic analysis (XPS, ToF-SIMS), which can lead to contradictory results across laboratories.

Recent works provide concrete examples of these aspects: surface modification routes for enhanced bioactivity [3], the role of nanotopography in cell–surface interactions [4], interfacial binding kinetics relevant to oxide functionalization [2], and catalytic synergy in multimetal oxide-supported systems [1]. These examples, from biological interfaces to catalytic surfaces, illustrate the versatility and cross-disciplinary relevance of valve-metal nanostructuring. Collectively, they provide practical guidelines for reliable synthesis and characterization, emphasizing reproducibility and transparency in advanced oxide-based materials research.

References

1. M.K. Pajić, A.S. Dobrota, A. Mazare, S. Đurđić, X. Zhou, N. Denisov, N.V. Skorodumova, D. Manojlović, R. Vasilić, I.A. Pašti, P. Schmuki, U. Lačnjevac, Polydisperse Pt Deposits over TiO_2-Nanotube-Array-Supported Ru Nanoparticles: Harnessing the Interfacial Synergy for Efficient Hydrogen Evolution Electrocatalysis, Small 2025, https://doi.org/10.1002/smll.202411870.
2. A. Mazare, M.H. Ulubas, H. Kim, I. Fomicheva, G. Sarau, S.H. Christiansen, W.H. Goldmann, A.B. Tesler, Binding Kinetics of Self-Assembled Monolayers of Fluorinated Phosphate Ester on Metal Oxides for Underwater Aerophilicity, Langmuir 2025, 41 (3), 1868. https://doi.org/10.1021/acs.langmuir.4c04320.
3. A. Mazare, I. Hwang, A.B. Tesler, Surface Modification of TiO_2 Nanotubes Towards Enhanced Bioactivity, Materials Today Communications 2024, 39, 109216. https://doi.org/10.1016/j.mtcomm.2024.109216.
4. J. Park, A.B. Tesler, E. Gongadze, A. Iglič, P. Schmuki, A. Mazare, Nanoscale Topography of Anodic TiO_2 Nanostructures is Crucial for Cell-Surface Interactions, ACS Applied Materials & Interfaces 2024, 16 (4), 4430–4438. https://doi.org/10.1021/acsami.3c16033.

IN VITRO AND *IN VIVO* TESTING OF PULP CAPPING AGENTS BASED ON CALCIUM SILICATES

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ABSTRACT

Pulp capping is a clinical procedure in dentistry which involves the placement of a biomaterial in direct or indirect contact with the dental pulp in order to maintain its vitality, thereby prolonging the life of the tooth. The role of o pulp capping agent is to stimulate the dentin forming cells, the odontoblasts, to activate the process of neodentinogenesis and deposit tertiary dentin bridges. Over time, numerous pulp capping biomaterials with different compositions have been used in dental practice, from calcium hydroxide to much more effective cements, such as the new standard, represented by mineral trioxide aggregate (MTA). Calcium silicate-based cements, such as MTA or modified and hybrid MTA-derived materials, are successfully used in pulp capping procedures [1]. The aim of this experimental research was to compare both *in vitro* and *in vivo* a MTA cement and a tricalcium silicate-based material modified with light-cured resin (TheraCal LC). The physical and chemical properties of these materials were tested *in vitro*. Complex thermal analysis and X-ray diffraction (XRD) indicated the presence of more mineral phases in the case of MTA and the presence of light-cured resin in the case of TheraCal LC. XRD analysis revealed the main mineralogical phase of tricalcium silicate for TheraCal LC. Scanning electron microscopy (SEM) analysis revealed a dense microstructure in the case of MTA and a dispersed particle appearance in the organic matrix for TheraCal LC. Atomic force microscopy (AFM) indicated a much rougher surface for the MTA cement and contact angle measurements showed a hydrophilic surface for both biomaterials. Mechanical testing was performed using Vickers microhardness which indicated a much higher hardness for the MTA cement. The biomineralization of the surfaces was evaluated *in vitro* for 28 days following the immersion of both materials in a simulated body fluid (SBF) solution. Following Fourier transform infrared spectroscopy (FT-IR) and SEM analysis, many more mineral phases were identified in the MTA cement, both materials having bioactive properties, as demonstrated by the presence of apatite formation on their surfaces [2]. *In vivo* testing on New Zealand White rabbits showed minimal pulp inflammation for both

materials and the formation and deposition of complete and incomplete dentin bridges following direct pulp capping. *In vivo* testing on human patients involved performing direct pulp capping on third molars, with pulp vitality being maintained with both materials. The deposition of dentin bridges following the activation of neodentinogenesis was more evident in the case of MTA, indicated by X-Ray microtomography and histological evaluation and a more attenuated pulp inflammatory status [3].

References

1. Andrei M., Vacaru R-P., Coricovac A., Ilinca R., Didilescu A.C., Demetrescu I. *The Effect of Calcium-Silicate Cements on Reparative Dentinogenesis Following Direct Pulp Capping on Animal Models*. Molecules. 2021;26(9):2725.
2. Voicu G., Didilescu A.C., Stoian A.B., Dumitriu C., Greabu M., Andrei M. *Mineralogical and Microstructural Characteristics of Two Dental Pulp Capping Materials*. Materials (Basel). 2019;12(11).
3. Covaci A.M., Andrei M., Dinca I., Ciocan L.T., Matei M.N., Didilescu A.C. *Tertiary Dentin Barrier Formation: A Comparison Between the Effects of Two Calcium Silicate Based Materials*. Curr Health Sci J. 2025; 51(1):96–104.

Book of Abstracts Keynote Lectures

UNLOCKING THE POTENTIAL OF BIOPOLYMER COMPOSITE FOR POST-HARVEST MANAGEMENT

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Abstract

A protective barrier is formed around food products by food packaging, which assists in food preservation. Despite protecting food against contamination and other forms of physical, biological, chemical, and environmental damage, proper packaging also keeps perishable food products fresh for longer periods of time during transit and storage. The loss of food, its shortened shelf life, and the increased risk of foodborne illnesses are all consequences of microbial contamination. Food deterioration resulted in economic losses exceeding 25% of the consumed food. Polyethylene, polypropylene, polystyrene, and polyethylene terephthalate are among the most popular synthetic petroleum-derived polymers for packaging because they are long-lasting, inexpensive, resistant to degradation, and have excellent mechanical properties. There are major environmental problems due to the widespread usage of these polymers, which are not biodegradable and do not regenerate themselves. The biopolymers are renewable biological resource used for the developing biodegradable food packaging has emerged as an eco-friendly alternative to traditional plastic packaging in the past few. These biopolymers are biodegradable materials improve the quality, safety, and longevity of packaged food while reducing the negative impact of plastics on the environment. Proteins, polysaccharides, and other food biopolymers, together with a variety of functional components such lipids, phospholipids, and inorganic particles, make up biodegradable packaging. To overcome the challenges and draw backs of the alone polysaccharide, protein and lipid containing edible coating and films, the composite packaging is best option for fruits and vegetables preservation. The composite packaging (films and coating) may refer to blend of two or more biopolymers and other ingredients such as active agents, plasticizers and emulsifiers linked with each other by non-covalent/ covalent bonds, hydrophobic, hydrogen bonds electrostatics and van der Waals interactions. The formation of these bonds between the biopolymer matrix and active agents may retard the migration of active agent in the packaging system and have ability to control their release and retention mechanism. The composite packaging is also eco-friendly, sustainable, non-toxic in nature and offer good barrier, mechanical, thermal, and antimicrobial properties in the packaging and helps in the prevention postharvest losses in fruits and vegetables as compared to the single polymer based edible coatings.

GREEN SYNTHESIS OF HYBRID ZINC OXIDE NANOFLOWERS FROM *LEUCOPHYLLUM FRUTESCENCE* FOR ENHANCED PHOTOCATALYSIS AND ANTIBACTERIAL SYNERGY

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ABSTRACT

Industrialization has significantly accelerated environmental pollution, especially through the discharge of hazardous dyes from textile, paper, and plastic industries into aquatic systems, posing severe threats to human and ecological health [1]. Concurrently, the global rise of multidrug-resistant (MDR) bacterial pathogens has created an urgent demand for novel antimicrobial strategies [2]. In this context, nanotechnology offers promising solutions, particularly through phytofabrication – a sustainable, non-toxic, and biocompatible approach for nanoparticle synthesis using plant-based reducing agents [3]. The present study reports the green synthesis of silver (Ag) and copper (Cu) doped zinc oxide (ZnO) nanoflowers utilizing the medicinal plant *Leucophyllum frutescens* and explores their photocatalytic and antibacterial properties. Optical characterization using UV-visible spectroscopy revealed absorption peaks at 378, 380, 397, and 392 nm for ZnONPs, Ag@ZnONPs, Cu@ZnONPs, and Ag–Cu@ZnONPs, respectively, while photoluminescence analysis exhibited strong emission at 423 nm across all samples. The estimated bandgap energies, obtained from Tauc's plots, decreased from 3.36 eV in the ZnONPs to 3.26, 3.21, and 3.24 eV for Ag@ZnONPs, Cu@ZnONPs, and Ag-Cu@ZnONPs, respectively, indicating successful doping-induced bandgap narrowing. Morphological analysis via field-emission scanning electron microscopy and high-resolution transmission electron microscopy confirmed the formation of nanoflower structure, while energy-dispersive X-ray spectroscopy and elemental mapping validated the presence and uniform distribution of Zn, O, Ag, and Cu elements. X-ray diffraction confirmed the crystalline structure of the synthesized nanoparticles with average crystallite sizes of 12.75, 11.22, 13.14, and 13.23 nm, respectively. Among the tested samples, Ag-Cu@ZnONPs exhibited the highest photocatalytic degradation efficiency of methylene blue following pseudo-first-order kinetics, whereas Ag@ZnONPs demonstrated superior antibacterial performance and synergistic activity with conventional antibiotics against *Bacillus subtilis*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. Overall, the study highlights the promising application of *L. frutescens*-synthesized Ag-Cu doped ZnO nanoflowers for environmental remediation and antibacterial applications.

Keywords: Hazardous dyes, MDR, phytofabrication, nanoflower, photocatalytic, antibacterial synergy.

References

1. Aroob, S., Carabineiro, S.A., Taj, M.B., Bibi, I., Raheel, A., Javed, T., Yahya, R., Alelwani, W., Verpoort, F., Kamwilaisak, K., Al-Farraj, S., Sillanpää, M. 2023. Green synthesis and photocatalytic dye degradation activity of CuO nanoparticles. Catalysts. 13(3), 502.
2. Bhuiyan, M.S.H., Miah, M.Y., Paul, S.C., Aka, T.D., Saha, O., Rahaman, M.M., Sharif, M.J.I., Habiba, O., Ashaduzzaman, M. 2020. Green synthesis of iron oxide nanoparticle using carica papaya leaf extract: application for photocatalytic degradation of remazol yellow RR dye and antibacterial activity. Heliyon. 6(8), e04603.
3. Ahammed, K.R., Ashaduzzaman, M., Paul, S.C., Nath, M.R., Bhowmik, S., Saha, O., Rahman, M.M., Aka, T.D. 2020. Microwave assisted synthesis of zinc oxide (ZnO) nanoparticles in a noble approach: utilization for antibacterial and photocatalytic activity. SN Appl. Sci. 2(5), 955.

BIOACTIVE PROPERTIES OF ARGININE NIOSOMES-LOADED SILK FIBROIN – CHITOSAN HYDROGELS

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ABSTRACT

Objectives: The aim of our research is the formulation of niosomes (NIO) incorporating arginine (Arg), and then their introduction into a hydrogel based on fibroin (FIB) and chitosan (CS).

Materials and methods: The stages of this research consist of: 1) extraction of fibroin starting from Bombyx mori silkworm cocoons; 2) obtaining niosomes-type nanocarriers with Arg 3) incorporation of niosomes (NIO) into hydrogel based on chitosan and fibroin. After obtaining these nanoformulations, they were characterized morphologically and followed by the evaluation for their antioxidant action. The assessment of antiradical capacity was conducted with the DPPH free radical and $ABTS^+$ radical cation assays. The antiradical capacity was determined as an inhibition percentage (I%) using the formula: $I\% = (A_0 – A_s/A_0) \times 100$, where A_0 – absorbance of the 0.1 mM DPPH methanolic solution or ethanolic solution of $ABTS^{+\cdot}$, A_s – sample's absorbance measured 30 minutes post-addition of the DPPH or 6 minutes post-addition of the $ABTS^+$.

Results: Formulations containing NIO-Arg and incorporated into the hydrogel based on CS sol 1% medium molecular weight in 2% acetic acid and FIB 5% in acetic acid 2% in a 1 : 1 ratio had the best antiradical results, compared to formulations containing only CS and NIO-Arg, or only FIB and NIO-Arg.

Conclusions: The studies and results obtained justify the further evaluation of the antibacterial and pro-healing potential in the treatment of various wounds.

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References

1. Haseli S. et al. *Biotechnol. Prog*. 2022; 38(5):e3280.
2. Bidaki A. et al. Q. *Int. J Bio.l Macromol.* 2025, 311, 143743.
3. Bahrololoumi, S.; Nikazar, S. Chapter 9 – NIO as a Promising Nanovesicular Drug Delivery. In Advanced and Modern Approaches for Drug Delivery; Nayak, A.K., Hasnain, M.S., Laha, B., Maiti, S., Eds.; Academic Press, 2023; pp. 223–258, ISBN 978-0-323-91668-4.

EPITAXIAL GROWTH OF COMPLEX FUNCTIONAL OXIDE THIN FILMS BY CHEMICAL SOLUTION METHODS

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ABSTRACT

Perovskites oxides are of strong interest due the huge potential range of applications they offer with a particularly simple structure, such as spintronics, magneto-optic devices, or catalysis, and most of these applications require the use of thin films and heterostructures [1]. Chemical solution deposition (CSD) techniques are promising methodologies to achieve epitaxial oxide thin films combining high performance with high easy scalability, environment friendly fabrication and low cost. The preparation of eco-friendly precursor solutions with zero flour content is the requirement of the superconducting layer fabrication with optimal performance [2–3].

This work presents the preparation of an eco-friendly $YBa_2Cu_3O_7$ (YBCO) seed layer obtained by CSD followed by the subsequent deposition of ex-situ nanocomposite propionate-based YBCO layer. In order to determine the thermal decomposition behavior, the precursor solution was investigated by thermogravimetry coupled with quadrupole mass spectrometry (TG-QMS), and differential thermal (DTA) analysis. The kinetics of the thermal decomposition of the precursor solution was studied under air, oxygen and humid oxygen atmosphere from ambient temperature up to 1 000°C. The structural, microstructural, and superconducting properties of the resulting YBCO layers were extensively characterized. X-ray diffraction (XRD) was employed to confirm the epitaxial growth. Atomic force microscopy (AFM) and scanning electron microscopy (SEM) analyses revealed a homogeneous surface morphology and well-distributed nanoinclusions. The superconducting transition temperature (Tc) and critical current density (Jc) were evaluated by electrical transport measurements, demonstrating that the eco-friendly CSD process yields high-quality YBCO films with excellent superconducting performance.

References

1. T. Araki, I. Hirabayashi. *Sci. Technol*, 16 (2003), R71-R94.
2. M. Nasui et al. Ceram. Int., 41 (2015), no. 3, pp. 4416–4421.
3. X. Obradors et al. Supercond. Sci. Technol., 25 (2012), pp. 123001.

PHYTOGENIC NANOMEDICINE: A SUSTAINABLE APPROACH

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ABSTRACT

The phytogenic approach for nanoparticle synthesis employing medicinal plants is an environmentally benign, rapid, and efficient method owing to the plethora of bioactive principles in plant extracts. Hereby, we employed a *Dioscorea bulbifera* tuber extract (DBTE) for the synthesis of silver and platinum nanoparticles. The plant extract showed predominance at reducing sugar, ascorbic acid, citric acid, starch, and saponin. The bimetallic nanoparticles (NPs) produced comprised both silver and platinum and were completed within 5 h at 100°C. Bioreduced AgNPs, PtNPs, and AgPtNPs were characterized using UV-visible spectrophotometry, dynamic light scattering, zeta potential measurements, high-resolution transmission electron microscopy, and Fourier transform infrared spectrometry. The biogenic AgPtNPs were 20 to 80 nm in size with an average diameter of ~59 nm. The zeta potential of the AgNPs, PtNPs, and AgPtNPs was ~14.46, ~1.09, and ~11.39 mV, respectively. The synthesized AgNPs, PtNPs, and AgPtNPs exhibited superior antimicrobial activity against both Gram-negative bacterial pathogens in combination with various classes of antibiotics. Further, naturally occurring bioactive principles like diosgenin and curcumin were functionalized on magnetic nanoparticles to enhance the anticancer and antioxidant properties. In view of the background, it can be concluded that there is a huge scope for further research towards the translation of the phytogenic nanoparticles as potential nanomedicine in the future.

Keywords: Bimetallic nanoparticles, antimicrobial synergy, antibiofilm, diosgenin, curcumin, anticancer.

Book of Abstracts Oral Presentations

DENSITY FUNCTIONAL THEORY INVESTIGATION OF THE HYDROGEN STORAGE CAPACITY OF LITHIUM-DECORATED TIS_2 TWO-DIMENSIONAL MATERIAL

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ABSTRACT

The efficient storage of hydrogen remains one of the major scientific challenges in realizing a sustainable energy transition. In this work, we employ *ab initio* simulations based on Density Functional Theory (DFT) to investigate the role of decorating atoms in improving the hydrogen storage capabilities of two-dimensional (2D) materials. The TiS_2 monolayer was selected as a model system owing to its structural stability, large surface area, and favorable electronic configuration. Structural optimizations and electronic property calculations were performed using the Quantum ESPRESSO package within the Generalized Gradient Approximation (GGA–PBE) and including Grimme's DFT-D2 correction for van der Waals interactions.

Our results show that the pristine TiS_2 monolayer exhibits weak physisorption of hydrogen due to limited charge transfer and low adsorption energy. However, the introduction of decorating atoms modifies the local electronic environment, inducing charge redistribution and creating polarization fields that enhance the binding strength of H_2 molecules. This improvement results in increased adsorption energy and better reversibility under ambient conditions.

These findings highlight the crucial role of atomic decoration in tuning the hydrogen adsorption behavior of 2D materials and provide valuable insights into the rational design of next-generation solid-state hydrogen storage systems.

Keywords: Hydrogen storage, DFT, 2D materials, Lithium decoration, TiS_2 monolayer.

APPLICATIONS OF EDIBLE COATINGS ENRICHED WITH PLANT EXTRACTS FOR SHELF LIFE EXTENSION OF FRESH PRODUCE

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ABSTRACT

Post-harvest, fruits undergo a series of physiological activities such as respiration and transpiration, which collectively contribute to substantial qualitative degradation during transportation and storage. Physical treatments such as refrigeration and irradiation, as well as chemical treatments such as the use of fungicides and other preservatives, are common strategies for mitigating these losses. However, growing concerns about the environmental impact and health risk linked with these approaches have prompted academics to investigate safer alternatives. Among these, edible coatings (ECs) enriched with plant extracts have emerged as a viable biodegradable alternative for increasing the shelf life of fresh produce and reducing postharvest losses. Edible coatings enhanced with non-toxic and environmentally friendly plant extracts increase customer acceptance. Such formulations preserve fruit quality by reducing weight loss and delivering extra antioxidants that help control the fruit's enzymatic activities. Polysaccharide-based edible films and coatings like chitosan, alginate, and cassava starch; protein-based films like caseinate films, whey protein isolates, and lipid-based films like beeswax, etc. have been found to improve the overall quality of the fruits or vegetables when plant extracts like pomegranate peel extract, pineapple extract, or essential oils like citrus oil and cinnamon oil are incorporated. This study aims to explore the effectiveness of an edible coating enriched with plant extract in improving the quality, reducing weight loss and extending shelf life of fresh produce.

Keywords: Antioxidants, edible coatings, plant extract, postharvest, shelf life.

A HYBRID DUAL SYRINGE BIOPRINTING – ELECTROSPINNING SYSTEM FOR HIERARCHICAL SCAFFOLD FABRICATION

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ABSTRACT

The development of advanced scaffolds for regenerative medicine increasingly demands hybrid fabrication methods capable of combining micro and nanoscale precision. Conventional extrusion-based bioprinters and electrospinning systems each provide distinct advantages, controlled macro-geometry versus nanoscale fibrous topology, but rarely coexist in a programmable, synchronized workflow. Recent studies have shown that hybrid or sequential integration of these technologies can significantly enhance scaffold mechanical integrity and cell response [1,2]. This work introduces a hybrid dual-syringe bioprinting and electrospinning platform designed to enable layer-by-layer multimaterial deposition for biomaterial scaffold fabrication.

The device integrates two piston-driven syringe modules, each of which can operate in extrusion or electrospinning mode. This modular architecture supports various configurations includes dual-material bioprinting, dual electrospinning, or mixed-mode hybrid deposition providing high flexibility in process design. A high-voltage source (up to 30 kV) with an adjustable collector distance (0–20 cm) enables controlled fiber formation under tunable electric fields, similar to dual-source electrospinning approaches reported previously [3]. All process coordination is achieved through a custom G-code–based macro system and an a custom hybrid slicer, extending conventional additive manufacturing commands to include voltage regulation, dwell control, and automatic tool-mode switching.

To ensure reproducibility and biofabrication stability, the system includes a controlled environment chamber equipped with heating elements, humidity and temperature sensors (BME/BMP series), filtered air circulation using dual fans and particulate filters and a full enclousre made of acrilic sheets. This setup minimizes contamination, stabilizes environmental conditions, and allows parameterized studies of solvent evaporation and fiber morphology during deposition. The workflow supports user-defined deposition strategies, electrospun layers between printed layers, surface coatings, or gradient sandwich structures within a single unified manufacturing sequence.

Initial mechanical evaluations demonstrate positioning accuracy and repeatability with less than 2–3% error rate, validating precise motion control. Ongoing tests include mechanical assessment of extrusion uniformity and fiber alignment, alongside scanning electron microscopy (SEM) characterization of layer

fidelity and interface integration. Candidate materials such as PLA or GelMA for extrusion and PCL or PVA for electrospinning are being examined for compatibility across thermoplastic and hydrogel systems [4, 5].

This hybrid methodology provides a programmable route toward hierarchical scaffolds with tunable mechanical and biological performance. Beyond immediate tissue engineering applications, the proposed platform and workflow establish a foundation for automated, multimodal biofabrication, where deposition techniques are digitally coordinated within a thermally and environmentally controlled fabrication chamber. The modular and open control structure further allows adaptation to a wide range of biomaterials and functional composites.

References

1. Smith, J.A., Mele, E. (2021). Electrospinning and additive manufacturing: Adding three-dimensionality to electrospun scaffolds. *Frontiers in Bioengineering & Biotechnology*, 9, 674738. https://doi.org/10.3389/fbioe.2021.674738.
2. Wang, C. et al. (2012). Dual-source dual-power electrospinning and nanofiber alignment for scaffold fabrication. *Polymer Engineering and Science*, 52(8), 1789–1797. https://pmc.ncbi.nlm.nih.gov/articles/PMC3464384/.
3. Fazal, F., McNamara, L.E., Syed, A., Ahmed, W. (2021). A modified 3D printer as a hybrid bioprinting-electrospinning system for vascular tissue engineering applications. *Medical Engineering & Physics*, 94, 77–88. https://www.research.ed.ac.uk/files/223479166/Accepted_manuscript_222603373.pdf.
4. Gonzalez-Pujana, A. et al. (2022). Hybrid 3D printed and electrospun multi-scale hierarchical scaffolds to induce bone differentiation. *International Journal of Molecular Sciences*, 23(23), 14732. https://doi.org/10.3390/ijms232314732.
5. Liu, F. et al. (2022). Hybrid biomanufacturing systems applied in tissue engineering. *Bio-Design and Manufacturing*, 5(4), 891–905. https://pmc.ncbi.nlm.nih.gov/articles/PMC9831066/.

BIO-RECOVERY OF TANNIN FROM POMEGRANATE (*CV. BHAGWA AND GANESH*) PEEL BY ULTRASONIC ASSISTED EXTRACTION

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ABSTRACT

Tannins are the paramount group of plant secondary metabolites, which help in precipitation and binding of proteins, and other organic compounds such as alkaloids and amino acids. The present study was focused on investigating effects of solvents (methanol, ethanol, water, acetone, hexane) and drying conditions (freeze drying, tray oven drying and sun drying) on total tannin content of two varieties of pomegranate (Bhagwa and Ganesh). The results demonstrated that the freeze-drying powder of both cultivars BFD (77.04%) and GFD (56.25) showed the highest tannin percentage in methanol solvents as compared to other dried powder and solvents. Ethanol also showed the maximum amount of tannins percentage in freeze drying powder of both cultivars BFD (41.50%) and GFD (38.86%). In aqueous extract of pomegranate peel powder the maximum amount of tannin content was recorded in BFD (35.91%) followed by GFD (33.32%), BTD (32.56%), GTD (31.31%) respectively.

Key words: Pomegranate peel; Waste utilization; Tannin content; Solvents; Drying methods.

HYDROGEN STORAGE PERFORMANCE OF MXENE Zr_2CO_2 MATERIAL DECORATED WITH LI ATOMS: A DFT STUDY

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ABSTRACT

In this work, we explore the potential of the MXene material Zr_2CO_2 for hydrogen storage using density functional theory (DFT) with DFT-D2 dispersion corrections. The adsorption energy of hydrogen molecules was calculated to identify the most stable adsorption sites. Two orientations, namely vertical and horizontal, were considered. The results show that the adsorption energy does not fall within the required range (-0.17 to -0.6 eV)[1] [2] for effective storage. To address this, Lithium atom decoration is performed. The most stable sites for Li atoms' attachment to the surface were identified. The results indicate that the hydrogen storage performance is significantly enhanced. The $8Li@Zr_2CO_2$ structure can hold onto 16 H_2 molecules, with the adsorption energy falling within the optimal range, i.e., -0.162 to -0.233 eV. The adsorption of 16 H_2 molecules on the $8Li@Zr_2CO_2$ system has a gravimetric hydrogen storage capacity (C_{wt} %) of 1.52% and a desorption temperature (T_D) of 234.148 K. Additionally, the material demonstrates stability and potential for reversible hydrogen storage at room temperature. However, further improvements can be achieved through structural modification or alternative surface functionalization.

References

1 U. DOE, "DOE technical targets for onboard hydrogen storage for light-duty vehicles", *DOE U*, editor, 2021.
2 "DOE Technical Targets for Onboard Hydrogen Storage for Light-Duty Vehicles".

EXTRACTION AND APPLICATIONS OF PERU BALSAM ABSOLUTE-ENRICHED PECTIN/GELLAN GUM COMPOSITE FILMS FOR FOOD PACKAGING

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ABSTRACT

Perubalsam Absolute is produced by solvent extraction of the balsamic resin derived from *Myroxylon balsamum (L.) Hams var. pereirae (Royle) Harms*. The main constituents of Peru balsam (55–66%) are esters of cinnamic and benzoic acids, especially benzyl cinnamate (cinnamein), cinnamyl cinnamate (styracine) and benzyl benzoate. Small amounts of vanillin and free cinnamic acid are also present [1]. Peru balsam has been reported to eradicate biofilms of *Pseudomonas* spp. (MIC 2.5) and *Staphylococcus aureus* (MIC 2.5%) [2]. Also a fungicidal or fungistatic potential have been demonstrated [3]. *Peru balsam* is approved for food use (Generally Recognized as Safe, GRAS), in accordance with section 201(s) of the Federal Food, Drug and Cosmetic Act [4].

This study focused on developing edible films using a combination of pectin/gellan gum (PGG), enriched with varying concentrations of Perubalsam Absolute (PBA) – 0.5%, 1.0%, and 1.5% by casting method. The effects of *Perubalsam* Absolute (PBA) on the surface, physical, mechanical, barrier and antioxidant properties of pectin/gellan gum (PGG) were evaluated. The developed films were characterized by Fourier transform infra-red spectroscopy (FTIR), scanning electron microscopy (SEM), thermogravimetric analysis (TGA), derivative thermogravimetry (DTG), and X-ray diffraction (XRD). Moreover, physiochemical properties, including moisture content, color, opacity, water solubility, and water vapor permeability, were measured. The antioxidant activity of the prepared films was determined by DPPH and ABTS radical scavenging assays. The incorporation of the extract into films increased opacity, thickness, elongation at break, water vapor permeability, and water solubility; however, tensile strength and moisture content decreased. SEM analysis revealed microstructural deformities like pores and cracks at higher concentrations of PBA. As expected, the antioxidant activities of the composite films increased with the increase in the PBA concentration in the films. Thus, such natural extract antioxidant films as a sustainable packaging material could offer better protection to the packed product against undesirable oxidation reactions.

References

1. Samuelson G., Bohlin L. (2009) Drugs of Natural Origin. A Treatise of Pharmacognosy, 6th edition.
2. Kavanaugh N.L., Ribbeck K. Selected antimicrobial essential oils eradicate Pseudomonas spp. and Staphylococcus aureus biofilms. Appl Environ Microbiol. 2012 Jun;78(11):40574061. doi: 10.1128/AEM.07499-11. Reference.
3. Hänsel, R., Keller, K., Rimpler, H., Schneider, G. Hagers Handbuch der Pharmazeutischen Praxis. Springer, Berlin – Heidelberg, 1994.
4. Leung, A.Y. and Foster, S. (1996) Encyclopedia of Common Natural Ingredients Used in Food, Drugs and Cosmetics. 2nd edition, John Wiley and Sons, Inc., New York.

TARGETING ERYTHROCYTE ENDOTHELIAL NITRIC OXIDE SYNTHASE: *IN VIVO* INSIGHTS INTO COPPER-THIOSEMICARBAZONE COMPLEX ACTIVITY

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ABSTRACT

A promising and relevant area of medicinal chemistry is the development of novel copper coordination compounds with antitumor properties. Numerous copper-based drug candidates are currently undergoing preclinical evaluation as low-cost and highly effective agents for cancer therapy. In clinical diagnostics, endothelial nitric oxide synthase (eNOS) plays a crucial role in maintaining endothelial homeostasis by promoting vasodilation, inhibiting platelet aggregation, and regulating vascular inflammation. In this *in vivo* study, we investigated the effects of copper coordination compounds with thiosemicarbazones (CuCCTs) on eNOS activity in erythrocytes.

This study evaluated the effects of CuCCT administration *in vivo* using 120 rats, which were divided into 10 groups and further stratified by sex into two subgroups: (a) males and (b) females. The first group served as a control and received subcutaneous injections of saline. The remaining groups (groups 2 to 10) were administered various CuCCTs - specifically: CMA-18, CMD-8, MG-22, CMC-34, CMJ-33, CMT-67, CMG-41, TIA-123, and TIA-160 [1]. Each compound was administered subcutaneously at a dose of 10 µg/kg daily for 30 consecutive days.

In this preclinical model, assessing changes in eNOS activity - the enzyme responsible for nitric oxide (NO) production - was essential for evaluating the impact of CuCCTs on endothelial function [2]. In female rats, eNOS activity showed a non-significant increase across all treatment groups, with the exception of MG-22 and CMG-41, which elicited a statistically significant enhancement compared to the control group ($p < 0.05$). In contrast, male rats exhibited a reduction in eNOS activity following administration of CMD-8, MG-22, CMC-34, CMT-67, and TIA-160, although these changes were not statistically significant ($p > 0.05$). Conversely, CMA-18, CMJ-33, CMG-41, and TIA-123 induced a modest, statistically non-significant increase in eNOS activity in males.

The observed effects of CCT compounds on eNOS activity appear to be selective. The study reveals a heterogeneous response: only MG-22 and CMG-41 induced a statistically significant boost in eNOS activity in females, while the other compounds produced variable but statistically non-significant effects. Notably, sex-related differences were evident; in general, females exhibit higher eNOS activity and enhanced flow-mediated vasodilation compared to males. This phenomenon is largely attributed to the action of estrogens,

which upregulate both the expression and activity of eNOS. eNOS catalyzes the production of NO, a key mediator of vascular function, that promotes relaxation of vascular smooth muscle, inhibits platelet aggregation, and prevents leukocyte adhesion to the endothelium - mechanisms that collectively contribute to the prevention of atherosclerosis and the maintenance of vascular homeostasis [3].

References

1. Pantea V. The metabolic effects of native bioactive compounds with antitumor activity. 2023. https://scholar.google.com/scholar?oi=bibs&hl=ru&cluster=9753061033081222071
2. Abdelkawy K.S., Salem K.A. Simple Method for Measuring Endothelial Nitric Oxide Synthase Activity in Clinical Researches. *Journal of Applied Pharmaceutical Science*. 2015; 5(3): 084-090. doi: 10.7324/JAPS.2015.510.S15
3. Tran N., Garcia T., Aniqa M., Ali S., Ally A., Nauli S.M. Endothelial Nitric Oxide Synthase (eNOS) and the Cardiovascular System: in Physiology and in Disease States. Am J Biomed Sci Res. 2022; 15(2): 153–177. Epub 2022 Jan 4. PMID: 35072089; PMCID: PMC8774925.

FROM LAB TO PILOT SCALE: BIOMASS CONVERSION WITH A NOVEL SUSTAINABLE CATALYST

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ABSTRACT

Waste utilization, alternatives to fossil fuels, and reduced greenhouse gas emissions are the latest scientific insights that foster the country's growth and strengthen its economy by developing energy-efficient and self-reliant alternative fuel technologies. Catalyst from waste resources offers triple facet benefits in biodiesel production, including environmental, technical, and economic benefits, making them acceptable in the industrial scale [1–4]. Functionalized porous carbonaceous materials prepared via impregnation, carbonization, and sulfonation of corncob powder were found to provide excellent activity in the esterification of oleic acid, palmitic acid, and highly acidic Karanja oils to biodiesel [1–3]. A range of conditions for producing the catalyst, like the impregnation time and ratio, the carbonization time and temperature, and the sulfonation time and temperature, were investigated and optimized. Corncob impregnated for 5h at impregnation ratio of 1, carbonized for 8h at 723K (mostly mesoporous with specific surface area of 1268 m^2/g) and sulfonated at 393K for 15h (containing –OH, –COOH and $–SO_3H$ groups with total acid density of 5.56 mmol g^{-1}) exhibited the optimum conversion (>94.4%) of oleic acid to fatty acid methyl esters after 2h of reaction [1]. Further, a range of conditions influencing reaction progress, such as reaction time, reaction temperature, the molar ratio of reactants, and catalyst loading, were assessed and optimized elaborately and via response surface methodology (5-level-4-factor central composite design). Results show that a quadratic model was suitable for analyzing the conversion of free fatty acids in Karanja oil, and the analysis of variance (ANOVA) reveals that the F and p values of the model were 3.89 & 0.0121, respectively, indicating that the model is statistically significant within a 95% confidence interval. Under the optimized reaction conditions of 338K, a 1 : 10 fatty acid to methanol molar ratio1 : 20 molar ratio of oil to methanol, and 10 wt% catalyst loading, the conversion of fatty acids or free fatty acids was observed to be ~90% within a 2h reaction time. Furthermore, the experimental data were modeled using the Langmuir-Hinshelwood-Hougen-Watson (LHHW) kinetic model to obtain the kinetic parameters [2,3]. The obtained kinetic parameters were incorporated into the Aspen Plus® simulator to simulate the continuous process. Additionally, the corncob-derived catalyst could be repeatedly employed for at least 20 cycles and still retain its activity by exhibiting around 90% conversion of oleic acid.

References

1. Zakir Hussain and Rakesh Kumar. Synthesis and Characterization of Novel Corncob-Based Solid Acid Catalyst for Biodiesel Production. Industrial & Engineering Chemistry Research 57:34 (2018) 11645–11657.
2. Zakir Hussain, Lingareddy Joji Reddy, Nazleen Sulthana, Boddu Shashi Kanth. Novel Corncob-Based Catalytic Biodiesel Production Process: Experiments, Modeling, and Simulation. Chemical Engineering & Technology 47:2 (2024) 289–296.
3. Zakir Hussain and Rakesh Kumar. Esterification of Free Fatty Acids in Karanja Oil Using Novel Corncob-Derived Solid Acid Catalyst. Materials Today: Proceedings 5:9 (2018) 18045–18051.
4. Zakir Hussain, Belal Haider, and Rakesh Kumar. Production of Biodiesel with and without Catalytic Booster. Materials Today: Proceedings 3:10 (2016) 4115–4120.

Scientometric analysis of silver nanoparticle (Ag-NPs) FOR wound healing application

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ABSTRACT

Diabetic and burn wounds are now predominantly harmful due to infections [1]. Instead of using standard antibiotics, which have reached a critical stage in terms of antimicrobial resistance, an alternate method is required for treating wound infections. According to the United State Centers for Disease Control and Prevention (CDC), antimicrobial-resistant bacteria are anticipated to kill more people than all cancers combined by 2050 [2]. As a result, it is essential to develop novel materials for wound dressing. The use of nanoparticles in wound dressings has gained considerable attention since few years ago. Due to their antibacterial characteristics, silver nanoparticles (Ag-NPs) are noble metal-based nanoparticles with a remarkable wound healing ability [1,3–5]. Ag-NPs loaded in wound dressing polymers improve wound healing and inhibit microbial development [1]. They can also reduce the development of bacterial resistance mechanisms via oxidative stress state [5,6]. On the other hand, AgNPs have broad-spectrum antimicrobial properties, which can help prevent infections in wounds caused by pathogens [7]. The aim of this work is to summarize the development of Ag-NPs utilization for wound healing therapy. This review focused on the scientometric analysis of 405 journal articles retrieved from the Scopus database during January 2014 to August 2023 using a PRISMA approach. By using VOSviewer software, the notable achievements and historical trends of Ag-NPs for wound healing were analyzed and visualized. The result showed a steady increase of published journal related Ag-NPs over the years. The scientometric analysis revealed that India became a top country which is publishing 106 papers related to the topic, followed by China with 90 articles. In addition, International Journal of Nanomedicine is the top featured publisher among the Scopus journals by 25 published articles with 1177 total citations. Therefore, this article can be used as an easy guide for further researchers to explore and predict further trends related to this topic, and identify potential collaborators, most impactful researcher scientists, countries, and publishers.

References

1 K. Kalantari, E. Mostafavi, A.M. Afifi, Z. Izadiyan, H. Jahangirian, R. Rafiee-Moghaddam, T.J. Webster, Wound dressings functionalized with silver nanoparticles: promises and pitfalls, Nanoscale 12 (2020) 2268–2291. https://doi.org/10.1039/C9NR08234D.

2 I. Negut, V. Grumezescu, A.M. Grumezescu, Treatment Strategies for Infected Wounds, Mol. J. Synth. Chem. Nat. Prod. Chem. 23 (2018) 2392. https://doi.org/10.3390/molecules23092392.

3 F. Paladini, M. Pollini, Antimicrobial Silver Nanoparticles for Wound Healing Application: Progress and Future Trends, Materials 12 (2019) 2540. https://doi.org/10.3390/ma12162540.

4 T. Gunasekaran, T. Nigusse, M.D. Dhanaraju, Silver Nanoparticles as Real Topical Bullets for Wound Healing, J. Am. Coll. Clin. Wound Spec. 3 (2011) 82. https://doi.org/10.1016/j.jcws.2012.05.001.

5 M. Rybka, Ł. Mazurek, M. Konop, Beneficial Effect of Wound Dressings Containing Silver and Silver Nanoparticles in Wound Healing – From Experimental Studies to Clinical Practice, Life 13 (2023) 69. https://doi.org/10.3390/life13010069.

6 B. Komazec, P. Cvjetko, B. Balen, I. Letofsky-Papst, D.M. Lyons, P. Peharec Štefanić, The Occurrence of Oxidative Stress Induced by Silver Nanoparticles in Chlorella vulgaris Depends on the Surface-Stabilizing Agent, Nanomaterials 13 (2023) 1967. https://doi.org/10.3390/nano13131967.

7 G. Chinnasamy, S. Chandrasekharan, T.W. Koh, S. Bhatnagar, Synthesis, Characterization, Antibacterial and Wound Healing Efficacy of Silver Nanoparticles from Azadirachta indica, Front. Microbiol. 12 (2021). https://www.frontiersin.org/articles/10.3389/fmicb.2021.611560 (accessed October 18, 2023).

A POTENTIAL BIOFUNCTIONAL BIOMIMETIC MULTILAYER SCAFFOLD FOR TRACHEAL TISSUE ENGINEERING

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ABSTRACT

The trachea plays a critical role in clearing mucosal secretions and ensuring air circulation[1]. The most prevalent tracheal injuries are tracheal stenosis and tracheomalacia. The treatment of damaged tracheal tissue is typically accomplished through a combination of surgical interventions, including anastomosis, tracheoplasty, and stenting [2]. However, due to limitation of these methods, there is a need for the development of new therapeutic strategies for the treatment of tracheal injuries. In this study, a three-layered tracheal patch was fabricated by integrating multiple production techniques. The innermost layer (Layer I), composed of GelMA incorporated with ciprofloxacin, was fabricated using the Digital Light Processing (DLP) method. Subsequently, a cartilage-mimicking PCL intermediate layer (Layer II) was added into Layer I through microextrusion-based 3D printing. Following this, EGF/Collagen-I nanoparticles were immobilized onto the luminal surface of the construct via electrohydrodynamic atomization (EHDA). Finally, the outermost layer (Layer III) was formed by coaxial electrospinning of PCL/Collagen fibers encapsulating TGF-β3. The patches were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), mechanical testing, swelling and degradation analysis. Drug release behavior was assessed using UV–visible spectrophotometry.

Keywords: Tracheal Tissue Engineering, Tracheal Patch, GelMA, DLP, EHDA, Electrospinning

References

1 L. Soriano et al. Development and clinical translation of tubular constructs for tracheal tissue engineering: a review, *Eur Respir Rev*, Vol. 30, no. 162, Dec. 2021, doi: 10.1183/16000617.0154-2021.

2 A. Dhasmana, A. Singh, S. Rawal, Biomedical grafts for tracheal tissue repairing and regeneration “Tracheal tissue engineering: an overview”, *J Tissue Eng Regen Med*, Vol. 14, no. 5, pp. 653–672, May 2020, doi:10.1002/TERM.3019.

DEVELOPMENT OF A BIOACTIVE ELECTROSPUN WOUND DRESSING INCORPORATING RECOMBINANT HUMAN-LIKE COLLAGEN AND AG-Zn NANOPARTICLES

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ABSTRACT

Wound healing remains a critical challenge in medical applications, especially concerning the prevention of infections and the acceleration of tissue regeneration. This study presents the development of a novel electrospun wound dressing incorporating recombinant human-like collagen, polyvinyl alcohol (PVA), and silver-zinc (Ag-Zn) ions. The recombinant collagen, produced via genetic engineering techniques, enhances cellular adhesion and proliferation, mimicking the extracellular matrix (ECM) environment more effectively than conventional collagen sources[1,2].

The incorporation of Ag-Zn ions provides a dual-functionality: antibacterial protection against biofilm formation and the generation of a localized electric field upon fluid exposure. The presence of an electric field has been shown to promote cell migration and proliferation, further accelerating wound closure. Electrospinning was employed to fabricate nanofibrous scaffolds, ensuring a high surface area and porosity suitable for cellular infiltration and sustained release of bioactive components[1,3].

This study compares the performance of the proposed wound dressing with existing commercial and experimental solutions, highlighting its superior bioactivity, infection control, and regenerative potential. In vitro cytocompatibility assays and antimicrobial efficacy tests demonstrate the enhanced wound healing capability of the developed dressing. The combination of electrospinning technology with bioactive materials and electric field induction positions this novel dressing as a promising alternative for advanced wound care applications[1,2,3].

References

1. Shuang Jia et al.,Genetically encoded zinc-binding collagen-like protein hybrid hydrogels for wound repair, International Journal of Biological Macromolecules,Vol. 254, Part 1 (2024)
2. Gahlawat, Sonal, Vikas Nanda, David I. Shreiber. Purification of recombinant bacterial collagens containing structural perturbations. PloS one 18.5 (2023)
3. Meganathan, Ilamaran et al. Recombinant and genetic code expanded collagen-like protein as a tailorable biomaterial. Materials Horizons 9.11 (2022): 2698–2721.

BIOMIMETIC SCAFFOLDS FABRICATED BY DIRECT INK WRITING FOR OSTEOCHONDRAL TISSUE REGENERATION

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ABSTRACT

The regeneration of osteochondral defects in the knee represents a significant challenge due to the complex, multilayered architecture of the tissue. Each layer exhibits distinct compositional characteristics and exceptional mechanical properties that are difficult to replicate using current biomaterial technologies. The subchondral bone provides structural rigidity and load-bearing capacity, while the overlying calcified cartilage layer ensures a gradual transition to articular cartilage, maintaining mechanical compatibility and biochemical integrity at the osteochondral interface. Consequently, biomimetic scaffolds that reproduce mechanical, chemical, and biological gradients are critical for successful outcomes in knee osteochondral regeneration [1].

In this study, the bone layer (BL) and calcified cartilage layer (CCL) within the osteochondral structure were fabricated using the Direct Ink Writing (DIW) technique to replicate these hierarchical features. DIW enables room-temperature processing and precise architectural control, which is advantageous for gradient constructs and bioactive composite systems [2]. Bioinks were prepared from poly(ε-caprolactone) (PCL), polyethylene glycol (PEG), and hydroxyapatite (HAp), and printability tests identified 55% w/v PCL with a Pr value close to 1 as the optimal formulation for reliable filament deposition and pore fidelity [3]. Accordingly, the BL was printed with a higher HAp content (55 wt%), while the CCL contained a lower HAp content (35 wt%), reproducing the compositional gradient of native osteochondral tissue. Rheological analyses confirmed shear-thinning behavior suitable for DIW extrusion. Morphological characterization revealed well-defined architectures with uniform pore sizes of 767.35 ± 40.05 μm (BL) and 732.40 ± 50.40 μm (CCL); such macroporous ranges support oxygen/nutrient transport and osteogenic activity in bone tissue scaffolds. FTIR confirmed the chemical integrity of the composites. Mechanical testing demonstrated a distinct gradient: the BL exhibited a Young's modulus of 167.45 ± 57.51 MPa and tensile strength of 4.05 ± 0.27 MPa, whereas the CCL showed 21.95 ± 0.43 MPa and 2.33 ± 0.25 MPa. Interfacial adhesion strength between layers was 414 ± 89 kPa, ensuring structural stability. Swelling and degradation analyses indicated that higher HAp content accelerated both fluid uptake and mass loss, supporting integration potential. In vitro studies with human osteoblasts confirmed biocompatibility, with cell viability exceeding 83% after seven days and effective cell attachment and proliferation observed by SEM and fluorescence microscopy.

Overall, these results demonstrate that DIW-fabricated bilayered scaffolds closely replicate the osteochondral microenvironment and hold strong potential as a biomimetic platform for knee osteochondral tissue regeneration.

References

1. Zhang, B., Huang, J., Narayan, R.J. (2020). Gradient scaffolds for osteochondral tissue engineering and regeneration. *Journal of Materials Chemistry B*, 8(36), 8149–8170.
2. Saadi, M.A.S.R., Maguire, A., Pottackal, N.T., Thakur, M.S.H., Ikram, M.M., Hart, A.J., ... & Rahman, M.M. (2022). Direct ink writing: A 3D printing technology for diverse materials. *Advanced Materials*, 34(28), 2108855.
3. Ouyang, L., Yao, R., Zhao, Y., Sun, W. (2016). Effect of bioink properties on printability and cell viability for 3D bioplotting of embryonic stem cells. *Biofabrication*, 8(3), 035020.

COATING OF MARINE STEEL WITH POLYVINYL ALCOHOL//CHITOSAN/GRAPHENE OXIDE

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ABSTRACT

In this study, polyvinyl alcohol (PVA), chitosan (CS), and graphene oxide (GO) were used to fabricate the coating solution applied onto ST37 marine steel via the dip coating method. GO contributes to the improvement of mechanical stability and barrier performance due to its layered structure, while chitosan provides biocompatibility and antibacterial activity [1]. PVA, acting as a polymeric binder, ensures film integrity and homogeneity. The synergistic effect of these components was observed during the study. The 5% (w/v) PVA solution was prepared by dissolving PVA in distilled water at 80°C under continuous magnetic stirring until complete homogenization. Separately, the 2% (w/v) CS solution was prepared in 1% acetic acid. The two polymeric solutions were then blended in different ratios (80:20, 70:30, 60:40, and 50:50), followed by the addition of GO in varying concentrations (0.5%, 1%, 1.5%, and 2% w/v) [2]. The GO amount was carefully adjusted to remain below cytotoxic levels [3,4]. After thorough mixing, the prepared solutions were deposited onto ST37 steel substrates and dried to form uniform thin films.

Preliminary evaluations show that the PVA/GO/CS system forms a uniform and adherent coating on ST37, which demonstrates improved durability under marine conditions. This strategy represents a sustainable and effective alternative to conventional coatings that often contain toxic components harmful to marine ecosystems. Consequently, this work highlights the potential application of PVA/GO/CS coatings as next-generation, eco-friendly protective systems for marine steels.

References

1. Bener, S. (1970, January 2). *Investigation of the physical properties of chitosan/graphene oxide composite films.* repository.title.prefixDSpace Angular. https://polen.itu.edu.tr/items/00822195-2cbe-459c-8a6c-b828967f5c50.
2. J. Julian, E. Santoso, Pengaruh Komposisi PVA Kitosan Terhadap Perilaku Membran Komposit PVA Kitosan Grafen Oksida Yang Terikat Silang Asam Sulfat.
3. Shams, S. et al. Biocompatibility of graphene oxide with chitosan for biomedical applications. *International Journal of Biological Macromolecules*, 99, 1040–1050, 2017.
4. Kumar, S. et al. Chitosan – graphene oxide nanocomposites: synthesis, characterization and applications. *Journal of Materials Chemistry B*, 4, 2269–2282, 2016.

ECO-BENIGN NANOCATALYSTS: PHYTOGENIC AG:ZNO NANOPARTICLES FOR POLLUTANT DETOXIFICATION

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ABSTRACT

Rapid industrial growth in dyeing and textiles has led to uncontrolled discharge of toxic dyes (e.g., methylene blue, methyl orange, Congo red, rhodamine B) and heavy metals into water, endangering humans and aquatic life [1,2]. Nanoremediation offers an eco-friendly and effective solution for dye removal [3]. To address this, *Plumbago auriculata* leaf extract (PALE) was used as a green reducing and stabilizing agent for the synthesis of zinc oxide nanoparticles (ZnOPs) and silver-doped ZnOPs (Ag:ZnOPs). Nanoparticles with varied Zn:Ag ratios (ZnOAg1Ps, ZnOAg10Ps, ZnO10Ag1Ps) were obtained by tuning precursor concentrations. Phytochemical analysis of PALE revealed abundant polyphenols, flavonoids, sugars, starch, citric acid, and plumbagin, which contributed to metal ion reduction and nanoparticle stabilization. Morphological studies showed polydisperse particles of different shapes, while UV–Vis spectra confirmed Ag doping with red-shifted absorption peaks and plasmon resonance bands. DLS indicated particle sizes of 407 nm (ZnOPs), 98 nm (ZnOAg1Ps), 231 nm (ZnOAg10Ps), and 90 nm (ZnO10Ag1Ps). EDX confirmed elemental composition, and FTIR indicated peptide and methyl group involvement. Photocatalytic studies using methylene blue demonstrated the superior performance of ZnOAg10Ps, achieving 95.7% degradation with a rate constant of 0.0463 s^{-1}. These findings establish PALE-mediated Ag:ZnOPs as efficient, eco-friendly photocatalysts for dye-contaminated wastewater treatment.

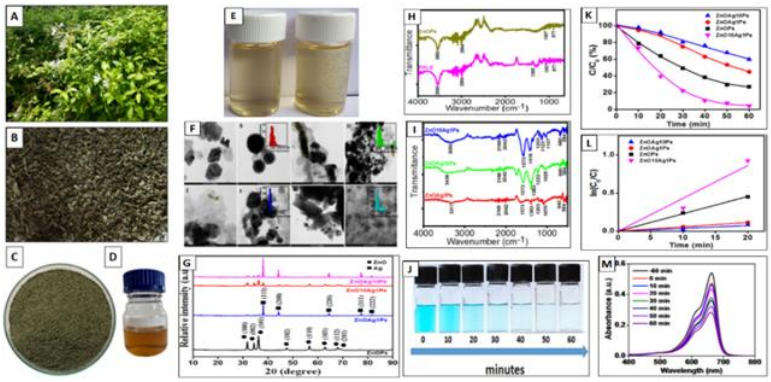

Figure 1. Phytogenic synthesis of Ag-doped ZnO nanoparticles using *P. auriculata*: A) Plant; B) Dried leaves; C) Leaf powder; D) PALE; E) ZnOPs; F) HRTEM images; G) XRD patterns; H) FTIR of PALE & ZnOPs; I) FTIR of Ag–ZnOPs; J) Time-dependent methylene blue degradation; K) Photocatalysis under UV; L) First-order kinetics; M) Absorption spectra of MB reduction with ZnO10Ag1Ps.

References

1. Slama, H.B., Bouket, A.C., Pourhassan, Z. et al. Appl. Sci. 11(14), 6255.
2. Dutta, S., Gupta, B., Srivastava, S.K. et al. Mater. Adv. 2, 4497–4531
3. Mehta, M., Sharma, M., Pathania, K. et al. Environ. Sci. Pollut. Res. Int. 28(36), 49434–49446.

INFLUENCE OF SOLID-STATE FERMENTATION ON THE GREEN SYNTHESIS AND PROPERTIES OF SILVER NANOPARTICLES FROM *ANNONA MURICATA* SEED COMPONENTS

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ABSTRACT

The green synthesis of silver nanoparticles (AgNPs) is a cornerstone of sustainable nanotechnology. The physicochemical properties of AgNPs, which dictate their functional efficacy, are highly influenced by the nature of the reducing and capping agents. This study posits that solid-state fermentation, as a bioprocessing tool, can fundamentally alter the phytochemical profile of *Annona muricata* seed extracts, thereby modulating the structural properties of the synthesised AgNPs, a premise supported by recent work on bio-enhancement of plant extracts [1].

AgNPs were synthesised using aqueous extracts from fermented and unfermented seed coats and cotyledons of *A. muricata* by reducing a 1 mM silver nitrate solution. The formation of AgNPs was confirmed by UV-Vis spectroscopy. A comprehensive structural characterisation was performed using Scanning Electron Microscopy (SEM) for morphological analysis, Energy-Dispersive X-ray Spectroscopy (EDX) for elemental confirmation, and Fourier-Transform Infrared Spectroscopy (FTIR) to identify the functional groups involved in bioreduction and stabilisation [2].

UV-Vis spectroscopy confirmed successful synthesis, with a sharper and more intense Surface Plasmon Resonance (SPR) peak observed for AgNPs from fermented extracts (~430 nm) compared to the broader peak of unfermented AgNPs. SEM analysis revealed a striking difference: AgNPs from fermented extracts were predominantly spherical, well-dispersed, and monodisperse with a narrow size range of 15-40 nm. In contrast, AgNPs from unfermented extracts were highly aggregated and polydisperse. EDX analysis confirmed the presence of a strong metallic silver signal in all samples. FTIR spectra indicated a marked increase in the intensity of peaks associated with O-H and C=O stretches in the fermented extracts, suggesting a higher concentration of polyphenols and carbonyl compounds acting as capping agents [3].
The structural analyses conclusively demonstrate that solid-state fermentation induces significant positive changes in the nucleation and growth of AgNPs. The enhanced phytochemical profile of fermented extracts, evidenced by FTIR, leads to superior reduction kinetics and stabilization, resulting in monodisperse, uniform nanoparticles. This refined morphology – specifically the small size, spherical shape, and lack of aggregation – is a critical determinant of biological activity, as high surface-area-to-volume ratio and dispersion are known to enhance bio-interactions [4,5]. In conclusion, fermentation is a powerful pre-treatment that directly controls the structural properties of biogenic AgNPs. The superior morphology and stability of the fermented AgNPs strongly suggest a concomitant enhancement in their potential biological efficacy, positioning them as highly promising candidates for further biomedical and environmental applications.

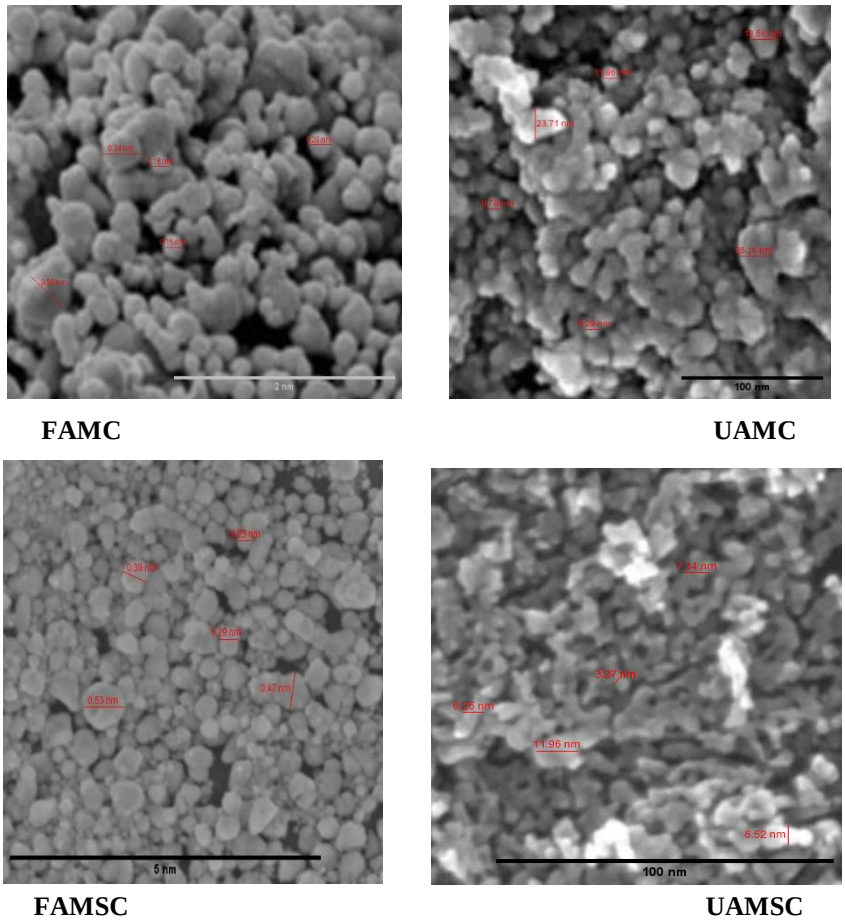

Figure 1: SEM for Fermented Annona muricata Cotyledon (FAMC), Unfermented Annona muricata Cotyledon (UAMC), Fermented Annona muricata Seed Coat (FAMSC), Unfermented Annona muricata Seed Coat (UAMSC).

References

1. Khan, S.A., Lee, C.S. (2020). Green biological synthesis of nanoparticles and their biomedical applications. Inamuddin and Asiri, A. (Eds.), Applications of nanotechnology for green synthesis Springer. pp. 247–280. https://doi.org/10.1007/978-3-030-44176-0_10
2. Lateef, A., Ojo, S.A., Azeez, M.A., Asafa, T.B., Yekeen, T.A., Akinboro, A., Oladipo, I.C., Gueguim-Kana, E.B., and Beukes, L.S. (2016). Cobweb as novel biomaterial for the green and eco-friendly synthesis of silver nanoparticles. Applied Nanoscience, 6, 863–874. https://doi.org/10.1007/s13204-015-0492-9
3. Hashemi, Z., Shirzadi-Ahodashti, M., Mortazavi-Derazkola, S., Ebrahimzadeh, M. A. (2022). Sustainable biosynthesis of metallic silver nanoparticles using barberry phenolic extract: Optimization and evaluation of photocatalytic, *in vitro* cytotoxicity, and antibacterial activities against multidrug-resistant bacteria. Inorganic Chemistry Communications, 139, 109320. https://doi.org/10.1016/j.inoche.2022.109320
4. Bokolia, M., Baliyan, D., Kumar, A., Das, R., Kumar, R., Singh, B. (2025). Biogenic synthesis of nanoparticles using microbes and plants: mechanisms and multifaceted applications. International Journal of Environmental Analytical Chemistry, 105(9), 2069–2097. https://doi.org/10.1080/03067319.2024.2305238
5. Singh, S., Tiwari, H., Verma, A., Gupta, P., Chattopadhaya, A., Singh, A., Singh, S., Kumar, B., Mandal, A., Kumar, R., Yadav, A.K., Gautam, H. K., and Gautam, V. (2024). Sustainable synthesis of novel green-based nanoparticles for therapeutic interventions and environmental remediation. American Chemical Society Synthetic Biology, 13(7), 1994-2007. https://doi.org/10.1021/acssynbio.4c00206.

STUDY OF THE ADSORPTION MECHANISMS OF Zn(II) AND Cu(II) BY RED CLAY FROM MOROCCO

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ABSTRACT

The elimination of toxic metals, in particular (Cu) and (Zn), which are present in the liquid effluents is crucial due to their toxicity and persistence in the environment, thus representing a major environmental risk [1]. This study explores the use of a natural red clay from the western region of Morocco as an economical and sustainable adsorbent for this task. The choice of this clay is justified by its local availability and intrinsic physico-chemical properties, which make it relevant for wastewater treatment [2,3]. The adsorption process was examined through kinetic and equilibrium studies. Adsorption kinetics of zinc and copper on the pseudo-second order model best describes the red clay under study. Equilibrium isotherm analysis, using Langmuir, Freundlich & Temkin models, has shown a better correlation with Langmuir's model to describe the adsorption by copper ions by this clay. On the other hand, the sorption of Zn(II) ions by this type of clay can be described by the Freundlich model. In addition, SEM-EDX and FTIR techniques were used before & after the adsorption process for zinc and copper ions, to study structural and chemical changes in the red clay studied during adsorption. The results enabled us to understand the interaction mechanisms and confirm the effectiveness of the clay as an adsorbent for these metals.

References

1. E. S. Sahib Al Saidi, N. Haider Al-Taei, W. Razzaq Hilal, Z. Hamzah Muttaleb, Water Pollution, Sources, Effect on Human Health and Treatment Technologies, J. Univ. Babylon Pure Appl. Sci. 32 (2024), 172–189. https://doi.org/10.29196/jubpas.v32i4.5529.
2. N. Ferraa, M. Ouakki, M. Barbouchi, M. Cherkaoui, M. Bennani Ziatni, Theoretical Investigation and Electrochemical Study of Stoichiometric Hydroxyapatite as an Ecofriendly Corrosion Inhibitor for Steel in 3% NaCl, Biointerface Res. Appl. Chem. 14 (2024) 54. https://doi.org/10.33263/BRIAC143.054.
3. A. Bhatnagar, V.J.P. Vilar, C.M.S. Botelho, R.A.R. Boaventura, A Review of the Use of Red Mud as Adsorbent for the Removal of Toxic Pollutants from Water and Wastewater, Environ. Technol. 32 (2011), 231–249. https://doi.org/10.1080/09593330.2011.560615.

DEVELOPMENT OF GABA-LOADED NANOFIBERS FOR POSTOPERATIVE ADJUVANT THERAPY

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ABSTRACT

Postoperative adjuvant therapy with GABA-loaded nanofibers aims to mitigate neurotoxicity, inflammation, and tissue damage often associated with postoperative complications, particularly in cancer treatment contexts where chemotherapeutic agents may exacerbate neural and tissue injury. The localized delivery system minimizes systemic exposure, potentially reducing side effects and improving patient outcomes by promoting tissue regeneration and neuroprotective effects [1].

This study focuses on the development of gamma-aminobutyric acid (GABA)-loaded nanofibers as a novel approach for postoperative adjuvant therapy. GABA, a key inhibitory neurotransmitter with known neuroprotective and anti-inflammatory effects, has been encapsulated within biocompatible nanofibrous scaffolds designed for localized, sustained drug release at surgical sites. The synthesis of these nanofibers employed electrospinning techniques using polymers optimized to maintain GABA stability while facilitating controlled release over an extended period. GABA was successfully incorporated into nanofibers fabricated via electrospinning, using a blend of poly(lactic acid) (PLA) and polyvinylpyrrolidone (PVP). Electrospun PLA/PVP/GABA nanofibers were characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FT-IR), thermal analysis (DSC), and tensile strength. Scanning SEM confirmed the formation of smooth, continuous nanofibers. FTIR spectroscopy analyses verified the successful incorporation of GABA into the polymer matrix and indicated an amorphous dispersion of the drug [2,3].

In conclusion, we have successfully engineered a biocompatible and biodegradable GABA-loaded nanofiber system. The study highlights the promise of GABA-loaded nanofibers as an innovative platform for improving postoperative healing and recovery by harnessing the therapeutic benefits of GABA while leveraging the advantages of nanofiber drug delivery technology [4].

References

1. Liechty, W.B., Kryscio, D.R., Slaughter, B.V., Peppas, N.A. (2010). Polymers for drug delivery systems. Annual review of chemical and biomolecular engineering, 1(1), 149-173.
2. Sill, T.J., Von Recum, H.A. (2008). Electrospinning: applications in drug delivery and tissue engineering. Biomaterials, 29(13), 1989–2006.
3. Kenawy, E.R., Bowlin, G.L., Mansfield, K., Layman, J., Simpson, D.G., Sanders, E.H., Wnek, G.E. (2002). Release of tetracycline hydrochloride from electrospun poly (ethylene-co-vinylacetate), poly (lactic acid), and a blend. Journal of controlled release, 81(1–2), 57–64.
4. Li, W.J., Laurencin, C.T., Caterson, E. J., Tuan, R. S., Ko, F.K. (2002). Electrospun nanofibrous structure: a novel scaffold for tissue engineering. Journal of Biomedical Materials Research: An Official Journal of The Society for Biomaterials, The Japanese Society for Biomaterials, and The Australian Society for Biomaterials and the Korean Society for Biomaterials, 60(4), 613–621.

THE EXPERIMENTAL INVESTIGATION OF THE COMPOSITE COMPOUND OF PYRAZOLE, PYRAN, AND FURAN AS A CORROSION INHIBITOR

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ABSTRACT

From electrochemistry view, one of the most efficient, cost-effective, and valuable corrosion inhibitors is the utilization of organic molecules with P, N, O, and S in their molecular structures. Due to their ability to transfer their electrons (charge) to the metallic d-orbitals and create a solid metal protective layer through coordinate bonding. The corrosion inhibition potential of heterocyclic compounds with one or more heteroatoms can correlate with their electronegativity.

Literature study suggests that heterocycle compounds having N, S, and P in their chemical structures are widely used in corrosion mitigation[2]. Obviously, in most of the cases these heteroatoms serve as site for bonding with the metallic surface. Noticeably, they also possess empty p or d-orbital where they can accept electrons being transferred from metallic d-orbitals. This process is called retro-donation. Thus. both donation and back (retro-) donation modes of chemical bonding are reinforced by these heteroatoms [3]. With each heterocyclic, we get different properties and characteristics according to its size and the heteroatoms, but in the case of combining them, will they still provide great performance or vice versa?

To answer this question, 3 different heterocycles have been adopted in such a way that pyran, pyrazole, and furan assemble to form a compound, including hetero-functional groups. To figure out their behaviour, a set of experimental studies have been carried out, such as PDP, EIS, adsorption studies , and MEB/EDX.. In which the results spotlighted a magnificent behaviour of the studied compound beside its potential and ability to interact via the different active sites in different mechanisms according to the environment surrounding.

References

1. A.Z. Halimehjani, I.N. Namboothiri, and S. E. Hooshmand, Part I: Nitroalkenes in the synthesis of heterocyclic compounds, RSC Adv.4 (2014) 48022–48084.
2. F.A. Almalki, An overview of structure-based activity outcomes of pyran derivatives against Alzheimer's disease, Saudi Pharm. J. 14 (2023).
3. C. Verma, D.K. Verma, E.E. Ebenso, M.A. Quraishi, Sulfur and phosphorus heteroatom-containing compounds as corrosion inhibitors: An overview, Heteroat. Chem. 29 (2018) e2143.

PRODUCTION OF BIO-NANOCARRIERS VIA SUPERCRITICAL EMULSION EXTRACTION FOR ENHANCED STABILITY AND CONTROLLED RELEASE OF WASTE-DERIVED ENZYMES

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ABSTRACT

The authors retain their rights to publish the abstract allong with the full paper, later.

PRODUCTION AND CHARACTERIZATION OF GAMMA-AMINOBUTYRIC ACID LOADED COMPOSITE SCAFFOLD USING 3D PRINTING TECHNIQUE

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ABSTRACT

Gamma-aminobutyric acid (GABA), the major inhibitory neurotransmitter in the central nervous system, plays a vital role in maintaining the balance between excitatory and inhibitory neural signaling. Although traditionally considered incapable of crossing the blood–brain barrier (BBB), recent evidence suggests the existence of specific transporter systems that facilitate its passage. In parallel, advances in 3D bioprinting have enabled the development of functional biomaterial systems for drug delivery and tissue regeneration (1).

In this study, polycaprolactone (PCL) and poly(vinyl alcohol) (PVA) composite scaffolds were fabricated using 3D printing technology to evaluate their potential as carriers for GABA in neuropharmacological and wound-healing applications(2). Four types of scaffolds – PCL, PCL-PVA, PCL-PVA-GABA, and PCL-PVA-GABA-PCL –were prepared, with GABA incorporated at three different concentrations (15 mg, 30 mg, and 45 mg). The structural, chemical, and morphological characteristics of the scaffolds were analyzed using Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). Thermal, mechanical, and swelling properties were also investigated to assess scaffold performance and stability.

The results demonstrated that GABA was successfully incorporated into the PCL/PVA matrix, forming a homogeneously distributed and stable composite structure. The fabricated scaffolds exhibited suitable mechanical integrity, thermal stability, and swelling behavior for potential biomedical applications. Overall, these findings indicate that GABA-loaded PCL/PVA scaffolds fabricated via 3D printing hold promise as biocompatible materials for controlled drug delivery and regenerative medicine applications.

References

1. Almutairi, S., Sivadas, A., Kwakowsky, A. (2024). The effect of oral GABA on the nervous system: potential for therapeutic intervention. *Nutraceuticals*, 4(2), 241-259.
2. Harmanci, S., Dutta, A., Cesur, S., Sahin, A., Gunduz, O., Kalaskar, D.M., Ustundag, C. B. 2022. Production of 3D printed bi-layer and tri-layer sandwich scaffolds with polycaprolactone and poly (vinyl alcohol)-metformin towards diabetic wound healing. Polymers, 14(23), 5306.

GREEN SYNTHESIS AND CHARACTERIZATION OF COPPER NANOPARTICLES USING *RHEUM RIBES* L. ROOT

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ABSTRACT

The burgeoning field of nanotechnology continually seeks sustainable and eco-friendly methods for nanoparticle synthesis to circumvent the environmental and biological drawbacks associated with conventional physical and chemical approaches. This study presents a novel, cost-effective, and environmentally friendly synthesis route for copper nanoparticles (CuNPs) utilizing the root extract of *Rheum ribes* L., a medicinal plant renowned for its rich phytochemical profile. The proposed biosynthesis method leverages the natural reducing and capping capabilities of the plant's secondary metabolites, thereby eliminating the need for harsh chemical reagents [1,2].

In this investigation, the ethanolic extract of *Rheum ribes* L. root was employed as both a reducing and stabilizing agent in reactions with various copper salts. The formation of CuNPs was initially confirmed by a visible color change in the reaction mixture to a characteristic yellowish-brown, and further verified by UV-Vis spectroscopy, which exhibited a distinct surface plasmon resonance (SPR) band in the range of 256–430 nm [3]. Characterization of the synthesized CuNPs was performed using X-ray diffraction (XRD) to confirm crystalline nature, scanning electron microscopy (SEM) to investigate morphology and size distribution, and Fourier-transform infrared spectroscopy (FTIR) to identify functional groups. X-ray Diffraction (XRD) analysis confirmed the crystalline nature of the biosynthesized CuNPs, revealing a face-centered cubic (fcc) structure, with an average crystallite size estimated using the Debye-Scherrer equation to be approximately 33.06 nm.

The study underscores the potential of Rheum ribes L. root extract as an efficient bioresource for producing stable CuNPs, which may find applications in antimicrobial therapies, catalytic processes, and environmental remediation. This green synthesis approach not only reduces environmental impact but also offers a scalable and cost-effective route for nanoparticle production, aligning with sustainable development goals in nanotechnology [4].

References

1. Varma, R. S. (2014). Journey on greener pathways: from the use of alternate energy inputs and benign reaction media to sustainable applications of nano-catalysts in synthesis and environmental remediation. Green Chemistry, 16(4), 2027–2041.
2. Mittal, A.K., Chisti, Y., Banerjee, U.C. (2013). Synthesis of metallic nanoparticles using plant extracts. Biotechnology advances, 31(2), 346–356.
3. Ghosh, M.K., Sahu, S., Gupta, I., Ghorai, T.K. (2020). Green synthesis of copper nanoparticles from an extract of Jatropha curcas leaves: Characterization, optical properties, CT-DNA binding and photocatalytic activity. RSC advances, 10(37), 22027–22035.
4. Dahl, J.A., Maddux, B.L., Hutchison, J.E. (2007). Toward greener nanosynthesis. Chemical Reviews, 107(6), 2228–2269.

BIOGENIC SYNTHESIS AND ANTIOXIDANT ACTIVITY OF *VACCINIUM CORYMBOSUM* L. BASED Cu/Zn/Ag NANOPARTICLES

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ABSTRACT

The paradigm in nanotechnology is shifting towards sustainable and eco-friendly synthesis methods to circumvent the environmental and economic drawbacks of conventional physicochemical approaches. Conventional chemical and physical methods frequently utilise hazardous reagents, consume substantial energy, and produce toxic byproducts [1].

This study presents a facile, cost-effective, and green strategy for the synthesis of copper (Cu), zinc (Zn) and silver (Ag) nanoparticles using an extract of highbush blueberry, *Vaccinium corymbosum* L. (VC). The fruit was selected as a bio-reductant and stabiliser due to its exceptionally rich profile of natural antioxidants, including anthocyanins, flavonols, and phenolic acids, which are capable of reducing metal ions and capping the nanoparticles to ensure colloidal stability [2,3].

A straightforward, one-pot synthesis method was employed where blueberry extract was reacted with solutions of metal salts individually for single nanoparticles, in pairs for binary combinations, and all together for the ternary nanoparticles. The formation of nanoparticles was confirmed by visual observation of characteristic color changes and subsequent UV-visible spectroscopy, which detected distinct absorption profiles for each type of nanoparticle. The study's core methodology centred on a systematic comparison of the antioxidant capacities of all synthesized nano-formulations. This was quantitatively assessed using standard in vitro assays, including the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging and Folin-Ciocalteu assay. The results indicate that the complex interaction between different metals in a composite nanoparticle stabilized with phytochemicals from blueberry extract creates an antioxidant material.

The successful synthesis and demonstrated potent antioxidant activity of these biogenic nanoparticles pave the way for their potential application in diverse fields. The VC-AgNPs, with their strong radical scavenging properties, are proposed as promising candidates for topical wound healing formulations and as active components in cosmetic products designed to mitigate oxidative stress. The VC-ZnNPs and VC-CuNPs hold significant potential in agri-food sectors as nano-fertilizers or antimicrobial coatings for food preservation, leveraging their dual role as essential micronutrients and antioxidants. This study demonstrates the efficacy of Vaccinium corymbosum extract in facilitating the green synthesis of multifunctional metal nanoparticles with antioxidant properties, supporting their prospective use as natural antioxidants in biomedical and industrial applications [4].

References

1. Bhardwaj, B., Singh, P., Kumar, A., Kumar, S., Budhwar, V. (2020). Eco-friendly greener synthesis of nanoparticles. Advanced pharmaceutical bulletin, 10(4), 566.
2. Wang, L., Lan, W., Chen, D. Blueberry (Vaccinium spp.) Anthocyanins and Their Functions, Stability, Bioavailability, and Applications, Foods. 2024; 13 (17):2851.
3. Mittal, A.K., Chisti, Y., Banerjee, U.C. (2013). Synthesis of metallic nanoparticles using plant extracts. Biotechnology advances, 31(2), 346–356.
4. Samuel, M.S., Ravikumar, M., John J.A., Selvarajan, E., Patel, H., Chander, P.S., Chandrasekar, N. (2022). A review on green synthesis of nanoparticles and their diverse biomedical and environmental applications. Catalysts, 12(5), 459.

REVOULATION FROM MONOMETALLIC TO TRIMETALLIC NANOPARTICLES: SYNTHESIS AND CHARACTERIZATION USING *CALENDULA OFFICINALS*

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ABSTRACT

The evolution in nanotechnology is progressively advancing from simple monometallic systems towards complex multimetallic architectures, driven by the pursuit of enhanced and novel functional properties. Trimetallic nanoparticles, in particular, represent a frontier in materials science, offering synergistic effects that are unattainable with their mono- and bimetallic counterparts due to the complex interplay between three distinct metals [1].

This study explores the synthesis and characterization of monometallic (Ag, Cu, Zn), bimetallic (Ag-Cu, Ag-Zn, Cu-Zn), and trimetallic (Ag-Cu-Zn) nanoparticles using *Calendula officinalis* L., a medicinal plant renowned for its rich content of bioactive phytochemicals such as flavonoids, carotenoids, and phenolic compounds [2]. Utilizing a green synthesis approach, *Calendula officinalis* L. extract acts as a natural reducing and stabilizing agent, enabling an environmentally friendly, cost-effective, and straightforward production process free from toxic chemicals. The synthesized nanoparticles were characterized by various analytical methods, including UV-Vis, FTIR, and XRD analyses.

This study provides a direct and comparative characterization of the structural evolution from monometallic to trimetallic systems. The confirmed formation of a homogeneous Ag-Cu-Zn trimetallic alloy nanoparticle highlights the effectiveness of the plant-mediated approach in facilitating the co-reduction of multiple metal ions. The findings provide a solid platform for future research into the catalytic, antibacterial, and antioxidant applications of these materials, while the synergistic effects of the trimetallic composition are expected to provide superior performance and significantly revolutionize the design of plant-based nanomaterials [3].

References

1. Crawley, J.W., Gow, I.E., Lawes, N., Kowalec, I., Kabalan, L., Catlow, C.R.A., ... & Hutchings, G. J. (2022). Heterogeneous trimetallic nanoparticles as catalysts. Chemical Reviews, 122(6), 6795-6849.
2. Matvieieva, N., Duplij, V., Shakhovsky, A., Klymchuk, D., Belokurova, V., Kuchuk, M. (2023). Silver nanoparticles initiation using Calendula officinalis L. hairy root extracts. Agrobiodiversity for Improving Nutrition, Health and Life Quality, 7(2).
3. Nasrollahzadeh, M., Sajjadi, M., Iravani, S., Varma, R. S. (2020). Trimetallic nanoparticles: greener synthesis and their applications. Nanomaterials, 10(9), 1784.9.

CHARACTERIZATION OF GLUCOSAMINE / CHONDROITIN SULFATE DOPED HYDROXYAPATITE FOR BONE DEFECT

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ABSTRACT

Osteoarthritis (OA) is a significant health problem among middle-aged and elderly populations due to its high prevalence and significant impact on daily living activities. Pathological changes initially occur in the articular cartilage of weight-bearing joints such as the knee, hip, and spine. In addition to cartilage degeneration, metabolic and structural changes also affect the subchondral bone and synovial membrane as the disease progresses.

As glycosaminoglycans, glucosamine and chondroitin sulfate are classified as Symptomatic Slow-Acting Drugs for Osteoarthritis and are considered potential Disease-Modifying Osteoarthritis Drugs, as evidenced by the reduction in joint space narrowing in clinical trials.Both compounds are endogenously synthesized in the human body and serve as essential structural components of cartilage. They are reported to provide not only symptomatic relief but also have potential disease-modifying effects. As glycosaminoglycans, glucosamine and chondroitin sulfate are classified as Symptomatic Slow-Acting Drugs for Osteoarthritis and are considered potential Disease-Modifying Osteoarthritis Drugs, as evidenced by the reduction in joint space narrowing in clinical trials [1].

Hydroxyapatite (HAp), are bioactive bioceramics that belong to the family of calcium phosphates and conform to the ideal formula of $Ca_{10}(PO_4)_6(OH)_2$. Since the presence of hydroxyapatite and the produced bioactivity activate osteoblast adhesion, proliferation, and osteoblast activity, promoting the activity of bone tissue-forming cells is a property of great interest [2,3] In this study, glucosamine-chondroitin sulfate-doped hydroxyapatite (HAp) was successfully synthesized via wet precipitation to enhance the bioavailability of these poorly absorbed active ingredients. Subsequently, polymer composite coatings were produced that mimicked the composition and structure of natural bone tissue while providing improved coating stability. Structural characterization of the HAp/PVA/GL, HAp/PVA/CH, and HAp/PVA/GL/CH composites was performed using Fourier Transform Infrared Spectroscopy (FTIR) and X-ray Diffraction (XRD). The results confirmed that the synthesized composites were carbonate-modified hydroxyapatite. Consequently, by mimicking the structure and function of native bone tissue, they could lead to better treatment outcomes for articular cartilage defects, proving to be an effective treatment opportunity.

References

1. Henrotin, Y., Marty, M., Mobasheri, A. (2014). What is the current status of chondroitin sulfate and glucosamine for the treatment of knee osteoarthritis? *Maturitas*, 78(3), 184–187. Biomaterials, The Japanese Society for Biomaterials, and The Australian Society for Biomaterials and the Korean Society for Biomaterials, 60(4), 613–621.
2. López-Álvarez, M., González, P., Serra, J., Fraguas, J., Valcarcel, J., Vázquez, J.A. (2020). Chondroitin sulfate and hydroxyapatite from Prionace glauca shark jaw: Physicochemical and structural characterization. *International Journal of Biological Macromolecules*, 156, 329–339.
3. Luo, H., Li, W., Ji, D., Zuo, G., Xiong, G., Zhu, Y., ... & Wan, Y. (2016). One-step exfoliation and surface modification of lamellar hydroxyapatite by intercalation of glucosamine. *Materials Chemistry and Physics*, 173, 262–267.

DETERMINATION OF THE MECHANICAL BEHAVIOR OF PCL TISSUE SCAFFOLDS PRODUCED BY DIFFERENT 3D PRINTING TECHNIQUES

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ABSTRACT

Tissue engineering is a multidisciplinary field of research that aims to functionally regenerate damaged or malfunctioning biological tissues. In this field, the production of biocompatible scaffolds that support cell adhesion, differentiation and tissue formation becomes crucial. In recent years, 3D bioprinting technologies have been extensively used in tissue engineering applications due to their ability to provide microstructural control and architectural accuracy [1]. Among these techniques, Melt Electrowriting (MEW) and Electrospinning (ES) methods offer distinct properties in terms of fiber morphology, pore structure, and mechanical strength.

In this study, scaffold structures based on polycaprolactone (PCL), a biodegradable polymer, were produced using the MEW and ES techniques and compared to evaluate the effect of the production method on biomaterial properties. The MEW method created, directional, high-resolution fiber networks through a thermomechanically controlled process involving heated polymer extrusion and electric fields. In contrast, the ES method fabricated porous structures composed of nanometer-diameter, randomly oriented fibers with high surface area, using an electrical force to draw polymer solution into fibers. The obtained samples were characterized using Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), Differential Scanning Calorimetry (DSC), mechanical tests and in vitro cell viability assays to evaluate their biocompatibility.

The comparisons revealed that MEW scaffolds exhibit a more rigid structure due to their regular fiber architecture and high elastic modulus values, while ES structures possess more flexible and biomimetic properties thanks to their high porosity and deformation capability [2,3]. The comparative analysis revealed that MEW and ES methods offer potential for different tissue types and that the choice of production technique should be optimized according to the targeted biological function.

References

1. Zhang, Q., Zhou, J., Zhi, P., Liu, L., Liu, C., Fang, A., Zhang, Q. (2023). 3D printing method for bone tissue engineering scaffold. Medicine in Novel Technology & Devices, 17, 100205. https://doi.org/10.1016/j.medntd.2022.100205.
2. Shahverdi, M., Seifi, S., Akbari, A., Mohammadi, K., Shamloo, A., Movahhedy, M. R. (2022). Melt electrowriting of PLA, PCL, and composite PLA/PCL scaffolds for tissue engineering application. Scientific reports, 12(1), 19935.
3. Zarrintaj, P. et al. (2023). Biopolymer-based composites for tissue engineering. Materials Science & Engineering: C. https://doi.org/10.1016/j.msec.2023.204.

ENGINEERING OF NANOFIBROUS SEPARATOR MEMBRANES VIA ELECTROSPINNING AND HYBRID SPINNING FOR NEXT-GENERATION (GEN3) LI-ION BATTERIES

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ABSTRACT

The increasing demand for reliable energy storage systems in the automotive industry has renewed attention on the fire hazards associated with advanced lithium-ion batteries. To mitigate these safety concerns, our study investigates the development of innovative separators fabricated using a dual-head hybridspinning approach that combines centrifugal and electrostatic fibre generation. Contrary to traditional electrospinning, the hybridspinning technique widens the processing window for different polymers, enhances the retention of functional additives, and enables membrane fabrication on a semi-industrial scale. The main objective is to engineer bifunctional separators by blending polymers with distinct melting points, thereby ensuring both effective thermal shutdown capability and robust mechanical integrity under challenging operational conditions.

Lithium-ion batteries (LIBs) are central to the progress of electric mobility; however, their tendency to ignite remains a significant safety issue, particularly in high-energy-density configurations. Conventional separators physically isolate the electrodes but offer limited functionality during thermal runaway events [1;2]. This limitation underscores the need for advanced separator materials capable of maintaining normal operation while simultaneously reducing flammability risks. Our research addresses this challenge by designing dual-functional separators with controlled thermal and mechanical performance. In this presentation, we discuss the fundamental strategies behind the fabrication of two distinct nanofibrous polymer membranes and assess the specific advantages each production method offers for LIB applications [3].

Polymer solutions were processed under various experimental conditions to determine how spinning parameters, device configuration, and solvent – antisolvent systems influence fibre morphology and, consequently, the structural and thermal behaviour of the resulting membranes. Compared with conventional electrospinning, the hybrid spinning process achieves substantially higher throughput and allows scalable membrane manufacturing, largely due to its unique head design. This setup enables efficient co-deposition

of polymer blends, facilitating the fabrication of large-area membranes within reduced processing times – a key benefit for industrial-scale separator production.

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References

1. Liu Z. et al. Safer lithium-ion batteries from the separator aspect: development and future perspectives. Energy Environ Mater, 4, 246–261, 2021.
2. Li Y., Li Q., Tan Z. A review of electrospun nanofiber-based separators for rechargeable lithium-ion batteries. J. Power Sources, 443, 227262, 2019.
3. Song L., Zheng Y., Xiao Z., Wang C., Long T. Review on thermal runaway of lithium-ion batteries for electric vehicles. J. Electron Mater, 51, 355–375, 2022.

FABRICATION OF BIOCOMPATIBLE POLYURETHANE FOAM FOR WOUND DRESSING APPLICATIONS

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ABSTRACT

Wound dressing is a material applied directly to the wound site that promotes wound healing and prevents scar formation. It keeps the wound area moist and protects against bacterial invasion [1]. Rapid wound healing and regeneration are essential for improving the barrier function of injured skin [2]. Wound healing and management is a problem that needs to be improved and developed in the world. Wound dressings are various materials that cover a wound to protect it from damage and pathogen attacks and to promote healing [3]. Several different types of dressings, including polyurethane foam, membrane dressings, hydrocolloid dressings, hydrogel dressings, alginate dressings, semi-permeable polyurethane membrane dressings, and genetically engineered flax dressings, are used all over the world [4–5]. The polyurethane, as a biomaterial, contains soft and hard segments and and it allows the product's performance to change depending on the ratio of these components. It has excellent biocompatibility and low durability. Its dimensions are due to its excellent mechanical structure [2].

In this study, we tested the effectiveness of polyurethane foam as a wound dressing. The morphological properties were observed with a scanning electron microscope (SEM). The Fourier-transformed infrared spectroscopy (FTIR) was utilised to observe the chemical interactions between the components. Biocompatibility tests were performed to determine its effect on live cells. Antimicrobial tests were conducted to test its effectiveness on microorganisms.

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References

1 J.G. Powers, L.M. Morton, T.J. Phillips, Dressings for chronic wounds, *Dermatol Ther*, Vol. 26, no. 3, pp. 197–206, May 2013, doi: 10.1111/dth.12055.

2 W. Liang, N. Ni, Y. Huang, and C. Lin, An Advanced Review: Polyurethane-Related Dressings for Skin Wound Repair, Nov. 01, 2023, *Multidisciplinary Digital Publishing Institute (MDPI)*. doi: 10.3390/polym15214301.

3 R. Dong, B. Guo, Smart wound dressings for wound healing, Dec. 01, 2021, *Elsevier B.V.* doi: 10.1016/j.nantod.2021.101290.

4 K. Skórkowska-Telichowska, M. Czemplik, A. Kulma, and J. Szopa, The local treatment and available dressings designed for chronic wounds, 2013. doi: 10.1016/j.jaad.2011.06.028.

5 Q. Zeng, X. Qi, G. Shi, M. Zhang, and H. Haick, Wound Dressing: From Nanomaterials to Diagnostic Dressings and Healing Evaluations, Feb. 22, 2022, *American Chemical Society*. doi: 10.1021/acsnano.1c08411.

PRODUCTION OF BACTERIAL CELLULOSE FROM TEA WASTE HYDROLYSATES: EVALUATION OF PRETREATMENT METHODS AND CULTURE PERFORMANCE

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ABSTRACT

This study aimed to assess the potential of tea waste a widely generated agro-industrial by-product as a sustainable and cost-effective carbon source for bacterial cellulose (BC) production, addressing the growing demand for circular bioeconomy solutions and waste valorization. Bacterial cellulose is a nanostructured biopolymer characterized by its high purity, mechanical robustness, and excellent biocompatibility, rendering it a promising material for applications in biomedical, food, and material science domains. In this context, tea waste was investigated as an alternative substrate, in alignment with the United Nations Sustainable Development Goal (SDG) 12: Responsible Consumption and Production.

Tea waste was hydrolyzed using 1% (v/v) sulfuric acid at a solid-to-liquid ratio of 1:8, resulting in a hydrolysate containing approximately 1 g/L of reducing sugars. Despite the low sugar concentration, bacterial cellulose formation was successfully achieved under these conditions. In contrast, subsequent pretreatment strategies including alkaline washing, phosphoric acid, hydrochloric acid, and supercritical processing produced hydrolysates with higher sugar concentrations (up to 7 g/L), yet failed to support bacterial growth or cellulose biosynthesis, even when fermentation media were prepared volumetrically or proportionally and supplemented with additional sugars.

These findings are consistent with previous studies reporting the formation of inhibitory compounds such as phenolics and furfural derivatives during acid hydrolysis of lignocellulosic biomass, which can suppress microbial metabolism and hinder BC production [1,2]. While herbal infusions and black tea media have been explored as substrates for BC synthesis using symbiotic cultures [3], our results emphasize that hydrolysate quality and microbial compatibility are more critical than sugar concentration alone.

By valorizing tea waste, this research contributes to circular bioeconomy strategies and waste-to-resource innovation, supporting both SDG 12 and SDG 9 (Industry, Innovation and Infrastructure). Future work will focus on the identification and removal of inhibitory compounds through detoxification techniques and on optimizing medium composition to enhance BC yields from tea waste hydrolysates.

References

1 Joshi, S.M., Gogate, P.R. et al. (2020). Intensification of dilute acid hydrolysis of spent tea powder using ultrasound for enhanced production of reducing sugars. *Bioresource Technology*.

2 Germec, M., Tarhan, K., Yatmaz, E., Tetik, N., Karhan, M., Demirci, A., Turhan, I. (2016). Ultrasound-assisted dilute acid hydrolysis of tea processing waste for production of fermentable sugar. *Biotechnology Progress*, 32(2), 393–403.

3 Tapias, Y.A.R., Di Monte, M. et al. (2022). Bacterial cellulose films production by Kombucha symbiotic community cultured on different herbal infusions. *Food Chemistry*.

ELECTROCHEMICAL EVALUATION OF *SALVIA OFFICINALIS L* ESSENTIAL OIL AS A GREEN CORROSION INHIBITOR FOR MILD STEEL IN ACIDIC MEDIA

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ABSTRACT

Corrosion is the destructive attacks of metals by its environment. The spontaneous destruction of metal due to heterogeneous chemical reaction is the chemical corrosion [1]. The serious consequences of the corrosion process havebecome a problem of worldwide significance. In addition to our everyday encounters with this form of degradation,corrosion causes enormous economic damage. The best way to protect materials againstcorrosion is using inhibitors[2]. One of the inorganic inhibitors, particularly those containingphosphate, chromate and other heavy metals are now beinggradually restricted by various environmental regulation [3]. Recently, several studies have been carried out on theinhibition of corrosion of metals by plant extract and essential oils [4].

This study investigates the electrochemical behavior of *Salvia officinalis L* essential oil (EO) as a natural corrosion inhibitor for mild steel in a 1 M HCl medium. Electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization (PDP) techniques were used to evaluate the inhibition efficiency at various EO concentrations.

The results revealed that the inhibition efficiency increased with higher EO concentration, reaching a maximum of 92% at 1.5 g/L. The polarization curves indicated that *Salvia officinalis L* EO acts as a mixed-type inhibitor, reducing both anodic and cathodic reactions.

Adsorption of the EO components onto the mild steel surface followed the Langmuir isotherm model, suggesting monolayer adsorption. The protective film formed by the EO significantly improved corrosion resistance by limiting metal dissolution and hydrogen evolution.

Overall, *Salvia officinalis L* essential oil demonstrates strong potential as an environmentally friendly corrosion inhibitor, offering an effective and sustainable solution to reduce the use of toxic synthetic inhibitors and protect both material and environmental health.

References

1. Ouakki Moussa, Galai Mouhsine, Benzekri Zakaria et al. (2021). A detailed investigation onthe corrosion inhibition effect of by newlysynthesized pyran derivative on mild steel in 1.0 MHCl: Experimental, surface morphological (SEM-EDS, DRX & AFM) and computational analysis (DFT & MD simulation). Journal of Molecular Liquids. 344. 117777.
2. Rhaimi S., Ouakki M., Rhaiem N., Galai M., Dahmani K., Farhani F.E., Barrahi M., Touhami M.E., Ouhssine M. (2022). Salvia officinalis essential oil as green corrosion inhibitor for mild steel in acidic media. Int. J. Chem. Biochem. Sci., p. 9.
3. I.A. Ammar, F.M. El KhorafiI. (1973).Adsorbability of thiourea on iron cathodes.Materials and corrosion. 24. 702–707.
4. A. Rodríguez-Torres, M.G. Valladares-Cisneros, J.G. Gonzalez-Rodríguez. (2015). Use of SalviaOfficinalis as Green Corrosion Inhibitor for CarbonSteel in Acidic Media. Int. J. Electrochem. Sci. 10.4053 – 4067.

VISIBLE-LIGHT BIOCHAR-NANOCATALYSTS FOR WASTEWATER REMEDIATION: HOW BIOCHAR AND IRON-DOPING ENHANCE TiO_2 PERFORMANCE

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ABSTRACT

The development of efficient, sustainable photocatalysts for water purification remains a critical challenge in environmental nanotechnology. This work explores the rational design of nanostructured biochar-TiO_2 composites, focusing on the interplay between material architecture and photocatalytic performance at the nanoscale. By integrating iron-doped TiO_2 with biochar matrices, we demonstrate how nanoscale engineering can simultaneously address three fundamental limitations of conventional photocatalysts: limited visible-light absorption, rapid charge recombination, and poor adsorption capacity.

Key to this approach is the creation of tailored interfaces where biochar's sp^2-carbon networks interact with TiO_2 nanocrystals, establishing electronic pathways that enhance charge separation while reducing the effective bandgap. The incorporation of transition metal dopants introduces intermediate energy states, further extending photoresponse into the visible spectrum. At the nanoscale, the composite's hierarchical porosity creates confined reaction environments that concentrate pollutants near active sites while facilitating mass transport.

Advanced characterization reveals how oxygen-functionalized biochar surfaces modify TiO_2's electronic structure through Ti-O-C bonding, while the carbon matrix serves as both an electron reservoir and a sensitizer. These synergistic effects shift the dominant degradation pathway from hydroxyl radicals to more selective superoxide-mediated oxidation, particularly beneficial for complex organic pollutants. The discussion emphasizes solvent-free synthesis routes that enable precise control of nanoparticle dispersion and interfacial contact – critical factors for scalable manufacturing.

These findings establish design principles for next-generation photocatalytic systems, highlighting how nanoscale integration of carbonaceous materials with metal oxides can overcome traditional efficiency limits. The work provides a framework for developing sustainable water treatment technologies that harness abundant materials and solar energy, offering solutions aligned with global environmental and economic priorities.

PHOTOCATALYTIC DEGRADATION OF METHYL ORANGE (MO) BY $ZnCuP_2O_7$ PYROPHOSPHATE UNDER UV IRRADIATION

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ABSTRACT

Dyes, and especially synthetic dyes utilized in the industry are an enormous problem to the environment and human health because of their toxicity, stability at aqueous environment and devastation to the ecosystems. In the present times, waters are flooded with numerous organic pollutants. Methyl orange (MO) is a widely used example of organic dye used among them. Scientific texts note that wastewater with this dye possesses severe health and water affects, especially on human beings and water life, especially because it is toxic, carcinogenic, teratogenic, and mutagenic[1]. To successfully eliminate organic dyes in the wastewater and lower their health effects, there is, therefore, an urgent need to come up with sustainable and environmental-friendly technologies. In this respect, photocatalysis seems to be one of the potential approaches: it uses the activation of the photocatalysts by photon to produce reactive redox species that can break down organic pollutants and contaminants[2]. It is due to this reason that the $ZnCuP_2O_7$ photocatalyst was synthesized. The analysis of UV-Vis spectroscopy indicated that the band gap of this material is 3.06 eV[3]. This has proved to be an important photocatalyst in the degradation of methyl orange with a removal rate of 70% after 180 minutes under UV radiation, at pH = 4.

References

1. A. Hojjati-Najafabadi, E. Farahbakhsh, G. Gholamalian, P. Feng, F. Davar, T.M. Aminabhavi, Y. Vasseghian, H. Kamyab, H. Rahimi, Controllable synthesis of nanostructured flower-like cadmium sulfides for photocatalytic degradation of methyl orange under different light sources, Journal of Water Process Engineering 59 (2024). https://doi.org/10.1016/j.jwpe.2024.105002.
2. B. Akhsassi, Y. Naciri, A. Bouddouch, B. Bakiz, A. Taoufyq, S. Villain, C. Favotto, J.C. Valmalette, J.R. Gavarri, A. Benlhachemi, Facile novel acid coprecipitation synthesis of $BiPO_4$ polymorphs: Enhanced photocatalytic degradation of the antibiotic AMX and the dyes RhB, MB and MO, Opt Mater (Amst) 137 (2023). https://doi.org/10.1016/j.optmat.2023.113575.
3. H. El Harmouchi, F.Z. Janani, S. Alami, O. Moumouche, L. Ait Hmid, M. Laourayed, M. El Moudane, N. Barka, M. Harcharras, Synthesis, characterization and photocatalytic activity of Zn-Cu, Ca-Cu and Ba-Cu pyrophosphates like photocatalyst for methyl orange degradation, Nanotechnology for Environmental Engineering 10 (2025). https://doi.org/10.1007/s41204-025-00433-9.

INTRANASAL DRUG DELIVERY WITH 3D-PRINTED MICRONEEDLES CONTAINING ACETYLSALICYLIC ACID AND VITAMIN C FOR MIGRAINE TREATMENT

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ABSTRACT

Migraine is a neurological disorder characterized by intense headache attacks that significantly affect patients' quality of life and productivity. Conventional oral and systemic drug delivery routes often result in delayed onset of action and undesired side effects due to first-pass metabolism. Therefore, intranasal administration has attracted attention as an effective and non-invasive alternative that enables rapid drug absorption and direct transport to the brain via the olfactory and trigeminal pathways.

In this study, three-dimensionally (3D) printed microneedles (MNs) were developed to deliver acetylsalicylic acid (ASA) and Vitamin C through the intranasal route for the treatment of migraine. Gelatin methacryloyl (GelMA) was used as the base matrix material due to its excellent biocompatibility and tunable mechanical properties. The microneedle arrays were fabricated by digital light processing (DLP) 3D printing and characterized by scanning electron microscopy (SEM) to evaluate their morphological integrity. Fourier-transform infrared spectroscopy (FTIR) confirmed the successful incorporation of ASA and Vitamin C into the GelMA matrix. their swelling and degradation behavior were investigated. Their mechanical strength was evaluated through compression testing.

The dual loading of ASA and Vitamin C is expected to provide both analgesic and antioxidant effects, enhancing the therapeutic potential against migraine-related oxidative stress and neuroinflammation. Based on these findings, GelMA-based ASA and Vitamin C loaded microneedles show great promise as an innovative intranasal delivery system for rapid and targeted migraine therapy.

Keywords: Microneedle, 3D printing, acetylsalicylic acid, vitamin C, intranasal drug delivery, migraine treatment.

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References

1. Agrawal, M., Saraf, S., Antimisiaris, S.G., Chougule, M.B., Shoyele, S.A., Alexander, A. (2018). Nose-to-brain drug delivery: an update on clinical challenges and progress towards approval of anti-Alzheimer drugs.Journal of Controlled Release, 281, 139–177.

2. Anlar, O., Tombul, T., Kisli, M. (2003). Aspirin'in Migren Atağında İntravenöz Kullanımı.Türk Serebrovasküler Hastalıklar Dergisi, 9(1), 19–21.
3. Awad, R., Avital, A., Sosnik, A. (2023).Polymeric nanocarriers for nose-to-brain drug delivery in neurodegenerative diseases and neurodevelopmental disordersActa Pharmaceutica Sinica B, 13(5), 1866–1886.
4. Baykara, D. et al. (2023). Fabrication and optimization of 3D printed gelatin methacryloyl microneedle arrays based on vat photopolymerization.Frontiers in Bioengineering and Biotechnology, 11, 1157541.
5. Becker, W.J. (2015). Acute migraine treatment in adults.Headache, 55, 778–793.
6. Jha, S., Jalwal, P. (2020). Nose-to-brain drug delivery of nanoformulations in the treatment of migraine.The Pharma Innovation Journal, 9(12), 248–253.
7. Luthfianti, H.R., Waresindo, W.X., Edikresnha, D., Hapidin, D.A., Noor, F.A., Elfahmi, E., Khairurrijal, K. (2024). Bioactive compounds-loaded polyvinyl alcohol hydrogels: advancements in smart delivery media for biomedical applications. Materials Research Express, 11, 062002.
8. Ruan, S., Li, J., Ruan, H., Xia, Q., Hou, X., Wang, Z., Guo, T., Zhu, C., Feng, N., Zhang, Y. (2024). Microneedle-mediated nose-to-brain drug delivery for improved Alzheimer's disease treatment. Journal of Controlled Release, 366, 712–731.
9. Sachan, N., Bahadur, S., Sharma, P.K. (2019). Recent Advances and Novel Approaches for Nose to Brain Drug Delivery for Treatment of Migraine.Drug Delivery Letters, 9(3), 182–198.
10. Shirahama, H., Lee, B.H., Tan, L.P., Cho, N.-J. (2016). Precise Tuning of Facile One-Pot Gelatin Methacryloyl (GelMA) Synthesis.Scientific Reports, 6(1), 31036.
11. Thai, N.L.B., Beaman, H.T., Perlman, M., Obeng, E.E., Du, C., Monroe, M.B.B. (2024). Chitosan Poly(vinyl alcohol) Methacrylate Hydrogels for Tissue Engineering Scaffolds.ACS Applied Bio Materials.
12. Yao, W., Li, D., Zhao, Y., Zhan, Z., Jin, G., Liang, H., Yang, R. (2020). 3D Printed Multi-Functional Hydrogel Microneedles Based on High-Precision Digital Light Processing.Micromachines, 11(1), 17.
13. Cieślik, M., Postek-Stefańska, L., Gawrońska-Grzywacz, M., Banas, J. (2021). Antioxidant properties of Vitamin C and its role in reducing oxidative stress in neurological disorders.Nutrients, 13(4), 1154.
14. Kusumoto, C., Umeda, Y., Saito, M., Ueda, H. (2022). Synergistic effects of Vitamin C and acetylsalicylic acid in anti-inflammatory and neuroprotective applications.European Journal of Pharmacology, 925, 175001.
15. Huang, S., Liu, Y., Zhang, J., Dong, Y. (2023). 3D-printed microneedles for co-delivery of antioxidant and anti-inflammatory agents.Advanced Drug Delivery Reviews, 195, 114825.

ADVANCEMENT OF NANOMATERIALS MEDIATED BY GREEN SYNTHESIS FOR VARIOUS APPLICATIONS

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ABSTRACT

Green synthesis of nanoparticles (NPs) has been a recent development in the field of nanotechnology. This kind of synthesis is a more eco-friendly approach compared to the chemical and physical methods. It involves the use of natural ingredients in the bio-reduction of metallic ions to nanoparticles [1,2]. This simple green eco-friendly method has been utilized to obtain metal nanoparticles using the leaf extract as a precursor [2-4]. Safer and easily metabolized drugs are natural compounds retrieved from plant materials as compared to other synthetic medicinal compounds. Metallic nanoparticles are mostly synthesized from precious metals viz., Ag, Au, Pt, Ti, Cu, and Pb. From these metals, silver is the most preferred in the area of the biological system due to its wide range of activities over other metals [1–3].

The development of nanomaterials has emerged as a transformative frontier in materials science, offering unprecedented control over physical, chemical, and biological properties at the nanoscale. Green synthesis of nanomaterials has emerged as a sustainable and eco-conscious approach to nanotechnology, leveraging biological systems and environmentally benign processes to fabricate functional nanostructures. This paradigm shift addresses the limitations of conventional synthesis methods by minimizing hazardous reagents, reducing energy consumption, and promoting biocompatibility. Recent advances in green synthesis approaches and bioinspired nanostructures underscore the growing commitment to sustainable innovation.

Recent advancements in green-mediated synthesis routes utilizing plant extracts, microbial agents, and natural polymers to produce metal, metal oxide, and hybrid nanomaterials sre described. Particular emphasis is placed on the physicochemical tuning of nanoparticles through biomolecular capping and templating mechanisms, which influence size, morphology, and surface activity. Applications span across biomedical therapeutics, antimicrobial potentials, environmental remediation, and energy conversion systems, where green-synthesized nanomaterials demonstrate enhanced performance and reduced toxicity.

This study describes the use of the synthesized green-capped TiO_2 NPs in the photocatalytic degradation of ‘tie and dye’ effluent, as a potential photoelectrode materials (higher rate of electron transfer) in dye-sensitized solar cells (DSSC) application, as an excellent optical properties and demonstrated enhanced photocatalytic performance in the degradation of methylene blue dye; and adsorbent nanomaterials for the removal of hexachlorocyclohexane isomers (HCHs) from the water system, biosorption of Cr(VI) from aqueous solution, an effective adsorbents for the removal of endocrine disruptors-steroids (estrone (E_1) and β-estradiol (E_2)) from water. The integration of green chemistry principles into nanomaterial development not only advances technological innovation but also reinforces the commitment to sustainable scientific practice [3–5].

References

1. Salleh, A., Naomi, R., Utami, N.D., Mohammad, A.W. et al. *Nanomaterials* (Basel). 2020, 10, 1566.
2. Ejidike, I.P Clayton, H.S. *Green Chemistry Letters and Reviews*, 2022, 15(2), 297-310.
3. John, M.O., Ogunbayo, T.B., Ejidike, I.P., Isanbor, C., Olopade, M.A., Babatunde, A.I., Olaleru, S.A. et al. *Chemistry Select*, 2025, 10(31), e02349.
4. Fakoya, T.O., Oyekunle, J.A.O., Adekunle, A.S., Oyinloye, A.J., Ejidike, I.P. *Chemical Thermodynamics and Thermal Analysis*, 2024, 15, 100140.
5. Dimo, S.N., Obidi, O.F., Nejo, A.O., Olaleru, S.A., Ejidike, I.P., Adetona, A.J. *Smart Science*, 2024, 12(2), 373–386.

OPTIMIZATION AND FABRICATION OF PVAMA-HYDROGEL BASED MICRONEEDLES

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ABSTRACT

Polyvinyl alcohol methacrylamide (PVA-MA) is a hydrogel derived from PVA, a synthetic polymer. PVA and methacrylate react to form methacrylated PVA (PVA-MA) with photo-crosslinking properties. The methacrylate double bond in PVA-MA is highly reactive and can easily cure when exposed to ultraviolet (UV) light.

Hydrogels based on polyvinyl alcohol–methacrylic acid (PVA-MA) are biocompatible, mechanically durable, and capable of forming chemical cross-links due to the methacrylate groups in their structure. Thanks to these properties, they are widely used in biomedical applications.

This study aimed to optimize the production parameters and curing conditions of PVA-MA-based hydrogel microneedles. The microneedles were produced using a DLP 3D printer. Polyvinyl alcohol–methacrylic acid (PVA-MA) was used as the matrix material to obtain the microneedles (MNs). The morphological analysis of the microneedles was performed using a scanning electron microscope (SEM), their molecular structures were characterized using a Fourier transform infrared (FTIR) spectrometer, and they were characterized using Nuclear Magnetic Resonance (NMR) methods. Additionally, their swelling and degradation behavior were investigated. Their mechanical strength was evaluated through compression testing. This study aims to contribute to the development of optimized, durable, and biocompatible microneedle systems for use in biomedical applications.

Keywords: Microneedle, 3D printing, Polyvinyl alcohol, PVA-MA, hydrogel, curing, characterization.

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References

1. Baştürk, E., Oktay, B., Kahraman, M.V. 2015. Dual-crosslinked thiol-ene/sol gel hybrid electrospun nanowires: Preparation and characterization, Journal of Polymer Research, 22(7), 1–7.
2. Crispim, E.G., Piai, J.F., Schüquel, I.T., Rubira, A.F., Muniz, E.C. (2006). Functionalization of poly (vinyl alcohol) by addition of methacryloyl groups: characterization by FTIR and NMR and optimization of reaction conditions by RSM. *e-Polymers*, 6(1), 062.
3. Lim, K.S., Levato, R., Costa, P.F., Castilho, M.D., Alcala-Orozco, C.R., Dorenmalen, K.M.A., Melchels, F.P.W., Gawlitta, D., Hooper, G.J., Malda, J., Woodfield, T.B.F. 2018. Bio-resin for high resolution lithography-based biofabrication of complex cell-laden constructs, Biofabrication 10(3), 034101.
4. Thummar, U.G., Saxena, M., Ray, S., Singh, P.S. (2022). Solvent-resistant polyvinyl alcohol nanofilm with nanopores for high-flux degumming. *Journal of Membrane Science*, 650, 120430.

STUDY OF THE INHIBITORY EFFECT OF ANISE SEED ESSENTIAL OIL ON THE CORROSION OF CARBON STEEL IN 1M HYDROCHLORIC ACID MEDIUM

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ABSTRACT

The corrosion inhibition ability of anise seed essential oil on the mild steel (MS) in a 1M HCl solution was evaluated using weight loss, electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization (PDP) methods at various temperatures. The results of these measurements confirmed that essential oil was an effective inhibitor. The inhibition efficacy (%IE) increased with increasing concentrations of anise seed essential oil and decreasing temperature. Polarization curves revealed that the anise seed essential oil acted as a mixed-type inhibitor, which was attributed to its adsorption onto the mild steel surface. The adsorption process follows the Langmuir adsorption isotherm. Electrochemical impedance spectroscopy (EIS) studies showed a single capacitive loop, indicating that the corrosion reaction was controlled by a charge transfer process.

Keywords: Green inhibitor**,** Anise seeds, Essential oil, Mild steel corrosion, EIS.

DEVELOPMENT OF VANILLIC ACID AND TRICALCIUM PHOSPHATE ADDITIVE GELMA-BASED COMPOSITES FOR BONE TISSUE ENGINEERING APPLICATIONS AND INVESTIGATION OF THEIR BIOLOGICAL PROPERTIES

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ABSTRACT

Bone tissue engineering is a multidisciplinary field requiring the development of biocompatible, biodegradable, and cell-supporting materials. It is critical that biomaterials used in this field provide both mechanical strength and support osteogenic potential by optimizing the cellular microenvironment. Methacrylate gelatin (GelMA) is frequently preferred in bone regeneration studies due to its derivation from natural gelatin, its functional groups conducive to biological interaction, and its ability to form three-dimensional structures through photopolymerization [1].

In this study, biofunctional composite materials suitable for bone tissue engineering were developed by adding vanillic acid (VA), a biologically active phenolic compound, and tricalcium phosphate (TCP), known for its osteoconductive properties, to the GelMA matrix. Vanillic acid, with its potent antioxidant and anti-inflammatory properties, reduces cellular oxidative stress and supports cell viability and proliferation. With these properties, VA facilitates the proliferation and matrix production of osteoblast-like cells in a favorable microenvironment, indirectly supporting bone tissue formation. Its combination with TCP complements the biological effects of VA, enhancing cell adhesion and proliferation while also optimizing the mineralization environment. Thus, the unique combination of VA and TCP creates a composite structure that improves both cellular compatibility and mechanical and biofunctional properties [2,3]. The swelling ratio, degradation profile, and FTIR analyses of the resulting samples were performed, and chemical properties of the materials were comprehensively evaluated. Additionally, cytotoxicity tests were conducted using the L929 fibroblast cell line, and proliferation and cell adhesion were investigated using the MC3T3-E1 osteoblast-like cell line. These experiments demonstrated the holistic effects of the developed composites on both biocompatibility and osteoblast behavior.

Consequently, the effects of vanillic acid and tricalcium phosphate additions on the physicochemical stability and cellular compatibility of GelMA-based composites were evaluated in detail. The findings provide a scientific basis for the development of biofunctional composite materials in bone tissue engineering applications and demonstrate that such materials have potential for osteogenic regeneration.

References

1. Mamidi, N., Ijadi, F., Norahan, M.H. (2023). Leveraging the recent advancements in GelMA scaffolds for bone tissue engineering: An assessment of challenges and opportunities. *Biomacromolecules*, 25(4), 2075–2113.
2. Yurteri, A., Mercan, N., Kilic, M., Çelik, M., Doğar, F., & Yildirim, A. (2024). Does vanillic acid affect fracture healing? An experimental study in a rat model of femur fracture. *Journal of Applied Biomedicine*, 22(2).
3. De Souza, J.R., Rahimnejad, M., Soares, I.P.M., Anselmi, C. de Oliveira, P.H., dos Reis-Prado, A.H., ... & Bottino, M.C. (2025). 3D Printing β-TCP-laden GelMA/Alginate interpenetrating-polymer-network biomaterial inks for bone tissue engineering. *Bioprinting*, 49, e00413.

BIOFUNCTIONAL DUAL-LAYERED 3D-PRINTED PCL/GELATIN BIOPATCHES FUNCTIONALIZEDWITH NATURAL AND SYNTHETIC ANTIBACTERIAL AGENTS

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ABSTRACT

This study presents a comprehensive strategy to mitigate the significant clinical challenge of surgical mesh infections following hernia repair. We designed and fabricated a novel dual-layered biopatch using advanced 3D printing technology, combining polycaprolactone (PCL) and gelatin matrices. The biopatch's unique architecture features a top antibacterial layer and a bottom gelatinous layer, meticulously engineered to provide robust mechanical support, mimic the native tissue interface, and facilitate optimal integration. To impart crucial biofunctional properties, the biopatches were loaded with either a methanol extract of *Agrimonia eupatoria* (AE), a medicinal herb renowned for its natural antimicrobial and anti-inflammatory properties, or rifampicin (RIF), a potent, broad-spectrum synthetic antibiotic [1,3]. Morphological characterization via scanning electron microscopy (SEM) confirmed the successful fabrication of uniform, fibrous dual-layered structures, while Fourier Transform Infrared Spectroscopy (FTIR) and Differential Scanning Calorimetry (DSC) analyses validated the material compatibility and thermal stability of the composite scaffolds [1]. Drug release studies revealed a sustained release profile for both AE and RIF over a period of one week, ensuring prolonged antibacterial efficacy. *In vitro* antibacterial assays against *Staphylococcus aureus* and *Escherichia coli* demonstrated significant zones of inhibition for both AE- and RIF-loaded biopatches, underscoring their potential to prevent post-operative infections [2]. Furthermore, cytotoxicity assessments using fibroblast cultures confirmed the biopatches' excellent biocompatibility and safety for biomedical applications. In a subsequent phase, the study further refined the design, presenting a dual-layer biopatch combining a 3D-printed PCL/gelatin scaffold with an electrospun nanofiber layer. Mechanical testing showed that these biopatches possessed tensile strengths well within the acceptable

range for hernia repair. Antimicrobial evaluation demonstrated superior activity for the RIF-functionalized patches, producing an inhibition zone more than four centimeters wide against *S. epidermidis*, and moderate activity for the AE-loaded ones, with a zone of inhibition approximately one centimeter wide. A controlled release profile over four weeks, with a cumulative release of roughly three-quarters of the loaded agent, confirmed their long-term therapeutic potential. Together, these findings demonstrate that our PCL/gelatin biopatches, whether functionalized with AE or RIF, offer a promising, reproducible, and scalable solution for preventing hernia mesh infections, marking a significant step toward personalized and advanced surgical care.

Keywords: 3D printing, antibacterial biopatch, polycaprolactone, gelatin, Agrimonia eupatoria, rifampicin, surgical mesh infection, tissue engineering.

References

1. Haag W. Zur Methodik und praktischen Bedeutung der Vitamin-C-Bestimmung beim Rind in Vergangenheit und Gegenwart. Doctoral Dissertation, 1985.
2. Paluch Z., Biriczová L., Pallag G., Carvalheiro Marques E., Vargová N., Kmoníčková E. The therapeutic effects of Agrimonia eupatoria L. Physiol Res 2020;69(Suppl 2):S555–71. https://doi.org/10.33549/physiolres.934641.
3. Granica S., Kluge H., Horn G., Matkowski A, Kiss A.K. The phytochemical investigation of Agrimonia eupatoria L. and Agrimonia procera Wallr. as valid sources of Agrimoniaeherba – the pharmacopoeial plant material. J Pharm BiomedAnal 2015;114:272–9.

FERROPTOSIS IN CANCER AND NEURODEGENERATION: MECHANISMS, THERAPEUTIC OPPORTUNITIES

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ABSTRACT

Ferroptosis is a regulated form of cell death driven by iron-dependent lipid peroxidation, increasingly recognized as a critical vulnerability in cancer and neurodegenerative diseases. Despite its therapeutic promise, the translational application of ferroptosis modulation remains constrained by the lack of selectivity and systemic toxicity of conventional inducers. Advances in nano chemistry and biomaterials engineering have enabled precise control of redox dynamics, iron availability, and antioxidant defences at the subcellular level, providing novel opportunities for ferroptosis regulation [1,2,12].

Nanoparticle-mediated delivery systems – including iron oxide, cerium oxide, lipid-based, and polymeric nanocarriers – can selectively amplify or suppress ferroptosis pathways through controlled iron release, reactive oxygen species (ROS) modulation, and targeted gluthathione peroxidase 4 (GPX4) inhibition. Metal-organic frameworks (MOFs) and ferroptosis-inducing nanodrugs (FINDs) enhance therapeutic specificity by integrating imaging, pH-responsive release, and tumor microenvironment (TME) adaptation. In oncology, such nanoplatforms exploit the metabolic reprogramming and elevated oxidative stress of malignant cells, inducing ferroptosis-resistant tumor subtypes such as pancreatic, triple-negative breast, and hepatocellular carcinomas. Conversely, neuroprotective nanomaterials aim to restore iron homeostasis and prevent lipid peroxidation in neurodegenerative disorders, including Alzheimer's and Parkinson's disease [3,4,5,6,7,10].

Mechanistically, nano mediated ferroptosis modulation affects key molecular nodes –gluthathione peroxidase 4 (GPX4), solute carrier family 7 member 11 (C7A11), ferroptosis suppressor protein 1 (FSP1) with qoenzyme Q10 (CoQ10), and nuclear factor erythroid 2- related factor 2 (NRF2) signalling – while dynamically interacting with mitochondrial reactive oxygen species (ROS) generation and lipid peroxidation feedback loops. Additionally, nano-immunotherapeutic strategies that combine ferroptosis induction with immune checkpoint inhibitors or chimeric antigen receptor T-cell (CAR-T) therapy show synergistic effects by enhancing antigen presentation and overcoming tumor microenvironment (TME) – induced immune suppression [3,5,8,9,11].

In conclusion, the integration of ferroptosis biology with nanotechnology represents a paradigm shift in redox-targeted therapy. By engineering multifunctional nanocarriers capable of spatially confined ferroptosis modulation, it becomes possible to achieve precision control over cell death, minimize systemic toxicity, and bridge therapeutic approaches across cancer and neurodegenerative diseases.

References

1. Shumin Sun, Jie Shen, Jianwei Jiang, Fudi Wang, Junxia Min. Targeting ferroptosis opens new avenues for the development of novel therapeutics; Signal Transduction and Targeted Therapy, Vol. 8, Article number: 372 (2023).
2. Yunxi Du, Zhong Guo. Recent progress in ferroptosis: inducers and inhibitors; Cell Death Discovery, Vol. 8, Article number: 501 (2022).
3. Feng-Jiao Li, Hui-Zhi Long, Zi-Wei Zhou, Hong-Yu Luo, Shuo-Guo Xu, Li-Chen Gao; System Xc−/GSH/GPX4 axis: An important antioxidant system for the ferroptosis in drug- resistant solid tumor therapy; Front Pharmacol. 2022 Aug. 29:13:910292. doi:10.3389/fphar.2022.910292.
4. Lianxiang Luo, Han Wang, Wen Tian, Xiaoling Li, Zheng Zhu, Riming Huang, Hui Luo. Targeting ferroptosis-based cancer therapy using nanomaterials: strategies and applications; Theranostics. 2021 Oct. 22;11(20):9937–9952. doi: 10.7150/thno.65480.
5. Adityanarayan Mohapatra, Ayeskanta Mohanty, In-Kyu Park. Inorganic Nanomedicine – Mediated Ferroptosis: A Synergistic Approach to Combined Cancer Therapies and Immunotherapy; Cancers (Basel). 2024 Sep. 20; 16(18):3210. doi:10.3390/cancers16183210.
6. Namdev Dhas, Ritu Kudarha, Ruchi Tiwari, Gaurav Tiwari, Neha Garg, Praveen Kumar, Sanjay Kulkarni, Jahnavi Kulkarni, Soji Soman, Aswathi R. Hegde, Jayvadan Patel, Atul Garkal, Anam Sami, Deepanjan Datta, Viola Colaco, Tejal Mehta, Lalitkumar Vora, Srinivas Mutalik. Recent advancements in nanomaterial-mediated ferroptosis-induced cancer therapy: Importance of molecular dynamics and novel strategies; Life Sciences. Vol. 346, 1 June 2024, 122629.
7. Wen Deng, Haojie Shang, Yonghua Tong, Xiao Liu, Qiu Huang, Yu He, Jian Wu, Xiaozhuo Ba, Zhiqiang Chen, Yuan Chen, Kun Tang. The application of nanoparticles-based ferroptosis, pyroptosis and authophagy in cancer immunotherapy; J. Nanobiotechnology. 2024 Mar. 7; 22(1):97. doi:10.1186/s12951-024-02297-8.
8. Jingbo Li, Jiao Liu, Zhuan Zhou, Runliu Wu, Xin Chen, Chunhua Yu, Brent Stockwell, Guido Kroemer, Rui Kang, Daolin Tang. Tumor-specific GPX4 degradation enhances ferroptosis-initiated antitumor immune response in mouse models of pancreatic cancer. Sci Transl Med. 2023 Nov.15(720):eadg3049. doi: 10.1126/scitranslmed.adg3049.
9. Zhongsheng Xu, Liang Zhang, Mingfu Gong, Tao Sun, Chunyu Zhou, Shilin Xiao, Yun Liu, Dong Zhang. Fe-Mediated Self-Assembled Nanodrug for Tumor Microenvironment Activated Synergistic Ferroptosis-Based-Chemodynamic/ ChemoTherapy and Magnetic Resonance Imaging. ACS Materials Lett. 2024, 6, 2, 656–665.
10. Jian Gao, Ningye Ma, Sha Ni, Xue Han, Intersection of ferroptosis and nanomaterials brings benefits to breast cancer; Cell Biol Toxicol. 2025 Jul. 22; 41(1):119. doi: 10.1007/s10565-025-10067-x.
11. Ziyue Wang, Hezhen Xu, Meng Li, Shan Lei, Yin Cai. Yumeng Wu, Jing Lin, Peng Huang. Nanotechnology for tumor ferroptosis. Cell Biomaterials 2, 100222, March 17, 2026.
12. Stepanić, V., Kučerová-Chlupáčová, M. Review and Chemoinformatic Analysis of Ferroptosis Modulators with a Focus on Natural Plant Products. Molecules 2023, 28, 475. https://doi.org/10.3390/molecules28020475.

ADSORPTION AND INHIBITIVE PROPERTIES OF *ELETTARIA CARDAMOMUM* ON CARBON STEEL CORROSION IN ACIDIC MEDIA: EXPERIMENTAL AND THEORETICAL STUDIES

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ABSTRACT

This study investigates the impact of Elettaria Cardamomum essential oil (ECr) on carbon steel corrosion in a 1 M HCl solution by employing potentiodynamic polarization, electrochemical impedance spectroscopy, surface analysis, and finally validated with theoretical studies like quantum calculation and MD simulation. The essential oil was obtained from Elettaria Cardamomum seeds using the hydro-distillation method. Elettaria Cardamomum demonstrated promising anticorrosive performance, and the inhibition efficiency increased with increasing ECr concentration, reaching 95 % at 150 ppm. The analysis demonstrated an increase in inhibition efficiency with rising inhibitor concentration and a decrease in effectiveness with increased temperature. Thermodynamic parameters were also investigated using the data obtained from temperature measurements. Potentiodynamic polarization validated that the ECr essential oil revealed mixed-type inhibitory behavior. During the adsorption process, the ECr molecules followed the Langmuir adsorption isotherm. In addition, SEM/EDS and AFM analysis demonstrated that the carbon steel surface is protected by the ECr molecules, confirming the electrochemical results. Finally, Theoretical calculations like quantum chemical calculations and molecular dynamics simulations also confirm excellent adsorption of Isoxsuprine hydrochloride on the metallic sample. The results from all of the different methods were consistent.

Keywords: Elettaria Cardamomum, Corrosion, EIS, AFM, MDs.

MULTI-CRITERIA DECISION ANALYSIS FOR WASTE-TO-RESOURCE OPTIONS: CONVENTIONAL PVC VS PHA

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ABSTRACT

This study employs Multi-Criteria Decision Analysis (MCDA) to compare two waste-to-resource scenarios: conventional polyvinyl chloride (PVC) production and circular polyhydroxyalkanoates (PHA) synthesis from organic waste. PVC, a chemically derived polymer, relies on fossil feedstocks and involves significant chemical costs. Moreover, PVC is a heavy consumer of resources, especially non-renewable ones, which further undermines its sustainability. In contrast, PHA production valorises organic waste, producing biodegradable polymers along with energy and bioproducts-thereby transforming waste into resource rather than consuming raw, non-renewable inputs. The evaluation considers ecological, economic and social dimensions. PVC benefits from established infrastructure and scalability but incurs high resource consumption, environmental impact and fossil-fuel dependence. PHA production, while facing higher initial costs and market uncertainties, offers superior economic efficiency through multiple revenue streams: energy plus high-value bioproducts. MCDA results indicate that when ecological and circularity criteria (including energy recovery) are weighted more heavily, the PHA scenario attains a higher ranking. Conversely, when cost and technological readiness dominate, the PVC pathway remains preferred. Sensitivity analysis shows that emphasising social innovation and waste valorisation further strengthens the circular alternative.

The findings underscore the importance of integrating multiple criteria in decision-making, explicitly addressing trade-offs, and engaging stakeholders. MCDA empowers decision-makers to transparently compare scenarios, highlight critical decision levers (like technological maturity, market design, regulation) and steer policy toward more sustainable material, energy and bioproducts valorisation of waste. In comparing PVC with PHA, the analysis emphasises that PVC's high consumption of non-renewable resources and chemical inputs make it a less favourable scenario, whereas PHA's ability to recover energy and produce bioproducts makes it the more sustainable choice.

In conclusion: MCDA helps us compare scenarios and determine which technology is more viable from economic, ecological and social perspectives; in this case, PHA emerges as the more holistic and future-proof option.

Keywords: circular polymer production, multi-criteria decision analysis, sustainability decision support, waste valorisation.

ELECTRODEPOSITION FROM NADES OF A NAPROXEN-LOADED POLYPYRROLE COATING ON A HIGH-ENTROPY ALLOY

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ABSTRACT

Natural deep eutectic solvents (NADES) have recently emerged as eco-friendly and versatile electrolytes for electrodeposition, offering wide electrochemical windows and compatibility with bioactive molecules [1]. The Ti–20Zr–5Ta–2Ag high-entropy alloy, previously patented as a promising biomedical material [2], has been recently further investigated by our group for its thermal, mechanical, and electrochemical stability [3]. In this work, a NADES-based electrodeposition approach was developed to produce naproxen-loaded polypyrrole (PPy–NAP) coatings on this alloy.

The synthesis was achieved by potentiostatic (1.2–1.6 V) and galvanostatic (0.5–1 mA) methods using a choline chloride–lactic acid NADES containing pyrrole and naproxen as monomer and therapeutic dopant. Surface morphology, composition, and wettability were investigated by SEM, FTIR, and contact-angle measurements in simulated body fluid (SBF). Electrochemical performance was assessed through open-circuit potential, potentiodynamic polarization, and impedance spectroscopy, while drug-release behavior was evaluated spectrophotometrically and modeled mathematically.

Compared with the uncoated substrate, PPy and PPy–NAP coatings significantly improved hydrophilicity (contact angle decreased from ~31° to <10°) and enhanced corrosion protection (corrosion current density reduced from 754 µA/cm² to below 5.5 µA/cm²; polarization resistance increased to 37.8 kΩ·cm²). The inclusion of naproxen further increased coating resistance ($R_{coat} \approx 1.4 \times 10^{11}$ Ω·cm²) and enabled a sustained release exceeding 90% over eight days. The release kinetics followed Fickian ($n \approx 0.51$) and anomalous ($n \approx 0.67$) transport for potentiostatic and galvanostatic coatings, respectively.

These multifunctional PPy–NAP coatings, prepared through a green NADES-based process, demonstrate a promising combination of corrosion protection and controlled drug delivery, underscoring their potential as smart, biomimetic interfaces for next-generation implantable devices.

References

1. Nartita, R., Golgovici, F., Demetrescu, I. NADES – Mediated Deposition of Potential Biomimetic Drug-Loaded Polypyrrole on Biomedical Ti20Zr5Ta2Ag. Biomimetics 2025, 10, 1–22, doi:10.3390/biomimetics10090568.
2. Vasilescu, E.V., Calderon, M.J., Vasilescu, C., Drob, S.I., Stanciu, D.E., Ivanescu, S., Ionita, M.D., Prodana, M. Ti-Zr-Ta-Ag Bio-alloy for Orthopedic Implants, RO 132031 B1 / 30.04.2019 (OSIM).
3. Nartita, R., Stoian, A.B., Ionita, D., Demetrescu, I. Thermal Effects on the Mechanical, Electrochemical, and Surface Properties of a Ti–20Zr–5Ta–2Ag Alloy for Potential Industrial and Biomedical Applications. J. Mater. Res. Technol. 2025, 35, 7215–7234, https://doi.org/10.1016/j.jmrt.2025.02.240.

TOURISM EMPLOYMENT IN THE EUROPEAN UNION: STRUCTURAL DYNAMICS AND IMPLICATIONS FOR THE CIRCULAR ECONOMY

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ABSTRACT

Tourism remains one of the most employment-intensive and socially significant sectors in the European Union (EU), contributing not only to economic development but also to cultural exchange and community well-being. Yet, as Europe advances toward a circular and sustainable economy, it becomes increasingly important to understand how tourism employment evolves and how its structure can support this transition. Building on recent studies linking circular economy strategies with sustainable tourism development [1,2], this paper explores the structural dynamics of tourism employment across EU Member States, highlighting the connections between economic growth, labour distribution, and circular transformation. Drawing on Eurostat database and complementary indicators from Our World in Data, the study adopts a mixed-methods approach that combines descriptive statistics, correlation analysis, and cross-country comparisons. The study investigates: (I) the share of tourism employment within total services and the overall economy, (II) the contribution of individual sub-sectors to total tourism jobs, and (III) the relationship between the size of national economies and the relative importance of tourism employment. Findings show that tourism remains an important sector for employment in the EU, accounting for almost 9% of total services jobs, with notable disparities between countries. Southern European economies, such as Greece, Spain and Portugal, continue to depend heavily on tourism labour, while Central and Northern states maintain more diversified employment structures. The analysis reveals a moderate positive correlation between total economic output and tourism employment share, suggesting that while tourism growth often aligns with broader economic expansion, it also exposes countries to cyclical vulnerabilities. Furthermore, the findings align with recent evidence suggesting that tourism contributes to the creation of inclusive employment opportunities, particularly benefiting women, across several EU economies [2]. These insights emphasize adaptive employment strategies that align tourism development with circular economy principles, promoting resource efficiency and workforce upskilling. Policymakers should promote innovation, education, and digitalization in tourism to foster inclusive, sustainable jobs. Understanding employment patterns is essential to ensuring tourism supports the EU's circular transition and advances economic, environmental, and social goals.

References

1. Strippoli R., Gallucci T., Ingrao C. (2024), Circular economy and sustainable development in the tourism sector – An overview of the truly-effective strategies and related benefits, *Heliyon*, 10, e36801, https://doi.org/10.1016/j.heliyon.2024.e36801.
2. Bolukoglu A., Gozukucuk T. (2023), Tourism development and women employment: A study on the European union countries, *Tourism Economics*, 30, 442–456.

FABRICATION OF A MULTI-LAYERED BIODEGRADABLE SCAFFOLD INCORPORATING METAL NANOPARTICLES FOR ADVANCED SKIN WOUND HEALING

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ABSTRACT

The biggest organ in the human body, the skin has a major impact on a variety of bodily processes and activities, including as thermoregulation, pathogen defense, and environmental sensing [1]. However, because skin is sensitive and elastic, it can develop flaws known as wounds when it is exposed to constant conflict and rests on the outside of the body [2]. Human skin has the ability to self-heal on its own to regain its structural and functional integrity, but wound care is still crucial to preventing infection and desiccation, reducing pain, protecting the open site, hastening the healing process, and preventing scarring, particularly in cases of large, open wounds or burns [3].

Skin injuries are a significant health problem worldwide. When these injuries, which can occur for various reasons, reach serious proportions, the healing process cannot be completed due to the failure of processes such as cell migration and angiogenesis to occur fully, resulting in chronic wounds. To address this problem, a multi-layered tissue scaffold that mimics skin tissue has been designed to accelerate cell migration, enhance the wound's healing capacity, and shorten the healing time [4].

The tissue scaffold was produced using electrospinning and 3D printing techniques. The materials used include PLA loaded with metal nanoparticles to protect the skin wound from infection in addition PVA and gelatin-based hydrogel to support wound healing. The gelatin-based hydrogel layer provides extra moisture on the side of the scaffold contacting the wound, addressing dryness, which is a major obstacle to wound healing. The produced scaffolds were characterized at an optimal level in terms of morphological, mechanical, and cytotoxicity properties. Based on the results of these characterizations, the scaffold is considered promising, as it exhibits biodegradability, biocompatibility, non-cytotoxic behavior, sufficient antibacterial properties from the metal nanoparticles, significantly enhanced cell migration due to the, the multi-layered structure and adequate hydration provided by the hydrogel layer.

References

1. M. Colonna, Skin function for human CD1a-reactive T cells. Nat. Immunol. 11, 1079–1080 (2010).
2. F. Strodtbeck, Physiology of wound healing. Newborn Infant Nurs. Rev. 1(1), 43–52 (2001).
3. B.K. Sun, Z. Siprashvili, P.A. Khavari, Advances in skin grafting and treatment of cutaneous wounds. Science 346(6212), 941–945 (2014).
4. R. Yu, H. Zhang, B. Guo, Conductive biomaterials as bioactive wound dressing for wound healing and skin tissue engineering, Nano-Micro Letters 14 (2022) 1–46.

SEQUENTIAL VACUUM LOADING OF DEMINERALIZED BONE MATRIX WITH VANCOMYCIN AND HUMAN ALBUMIN FOR CONTROLLED ANTIBIOTIC RELEASE

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ABSTRACT

Bone grafting remains a key therapeutic strategy for repairing skeletal defects, yet the preparation of demineralized bone matrix (DBM) results in the loss of native growth factors essential for osteoinduction. This study proposes a dual sequential vacuum-loading [1] of DBM with vancomycin and human albumin (HA), aiming to achieve deeper penetration and sustained release of the bioactive compound. Bovine iliac bones were demineralized using 1 M HCl, processed according to Human Tissue Bank protocols [2], and lyophilized. Primary loading was performed with vancomycin solutions of 100 mg/mL and 200 mg/mL, followed by secondary loading with 10% and 20% HA [3].

To analyze samples properties were evaluated swelling ratio, elastic modulus, enzymatic degradation, vancomycin release profile using HPLC and antibacterial activity by difuzimetric method. Thus, vancomycin loading reduced the liquid absorption capacity of the samples, which was partially restored by secondary HA loading, especially at 20% concentration, suggesting a stabilizing structural interaction. Mechanical test revealed a significant increase in elasticity modulus after vancomycin incorporation, further enhanced by HA. The enzymatic degradation rate decreased with all loaded samples, indicating improved structural resistance. HPLC analysis showed that HA modulated the vancomycin release profile, reducing the initial burst and ensuring prolonged release after 20 days. Antibacterial tests confirmed strong activity against *Staphylococcus aureus* and intermediate activity against *Klebsiella pneumoniae*, with no inhibition observed for *Enterococcus faecalis* or *Pseudomonas aeruginosa* after 24 hours.

The obtained results demonstrate that sequential vacuum loading with vancomycin and then with albumin provides a promising strategy for designing multifunctional DBM-based grafts with tunable mechanical and pharmacokinetic properties suitable for regenerative and anti-infective bone applications.

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References

1. Petrisor G., Ficai D., Motelica L., Trusca RD., Bîrcă A.C., Vasile B.S., Voicu G., Oprea O.C., Semenescu A., Ficai A. et al. Mesoporous Silica Materials Loaded with Gallic Acid with Antimicrobial Potential. Nanomaterials. 2022; 12(10):1648. DOI: https://doi.org/10.3390/nano12101648.
2. Cobza, V., Vereștiuc L., Jian M., Nacu V. Assessment of ionic and anionic surfactants effect on demineralized osteochondral tissue. IOP Conf. Ser. Mater. Sci. Eng. 572, 012084 (2019). DOI: https://doi.org/10.1088/1757-899X/572/1/012084.
3. Cobzac V., Jian M., Baranețchi I., Marițoi T., Malcova T., Ficai D., Ficai A., Nacu V. Controlled release of bioactive agents from demineralized bone using sequential double vacuum loading. IFMBE Proceedings. 2025; 135:423–432. DOI: https://doi.org/10.1007/978-3-032-06497-4_42

DEVELOPMENT OF A 3D-PRINTED ALGINATE–GELATIN SCAFFOLD INCORPORATING SUPERCRITICAL CO_2-EXTRACTED GRAPE SEED EXTRACT FOR POSTHARVEST ANTIFUNGAL FOOD PACKAGING

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ABSTRACT

Post-harvest fungal contamination poses a significant challenge in maintaining the quality, safety, and shelf life of grapes and often leads to significant economic losses [1]. Traditional preservation and packaging methods largely rely on synthetic chemicals, which can pose health and environmental concerns. The current study aims to develop a biodegradable and environmentally friendly food packaging scaffold that can prevent fungal growth on post-harvest grapes [2].

This study aims to develop an environmentally friendly and biodegradable packaging system to combat fungal contamination observed in grapes after harvest. In the study, a composite scaffold was prepared consisting of alginate, which has film-forming and moisture control properties, and gelatin, which provides mechanical strength. The structure was functionalized with grape seed extract (GSE) obtained by supercritical CO_2 extraction, thereby imparting natural antifungal and antioxidant properties. Using 3D printing technology in the production process allowed for precise control over porosity, thickness, and mechanical strength, enabling the homogeneous distribution of active components. Thus, the developed 3D-printed alginate-gelatin – GSE scaffold was designed to prevent fungal growth, maintain moisture balance, and extend the shelf life of grapes.

The surface morphology and elemental analysis of the produced material were investigated using SEM and FTIR; its biological activity was tested in vitro using the agar dilution method in Aspergillus niger and Botrytis cinerea. The findings demonstrated that the structure possesses favorable mechanical and functional properties and revealed the potential of the developed alginate-gelatin scaffold to be an innovative 3D-printed packaging system produced with environmentally safe and biofunctional materials. The promising results indicate a promising alternative to synthetic preservatives and traditional plastic packaging for extending the shelf life of post-harvest foods. Future studies are foreseen to perform additional characterization tests to obtain a deeper understanding of the performance of this material.

References

1. Solairaj, D., Yang, Q., Legrand, N.N.G., Routledge, M.N., Zhang, H. (2021). Molecular explication of grape berry-fungal infections and their potential application in recent postharvest infection control strategies. Trends in Food Science & Technology, 116, 903–917.
2. Di Canito, A., Mateo-Vargas, M.A., Mazzieri, M., Cantoral, J., Foschino, R., Cordero-Bueso, G., Vigentini, I. (2021). The role of yeasts as biocontrol agents for pathogenic fungi on postharvest grapes: A review. Foods, 10(7), 1650.

EVALUATION OF THE ACTIVITY OF BIOGENIC AG/ZN BIMETALLIC NANOPARTICLES DERIVED FROM *TERMINALIA CHEBULA* AGAINST VARIOUS MICROORGANISMS

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ABSTRACT

In the context of green chemistry, nanoparticles have effectively facilitated the biosynthesis of various bioactive compounds present in plant extracts. *Terminalia chebula* is a plant with versatile medicinal and pharmacological properties and is known as the "King of Medicine" [1]. In this study, inhibitory effects of Ag, Zn and Ag-Zn nanoparticles (NPs) as reducing and stabilizing agents from ethanol extract of *Terminalia chebula* against microorganisms were evaluated by the agar well diffusion method [2]. Ag-Zn NPs formed an inhibition zone of 20.86 mm against *Acinetobacter baumannii* and 28.36 mm against *Candida tropicalis*. The study results showed that both Ag- and Zn-based monometallic nanoparticles exhibited inhibitory activity, while the bimetallic Ag/Zn nanoparticle formulation exhibited superior performance. This performance is attributed to the synergistic effect of the combination of two different metals coexisting on the surface.

Keywords: *Terminalia chebula*, Ag-Zn nanoparticles, antimicrobial activity.

References

1 Hassan Bulbul, M.R., Uddin Chowdhury, M.N., Naima, T.A., Sami, S.A., Imtiaj, M.S., Huda, N., Uddin, M.G. A Comprehensive Review on the Diverse Pharmacological Perspectives of Terminalia Chebula Retz. *Heliyon*, 2022, 8 (8), e10220. https://doi.org/10.1016/J.HELIYON.2022.E10220.

2 Rather, G.A., Hassan, S., Pal, S., Khan, M.H., Rahman, H.S., Khan, J., Rather, G.A., Hassan, S., Pal, S., Khan, M.H. et al. Antimicrobial Efficacy of Biogenic Silver and Zinc Nanocrystals/Nanoparticles to Combat the Drug Resistance in Human Pathogens. *Nanocrystals [Working Title]*, 2021. https://doi.org/10.5772/INTECHOPEN.99200.

BIOACTIVE ZNO COMPOSITE SCAFFOLD FOR TISSUE REGENERATION

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ABSTRACT

This study explores the combined effect of zinc oxide nanoparticles (ZnO) and human albumin (HA) on the physicochemical parameters, cytocompatibility and antibacterial activity of demineralized bone matrix (DBM). The objective was to develop a multifunctional DBM-based composite combining structural reinforcement, cytocompatibility and antimicrobial protection for bone tissue regeneration using a rough vacuum pressure [1,2]. DBM composites were loaded under rough vacuum pressure with aqueous solutions of 1, 5, and 10 mg/ml ZnO in the first step [1,3]. After freeze-drying, the obtained samples were secondarily loaded with 10% and 20% HA [1]. The elastic modulus was determined by mechanical testing, enzymatic degradation was assessed in collagenase solution, and swelling capacity was expressed as a percentage of mass uptake. Cytocompatibility was evaluated using the MTT assay on bone marrow mesenchymal stem cells (BM-MSCs), and antibacterial properties were tested against *S. aureus, E. faecalis, K. pneumoniae, E. coli* and *P. aeruginosa*.

Loading DBM with ZnO increased its elastic modulus in a concentration-dependent manner, reaching maximal stiffness in the 10 mg/ml ZnO+dH_2O group, indicating enhanced crosslinking and matrix rigidity. Enzymatic degradation decreased progressively with higher ZnO content, reflecting improved collagenase resistance, while HA-modified samples displayed a moderate degradation rate, preserving bioresorbability. The swelling ratio peaked at 5 mg/ml ZnO, whereas the addition of HA reduced swelling, producing a denser and more stable matrix. Cytocompatibility assays revealed that high ZnO levels diminished cell viability; however, HA addition (10-20%) significantly restored metabolic activity, achieving values close to control DBM. The combination of 1 mg/ml ZnO+20% HA showed the most favorable cell response, demonstrating that albumin mitigates ZnO-induced oxidative stress. Antibacterial testing confirmed a strong antimicrobial effect of ZnO-containing composites. All ZnO groups completely inhibited *E. coli* and *S. aureus* growth at 24–48 h. *E. faecalis* showed pronounced bactericidal zones (25–30 mm) at 48 h in the 10

mg/ml ZnO+HA formulations. *K. pneumoniae* displayed minimal sensitivity (2–3 mm), while *P. aeruginosa* remained resistant.

The sequential dual loading of DBM scaffolds under vacuum with ZnO nanoparticles and HA enables tunable optimization of their physicochemical and biological properties. ZnO enhances stiffness, enzymatic resistance and antibacterial activity, while HA restores flexibility, hydrophilicity and cytocompatibility. The 1 mg/ml ZnO+20%HA formulation achieved the most balanced performance, combining mechanical reinforcement, controlled degradation, strong antimicrobial activity and high cell viability.

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References

1. Cobzac V., Jian M., Baranețchi I., Marițoi T., Malcova T., Ficai D., Ficai A., Nacu V. Controlled release of bioactive agents from demineralized bone using sequential double vacuum loading. IFMBE Proceedings. 2025; 135:423–432. DOI: https://doi.org/10.1007/978-3-032-06497-4_42
2. Petrisor G., Ficai D., Motelică L., Trusca RD., Bîrcă AC., Vasile BS., Voicu G., Oprea OC., Semenescu A., Ficai A. et al. Mesoporous Silica Materials Loaded with Gallic Acid with Antimicrobial Potential. Nanomaterials. 2022; 12(10):1648. DOI: https://doi.org/10.3390/nano12101648
3. Braniste T., Cobzac V., Ababii P., Pleşco I., Raevschi S., Didencu A., Maniuc M., Nacu V., Ababii I., Tiginyanu I. The influence of semiconductor nanoparticles upon the activity of mesenchymal stem cells. IFMBE Proceedings. 2019; 77:607–611. DOI: https://doi.org/10.1007/978-3-030-31866-6_108.

IMPACT OF SURFACE TREATMENTS ON CELLULOSE NANOFIBERS: A COMPARATIVE STUDY ON THEIR INTERACTION WITH A SULFATED POLYSACCHARIDE

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ABSTRACT

The attention of researchers around the world is shifting towards more green and renewable pursuits in response to the growing environmental concerns. Among many possible candidates for producing new, eco-friendly materials is cellulose, a biopolymer with attributes that include renewability, biocompatibility, water retention capacity, and a modifiable surface due to the high number of hydroxyl groups on its surface. Having extensive possibilities for modification, cellulose–derived materials can be tailored for different sectors of the industry (pharmaceutical, medical, sensors, etc.), for example, through TEMPO-mediated oxidation or through silanization.[1]

Further associations with other compounds of natural origin expand the application spectra of the materials, especially when the addition has antibacterial properties, which cellulose lacks. For example, the formulations between cellulose and fucoidan, a polysaccharide extracted from brown algae, inherit the antibacterial, anti-inflammatory, and antioxidant traits of the fucoidan, while still exhibiting the properties that make cellulose such a reliable material. On its own, fucoidan is a rather weak material, with a low viscosity and poor water resistance, that does not permit its use independently when it comes to topical or wound dressing applications. [1,2]

In this work, the influence of different types of cellulose on the chemistry, thermal stability, structural organization, and viscoelastic behavior of fucoidan was studied through Fourier-transform infrared spectroscopy, thermogravimetric analysis, scanning electron microscopy, and rheometry. Following chemical modification, cellulose was shown to have a beneficial effect on fucoidan, improving its processability and structural cohesion.

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References

1. Uşurelu, C.D., Panaitescu, D.M., Oprică, G.M., Nicolae, C., Gabor, A.R., Damian, C.M., Ianchiş, R., Teodorescu, M., Frone, A.N. Effect of Medium-Chain-Length Alkyl Silane Modified Nanocellulose in Poly(3-hydroxybutyrate) Nanocomposites. *Polymers*, 16(21), 3069 (2023). https://doi.org/10.3390/polym16213069
2. Akter, A., Sobuj, M.K.A., Islam, M.S. et al. Seaweed polysaccharides: Sources, structure and biomedical applications with special emphasis on antiviral potentials. Future Foods 10, 100440 (2024). https://doi.org/10.1016/j.fufo.2024.100440.

COLLAGEN SPONGES EXTRACTED FROM THE UMBILICAL-PLACENTAL COMPLEX: *IN VIVO* TESTING ON RATS

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ABSTRACT

Collagen sponges are widely used as biomaterials in dentistry, especially in guided bone regeneration, periodontitis treatment, implantology and post-extraction surgery due to their high bioresorbability and biological compatibility [1]. Currently, collagen sponges extracted from xenogeneic sources are widely used, but there are certain limitations in their use associated with the transmission of zoonoses and zooanthroponoses [2]. The development of collagen-based biomaterials that provide safety after transplantation is an imperative of the time.

The aim of the study was to test collagen sponges extracted from the umbilical-placental complex *in vivo* on laboratory animals. The collagen sponges were transplanted subcutaneously in the lumbar region bilaterally of the spine. The animals were euthanasied at different intervals and Hematoxylin Eosin staining was performed.

Histological analysis showed a resorption of the implanted biological material, moderate inflammatory reaction in some sponges, lack of necrosis areas, formation of connective tissue in the implant area, infiltration of fibroblasts and collagen resorption, but also the initiation of angiogenesis essential for the process of nutrition and oxygenation of the cells involved in the regeneration process. The histological changes highlighted by Hematoxylin-Eosin staining demonstrate biocompatibility and controlled resorption of the transplanted graft and their efficient integration, which indicates the potential for their application for regenerative purposes in the field of dentistry.

References

1. Kuroyanagi, Y., Suzuki, R. Kuroyanagi, M. (2021) Design of Collagen-Based Sponge Device for Use in Oral Surgery. Open Journal of Regenerative Medicine, 10, 31–49. doi: 10.4236/ojrm.2021.103003.
2. Fishman J.A., Patience C. Xenotransplantation: infectious risk revisited. Am J Transplant. 2004 Sep. 4(9):1383–1390. doi: 10.1111/j.1600-6143.2004.00542.x. PMID: 15307825; PMCID: PMC7175990.

NANOPARTICULES FOR DRUG DELIVERY IN MULTIPLE SCLEROSIS

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ABSTRACT

Multiple sclerosis (MS) is a neuro-immunological disorder, caused by demyelination of the central nervous system (CNS) through the loss of oligodendroglial cells (OLC) and axonal degeneration [10]. Traditional therapies, such as disease-modifying drugs (DMD), have a discrete efficacy caused by reduced bioavailability due to limited permeability of the blood-brain barrier (BBB) and severe side effects, such as increase infections rate by 33%, increased risk of heart and cerebrovascular pathologies (Fingolimod, Natalizumab), thyroid dysfunction and arterial hypertension (Alemtuzumab)[5]. Thus, long-term administration requires rigorous monitoring.

Recent advances in nanomedicine have introduced nanoparticles (NPs) as promising solutions for targeted drug delivery in the treatment of multiple sclerosis. NPs can slow MS progression and promote remyelination by stimulating OLC. Their nanometric size allows the passage of the BBB and direct absorption by CNS cells. Their capsule has a dual function: covered by specific ligands, it targets CNS components, while protecting the active agents (proteins, peptides, lipids, amino acids, nucleic acids) from enzymatic degradation [1,8]. Due to their properties, NPs expand the range of available therapies, prolonging the circulation time which reduce the frequency of controlled release, thus avoiding overdose, and stabilizes the plasma levels of drugs. They decreased autoimmune responses and side effects due to PEGylation: the covalent attachment of polyethylene glycol (PEG) chains to the surface of the NPs, which can be seen in the case of dendrimers, liposomes, gold nanoparticles (AuNPs), silica nanoparticles (SiNPs) and many others [2,7]. Brain-derived neurotrophic factor (BDNF) is a NP with a protective role in the CNS, releasing growth factors that contribute to the maturation of OLC, slowing disease progression and quantitatively reducing anti-myelin basic protein antibodies. In the CNS, BDNF binds to the tropomyosin receptor kinase B (TrkB) and activates the phosphatidylinositol 3-kinase (PI3K), mitogen-activated protein kinase (MAPK) and phospholipase C (PLC) pathways that stimulate the growth of OLC [4,6].

An innovative nanotherapy option is exomes – they regulate microglia polarity, changing the status from inflammatory to anti-inflammatory, increase the number of CD206+ microglia cells and quantitatively reduce CD16/32+ microglia cells [3]. Exomes have the potential to be subsequently applied in modifying genes, proteins and signaling pathways of stem cells. Combining stem cell biology with nanotechnology that promotes OLC proliferation by manipulating pathways such as platelet-derived growth factor (PDGF), bone morphogenetic protein (BMP) and wingless-related integration site Wnt/Notch, targeting genes such as Sox, bHLH and Nkx, is a contemporary approach to the treatment of MS [1,2,9].

In conclusion, nanotechnology offers a new therapeutic frontier in MS management by enabling targeted, efficient, and sustained drug delivery across the BBB. It has shown to significantly enhance treatment efficacy and patient safety, paving the way toward more precise and personalized neuroregenerative therapies.

Keywords: Nanopartiules, Multiple Sclerosis, Targeted Therapy, Blood-brain Barrier.

References

1. Biswas, A., Hivare, P., Solanki, R., Gupta, S., Bhatia, D. (2025). Applications of bionanomaterials in neurodegenerative diseases. *Materials Advances* (Vol. 6, Issue 12, pp. 3785–3804). Royal Society of Chemistry. https://doi.org/10.1039/d4ma01215a.
2. Ghosh, S., Bhatti, G.K., Sharma, P.K., Kandimalla, R., Mastana, S.S., Bhatti, J.S. (2024). Potential of Nano-Engineered Stem Cells in the Treatment of Multiple Sclerosis: A Comprehensive Review. In *Cellular and Molecular Neurobiology* (Vol. 44, Issue 1). Springer. https://doi.org/10.1007/s10571-023-01434-5.
3. Kråkenes, T., Sandvik, C.E., Ytterdal, M., Gavasso, S., Evjenth, E.C., Bø, L., Kvistad, C.E. (2024). The Therapeutic Potential of Exosomes from Mesenchymal Stem Cells in Multiple Sclerosis. In *International Journal of Molecular Sciences* (Vol. 25, Issue 19). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/ijms251910292.
4. Maiworm, M. (2024). The relevance of BDNF for neuroprotection and neuroplasticity in multiple sclerosis. *Frontiers in Neurology* (Vol. 15). Frontiers Media SA. https://doi.org/10.3389/fneur.2024.1385042.
5. Ng, H. S., Zhu, F., Zhao, Y., Yao, S., Lu, X., Ekuma, O., Evans, C., Fisk, J. D., Marrie, R. A., Tremlett, H. (2024). Adverse Events Associated With Disease-Modifying Drugs for Multiple Sclerosis. *Neurology*, *102*(3). https://doi.org/10.1212/WNL.0000000000208006.
6. Nociti, V., Romozzi, M. (2023). The Role of BDNF in Multiple Sclerosis Neuroinflammation. *International Journal of Molecular Sciences* (Vol. 24, Issue 9). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/ijms24098447.
7. Panghal, A., Flora, S.J.S. (2024). Nano-based approaches for the treatment of neuro-immunological disorders: a special emphasis on multiple sclerosis. In *Discover Nano* (Vol. 19, Issue 1). Springer. https://doi.org/10.1186/s11671-024-04135-0.
8. Sabatino, J.J., Cree, B.A.C., Hauser, S.L. (2025). New Horizons for Multiple Sclerosis Therapy: 2025 and Beyond. *Annals of Neurology* (Vol. 98, Issue 2, pp. 317–328). John Wiley and Sons Inc. https://doi.org/10.1002/ana.27270
9. Santos, S.I.P., Ortiz-Peñuela, S.J., de Paula Filho, A., Tomiyama, A.L.M.R., Coser, L. de O., da Silveira, J.C., Martins, D. dos S., Ciena, A.P., de Oliveira, A.L.R., Ambrósio, C.E. (2024). Oligodendrocyte precursor cell-derived exosomes combined with cell therapy promote clinical recovery by immunomodulation and gliosis attenuation. *Frontiers in Cellular Neuroscience*, 18. https://doi.org/10.3389/fncel.2024.1413843
10. Zhao, X., Jacob, C. (2023). Mechanisms of Demyelination and Remyelination Strategies for Multiple Sclerosis. *International Journal of Molecular Sciences* (Vol. 24, Issue 7). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/ijms24076373

COST – BENEFIT BASED RISK MODELING FOR FOOD WASTE MANAGEMENT

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ABSTRACT

The modeling of risks associated with food waste management scenarios- recovered by composting, anaerobic digestion for biogas, and bioproduct production-was performed using an integrated cost-benefit analysis (CBA) to assess the environmental, economic, and social viability of the proposed solutions. In the first phase, three operational scenarios were developed (e.g., composting only; anaerobic digestion + composting; complete recovery in bioproduct) and, for each of these, the investment, operational, collection, and treatment costs were identified, along with the anticipated benefits (energy and biogas incomes, savings on fertilizers, disposal costs, and avoided emissions). The CBA modeling included indicators such as the benefit/cost (B/C) ratio, net present value (NPV), and internal rate of return (IRR). From an environmental perspective, the avoided greenhouse gas emissions, reduced dependence on chemical fertilizers, and reduction of waste sent to landfills were evaluated. From an economic perspective, the scenarios were compared based on the cost per ton of waste treated in relation to the avoided revenues/costs.

The results demonstrate that scenarios that combine anaerobic digestion and composting – that it means the simultaneous production of biogas and compost/bioproducts – achieve more favorable cost/benefit ratios than simple composting, given that energy and fertilizer prices support the valorization. However, sensitivity to the critical variables (investment costs, biogas price, fertilizer prices) is high – in line with the literature on cost-benefit analysis of organic waste. Identified risks also include: high initial costs, fluctuations in the biogas/compost market, risks of social or logistical non-acceptance in collection, and potential secondary emissions if the process is not optimally managed. From an environmental point of view, the benefits are clear, but can be offset by high costs if the technology is not properly adapted. In conclusion, the study highlights that risk modeling based on cost-benefit analysis provides a solid basis for decision-making regarding the implementation of food waste management scenarios, but the success of implementation depends on aligning technological and economic factors with local conditions and realistically assessing social and environmental benefits.

Keywords: compost and biogas, cost-benefit analysis, food waste, social sustainability

MAGNETIC HYDROGEL: SYNTHESIS AND APLLICATIONS IN ONCOLOGY

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ABSTRACT

Nowadays, oncological pathologies are one of the most important causes of patient death or have a high impact on the survivor's quality of life. Although old treatments have proven to be highly efficient in disease remission, it is of utmost importance to continuously search for new, innovative solutions that can be locally applied with reduced side effects. In this regard, we conducted a literature review on magnetic hydrogels. Devoted attention was given to the synthesis methods, with one of the most suggestive studies presented in detail, focusing on the preparation method and magnetic characterization. Then, the main properties that an ideal magnetic hydrogel should possess, such as injectability, shear-thinning, self-healing, mechanical properties, porosity, biodegradability, and biocompatibility, are discussed, along with the primary magnetic field-guided physical mechanisms associated with each investigated property. Last but not least, in vitro and in vivo studies are described by considering the main medical applications of magnetic hydrogels, such as magnetic hyperthermia, drug targeting, and immunotherapy. We concluded our study with a series of clinical trials that examined the hydrogel and magnetic nanoparticles separately. Since there are no human studies, we hope that demonstrating the advantages of the strategies mentioned above will provide them with an opportunity to be applied in future clinical trials for various oncological pathologies.

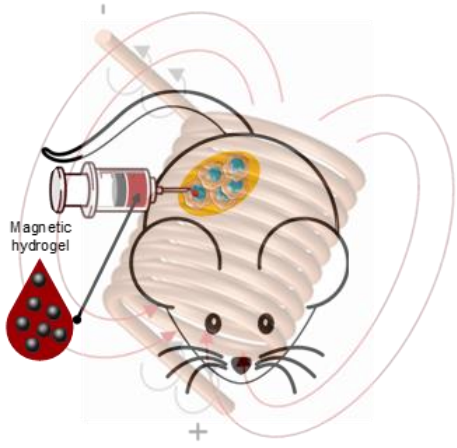

Figure 1. Example of magnetic hydrogel application in cancer therapy.

REFERENCES

1. V. Manescu et al., Int. J. Mol. Sci. 2024, 25, 10065. https://doi.org/10.3390/ijms251810065
2. V. Manescu et al., Materials, 2021, 20, 5948. https://doi.org/10.3390/ma14205948

EVALUATION OF CELL VIABILITY ON A THREE-DIMENSIONAL SCAFFOLD DESIGNED FOR ORAL MUCOSA

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ABSTRACT

In this study, a novel three-dimensional (3D) scaffold composed of polycaprolactone (PCL) and alginate was developed to closely mimic the architecture and cellular composition of oral mucosa tissue. The scaffold was designed to support a layered culture of four distinct cell types critical to oral mucosal function: gingival keratinocytes, gingival fibroblasts, human umbilical vein endothelial cells (HUVECs), and human dermal microvascular endothelial cells (HDMECs). These cells were seeded onto the scaffold in a stratified manner to replicate the native tissue's multilayered structure.

The metabolic activity and viability of the cells within the scaffold were assessed using the MTT assay at three time points: day 1, day 7, and day 14. For each time point, three replicates were measured to ensure statistical reliability. The results demonstrated a clear upward trend in cellular metabolic activity, with average absorbance values (mean ± standard deviation) of 0.598 ± 0.399 on day 1, 0.910 ± 0.540 on day 7, and 1.047 ± 0.004 on day 14. The relatively high variability in early time points likely reflects differences in initial cell attachment and adaptation to the 3D environment. By day 14, however, the reduced variability and increased absorbance indicate stable cell proliferation and enhanced metabolic function, suggesting successful integration and biocompatibility of the scaffold.

These findings support the suitability of the PCL-alginate composite scaffold as a biomimetic platform for oral mucosa tissue engineering. The scaffold not only facilitates the adhesion and growth of multiple oral mucosal cell types but also promotes their sustained viability and function over a two-week culture period. This approach has potential applications in regenerative medicine, drug testing, and disease modeling related to oral mucosal tissues.

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Keywords: Oral mucosa scaffold, 3D bioprinting, polycaprolactone (PCL), cell viability.

References

1. Koopaie, M., Nassar, D.H. M.A., Shokrolahi, M. (2022). Three-dimensional bioprinting of mucoadhesive scaffolds for the treatment of oral mucosal lesions: an in vitro study. *3D Printing in Medicine*, 8(1), 30. https://doi.org/10.1186/s41205-022-00148-4.

2. Nishiyama, K., Akagi, T., Iwai, S., Akashi, M. (2019). Construction of vascularized oral mucosa equivalents using a layer-by-layer cell coating technology. *Tissue Engineering Part C: Methods, 25*(5), 262–275. https://doi.org/10.1089/ten.TEC.2018.0436.
3. Heller, M., Frerick-Ochs, E.V., Bauer, H.-K., Schiegnitz, E., Flesch, D., Michel, B., Brenner, W. (2016). Tissue engineered pre-vascularized buccal mucosa equivalents utilizing a primary triculture of epithelial cells, endothelial cells and fibroblasts. *Biomaterials*, 77, 207–215. https://doi.org/10.1016/j.biomaterials.2015.11.024.
4. Kim, Y.B., Lee, H., Yang, G.H., Choi, C.H., Lee, D., Cho, D.-W., Kim, G.H. (2016). Mechanically reinforced cell-laden scaffolds formed using alginate-based bioink printed onto the surface of a PCL/alginate mesh structure for regeneration of hard tissue. *Journal of Colloid and Interface Science*, 461, 359–368. https://doi.org/10.1016/j.jcis.2015.09.051.
5. Echeverria Molina, M.I., Chen, C.-A., Martinez, J., Tran, P., Komvopoulos, K. (2023). Novel electrospun polycaprolactone/ calcium alginate scaffolds for skin tissue engineering. *Materials*, 16(1), 136. https://doi.org/10.3390/ma16010136.

ELECTROSPUN SCAFFOLDS FOR PERIPHERAL NERVE REPAIR: CHITOSAN ENHANCED WITH GRAPHENE OXIDE AND CURCUMIN

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ABSTRACT

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THE ANTIMICROBIAL PARADOX OF MORINGA OLEIFERA SEED ESSENTIAL OIL: CHEMICAL INSIGHTS AND ALTERNATIVE MECHANISMS

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ABSTRACT

Moringa oleifera seed essential oil (MSEO) presents a striking paradox in antimicrobial research. Despite its chemically rich composition revealed by GC–MS – comprising fatty acids, hydrocarbons, esters, and minor phenolics – traditional disc and well diffusion assays often exhibit weak or absent inhibition zones. This inconsistency contrasts with the pronounced bioactivity of *Moringa* leaf extracts or other essential oils. Literature and experimental data confirm that even at high concentrations, MSEO fails to inhibit *Staphylococcus aureus*, *Bacillus subtilis*, and *Escherichia coli* [1,2]. The paradox likely arises from poor agar diffusion of long-chain, nonpolar constituents and methodological differences in extraction or assay procedures. Yet, emerging studies highlight alternative mechanisms – membrane perturbation, anti-quorum sensing, biofilm suppression, and antibiotic synergism – that redefine MSEO's role as a multi-target adjuvant rather than a direct bactericide [3,4]. This work underscores how chemical insight and mechanistic reinterpretation can reposition neglected plant oils within modern antimicrobial strategy frameworks.

References

1 Pereira, A. et al. (2018). Chemical composition and antibacterial activity of *Moringa oleifera* seed oil. *Industrial Crops and Products*, 123, 376–382.

2 Nikkon, F. et al. (2003). Antibacterial activities of the seeds of *Moringa oleifera*. *Fitoterapia*, 74(3), 312–315.

3 Leone, A. et al. (2015). *Moringa oleifera* seeds and oil: Emerging bioactivity beyond nutrition. *Frontiers in Pharmacology*, 6, 1–9.

4 Jaiswal, D. et al. (2020). Synergistic antimicrobial and anti-quorum sensing activity of *Moringa* seed oil fractions. *Journal of Ethnopharmacology*, 259, 112913.

DEVELOPMENT OF CU–FE MODIFIED ZNAL LAYERED DOUBLE HYDROXIDE FOR EFFICIENT UV-ASSISTED DYE DEGRADATION

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ABSTRACT

Water pollution from dye effluents remains a major environmental issue, creating a need for multifunctional, stable, and cost-effective photocatalysts. This study presents a multi-metal layered double hydroxide (ZnCuFeAl LDH) synthesized by introducing varying trace amounts of Cu^{2+} and Fe^{3+} into a ZnAl precursor solution, and the hydrothermal method was adopted for the LDH synthesis [1], followed by thermal decomposition to form the active layered double oxide (LDO). The modified photocatalyst was evaluated for UV-assisted degradation of methyl orange (MO). The introduction of 1 % amounts of Cu^{2+} and Fe^{3+} ions into the ZnAl precursor solution subtly modified the electronic structure, leading to improved charge carrier separation and enhanced surface reactivity without significantly altering the optical absorption edge. Cu^{2+} acted as shallow electron traps that promoted interfacial charge transfer [2], while Fe^{3+} facilitated redox cycling, improving the utilization of photogenerated holes [3].

Figure 1a shows the adsorption and degradation efficiencies of varying Cu^{2+} and Fe^{3+} doping with a corresponding photodegradation pathway (Figure 1b) over 1 hour of UV irradiation. It can be seen that the 1:1% – ZnCuFeAl LDO exhibited a remarkable methyl orange degradation removal of over 80%, which corresponds to a degradation capacity exceeding 1300 mg g^{-1}, surpassing most conventional LDH-derived photocatalysts. The photocatalytic mechanism is attributed to a synergistic interplay between structural oxygen vacancies, multivalent metal centers, and efficient surface adsorption, which collectively accelerated the degradation kinetics [4]. Despite limited visible-light absorption, the material demonstrated excellent stability and reusability across several photocatalytic cycles as shown in Figure 1c, indicating strong structural resilience and durability. Further investigations revealed super oxide radical as the most reactive oxygen specie (ROS) in degrading MO dye as depicted in Figure 1d, owing to the supressed degradation of MO in the presence of ethanol as a hydroxyl radical •OH scavenging agent.

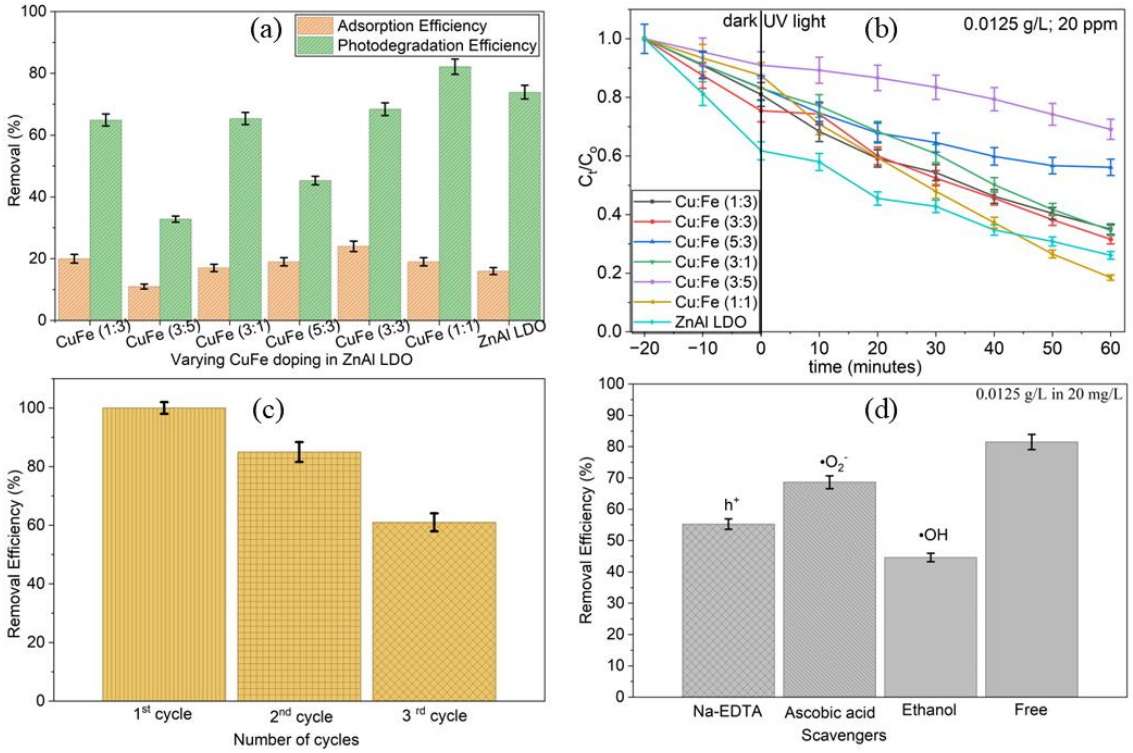

Figure 1. Adsorption and photodegradation removal efficiencies (a), degradation pathway (b), recyclability and scavenging test (d) of synthesized photocatalyst.

In conclusion, this work introduces a mildly doped, multi-cationic LDO system that achieves outstanding UV-light-driven photocatalytic performance through electronic structure modulation rather than extensive bandgap engineering. The findings provide new insights into designing low-cost, tunable LDO photocatalysts for the efficient removal of organic pollutants from wastewater, bridging the gap between traditional LDHs and next-generation oxide-based photocatalysts.

References

1 M.M. Rao, B.R. Reddy, M. Jayalakshmi, V.S. Jaya, and B. Sridhar, Hydrothermal synthesis of Mg-Al hydrotalcites by urea hydrolysis, *Materials Research Bulletin*, Vol. 40, no. 2, pp. 347–359, Feb. 2005, doi: 10.1016/j.materresbull.2004.10.007.

2 C. B. Anucha, I. Altin, E. Bacaksiz, V.N. Stathopoulos, Titanium dioxide (TiO_2)-based photocatalyst materials activity enhancement for contaminants of emerging concern (CECs) degradation: In the light of modification strategies, *Chemical Engineering Journal Advances*, Vol. 10, p. 100262, May 2022, doi: 10.1016/j.ceja.2022.100262.

3 H. Alyasi et al. Reactive oxygen species-mediated UV photocatalytic removal of cyclophosphamide by Fe3O4/Ti3C2Tx, *Chemical Engineering Journal Advances*, Vol. 24, p. 100913, Nov. 2025, doi: 10.1016/j.ceja.2025.100913.

4 I. Groeneveld, M. Kanelli, F. Ariese, and M. R. van Bommel, Parameters that affect the photodegradation of dyes and pigments in solution and on substrate – An overview, *Dyes and Pigments*, Vol. 210, p. 110999, Feb. 2023, doi: 10.1016/j.dyepig.2022.110999.

BACTERIOPHAGE-ENCAPSULATED ALGINATE MICROSPHERES AS A CONTROLLED DELIVERY SYSTEM

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ABSTRACT

In recent years, antibiotic resistance has become a critical public health concern, significantly complicating the management of bacterial infections. In particular, the rising incidence of infected skin wounds, especially those unresponsive to conventional antibiotic treatments, presents a major obstacle in clinical practice. Bacteriophages, as cost-effective and highly specific antibacterial agents, have been increasingly utilized as an alternative therapy to address the growing threat posed by antibiotic-resistant bacteria. While bacteriophages show considerable promise in addressing such infections, their clinical application is limited by the lack of effective delivery systems capable of targeting infected wound tissues. One promising strategy to overcome this limitation is the use of encapsulation systems that enable the topical delivery of bacteriophages [1]. Microspheres can facilitate the localized transport of phages to infected tissues, thereby enhancing their antibacterial efficacy. In addition, they provide protective barrier properties and, support tissue regeneration. These features make microspheres a versatile and effective platform for advancing the treatment of wound infections [2].

To achieve controlled and sustained phage release while preserving bioavailability, novel carrier systems are necessary [2,3]. This study aimed to develop an alginate microsphere system with sizes ≤ 100 µm, encapsulating bacteriophage EAS1, which specifically targets *Staphylococcus aureus*, for topical antibacterial therapy in wound healing. The phages were encapsulated within polysaccharide-based alginate microspheres via ionic gelation to enhance phage stability and enable controlled release. The size and morphology of the microspheres were characterized using optical microscopy and scanning electron microscopy (SEM). Additionally, in vitro release studies assessed phage diffusion kinetics. The microsphere system exhibited significantly slower and more sustained phage release. In conclusion, the proposed approach offers a promising platform technology for the encapsulation of biologically active bacteriophages, potentially facilitating the integration of phage therapy into clinical wound care applications.

References

1. S.T. Abedon, Bacteriophage therapy: A reappraisal of bacteriophage treatment in the antibiotic era, Adv. Appl. Microbiol., Vol. 78, pp. 1–45, 2012.
2. S. H. Kim et al. Development of phage-loaded hydrogels for the treatment of bacterial infections, J. Control. Release, Vol. 280, pp. 108–116, 2018.
3. X.L. Li, J.D. Li, Y.Z. Zhu, Alginate microspheres in drug delivery applications: A review, RSC Adv., Vol. 4, no. 34, pp. 17372–17380, 2014. [Data inferred from DOI: 10.1039/C4RA00788C]

SYNERGISTIC PHOTODEGRADATION OF TETRACYCLINE AND DIRECT RED 81 USING ZNAL LAYERED DOUBLE OXIDE: A STEP TOWARD REALISTIC WASTEWATER REMEDIATION

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ABSTRACT

This study investigates the simultaneous photodegradation of tetracycline and Direct Red 81 using ZnAl layered double oxide (LDO) as a cost-effective photocatalyst under UV irradiation. The results reveal a synergistic degradation mechanism, highlighting ZnAl LDO's potential for treating complex, co-existing pharmaceutical-dye pollutants in realistic wastewater systems.

Keywords: ZnAl LDO, Photocatalysis, Tetracycline, Direct Red 81, Co-degradation, Advanced oxidation

Introduction. The simultaneous presence of pharmaceutical and dye pollutants in industrial and municipal effluents poses a significant environmental challenge, with detrimental effects on aquatic ecosystems and human health. This co-occurrence arises from common contamination sources such as industrial, domestic, and hospital wastewater [1]. Notably, dye molecules retain crucial functions in clinical treatments, molecular diagnostics, pharmacokinetics, and high-throughput screenings, amplifying the potential toxicity of combined chemical mixtures [2]. Tetracycline (TC), a widely used broad-spectrum antibiotic, and Direct Red 81 (DR), a prevalent azo dye in textile manufacturing, are among the most persistent contaminants due to their chemical stability, strong chromophoric structures, and low biodegradability, resulting in their persistence in aquatic environments [3].Traditional treatment methods often inadequately address the simultaneous removal of these recalcitrant pollutants [4].

Semiconductor-based photocatalysis has emerged as a sustainable and effective approach for mineralizing complex organic pollutants under mild conditions. Layered Double Oxides (LDOs), obtained by controlled thermal activation of Layered Double Hydroxides (LDHs), offer enhanced catalytic performance through high surface area, abundant oxygen vacancies, and tunable metal cation composition [1]. In particular, ZnAl LDO demonstrates excellent structural stability and efficient electron–hole separation, making it a promising catalyst for photocatalytic degradation [5].

This study investigates the synergistic decontamination of tetracycline and Direct Red 81 using ZnAl LDO, simulating complex real-world wastewater scenarios. By focusing on the integrated removal of a

pharmaceutical and an azo dye, this work addresses a critical gap in pollutant co-treatment. The combined effects of adsorption and photocatalytic oxidation are systematically analyzed to elucidate pollutant interactions and catalyst selectivity, advancing the understanding of synergistic strategies in wastewater remediation.

Methodology. ZnAl LDH precursor was synthesized via urea hydrothermal route, maintaining a Zn/Al molar ratio of 3:1, followed by calcination at 550 °C to obtain ZnAl LDO [6]. Photocatalytic experiments were conducted under UV irradiation in a batch reactor containing aqueous solutions of TC and DR81 (both 10 mg L^{-1}). Single pollutant and mixed pollutant experiments where conducted for the adsorption and photodeagradation study. Both adsorption and degradation efficiencies where monitored by UV–Vis spectroscopy at λ_{max} = 357 nm (TC) and λ_{max} = 508 nm (DR81).

Results and discussions. Characterization techniques revealed that the ZnAl LDO exhibited a high surface area and a well-retained mixed oxide structure favorable for active site generation. The UV–Vis absorption edge confirmed strong light response in the UV region, correlating with its band gap energy of 3.1 eV, while the PL analysis shows reduced peaks depicting proper seperation of photogenerated charge carriers.

Figure 1 depicts the preliminary test carried out for the degradation of DR81 and tetracycline, the results shows that the photocatalyst achieved 74 and 72% degradation of DR81 and tetracycline respectively, within 30 min of UV light irradiation in a single pollutant system, with an average adsorption of 14% removal. An improved degradation efficiency of 90 and 83 % removal was observed in the mixed pollutant system, with increased adsorption of about 40% removal. The combined system of DR81 and tetracycline demonstrated competitive yet synergistic degradation behavior. The presence of DR81 enhanced TC degradation due to increased surface photoactivation, suggesting interspecies charge mediation [7]. Kinetic modeling followed pseudo-first-order behavior with k_1 values of 0.041 min^{-1} (DR81) and 0.039 min^{-1} (TC) for the single pollutant system, which was increased to 0.054 min^{-1} and 0.047 min^{-1} in the mixed pollutant system respectively.

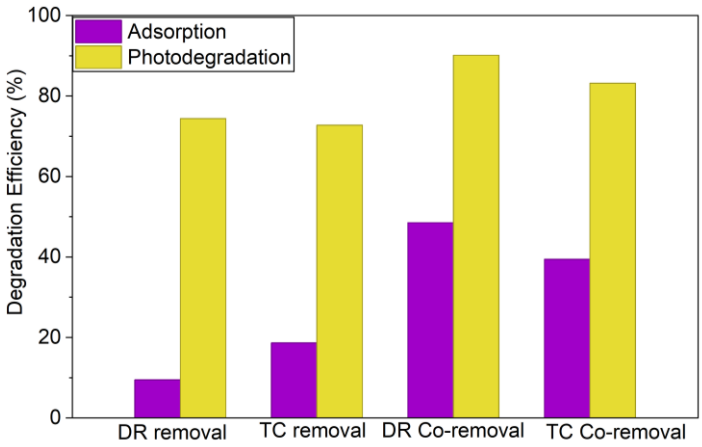

Figure 1. Degradation efficiencies of DR81 and TC using 0.01 g/L of ZnAl LDO in a single and combined system.

This study is the first to report on the use of ZnAl LDO for the co-degradation of tetracycline and Direct Red 81, offering crucial insights into pollutant interactions during photocatalysis. It advances understanding from single-pollutant systems toward realistic wastewater conditions. Moreover, it confirms ZnAl LDO as a cost-effective, non-toxic catalyst suitable for integrated treatment of pharmaceutical and dye-contaminated effluents, supporting sustainable wastewater management.

Conclusions. ZnAl LDO demonstrated remarkable potential as a multifunctional photocatalyst for the simultaneous degradation of tetracycline and Direct Red 81 under UV irradiation. The synergy between the two pollutants enhanced photocatalytic efficiency, with the photocatalyst showing excellent structural resilience. These findings underscore the relevance of LDO-based photocatalysts in developing next-generation materials for comprehensive wastewater remediation, aligning with global goals for sustainable water management.

References

1 M.E. Mahmoud et al. Recent progress in water decontamination from dyes, pharmaceuticals, and other miscellaneous nonmetallic pollutants by layered double hydroxide materials, *Journal of Water Process Engineering*, Vol. 57, p. 104625, Jan. 2024, doi: 10.1016/j.jwpe.2023.104625.

2 M.A. Manavi, M. Salehi, R. Mohammad Jafari, A.R. Dehpour, From dyes to drugs: The historical impact and future potential of dyes in drug discovery, *Arch Pharm (Weinheim)*, Vol. 357, no. 11, p. e2400532, Nov. 2024, doi: 10.1002/ardp.202400532.

3 U.N. Environment, Environmentally Persistent Pharmaceutical Pollutants (EPPPs) | UNEP – UN Environment Programme. Accessed: Nov. 04, 2025. [Online]. Available: https://www.unep.org/topics/chemicals-and-pollution-action/chemicals-management/pollution-and-health/environmentally

4 D. Park et al. Removal of selected contaminants of dyes and pharmaceuticals using MXene-based nanoadsorbents: A review, *Separation and Purification Technology*, Vol. 341, p. 126864, Aug. 2024, doi: 10.1016/j.seppur.2024.126864.

5 Rohmatullaili et al. ZnAl LDH-based Derivative Materials as Photocatalysts: Synthesis, Characterization, and Catalytic Performance in Tetracycline Degradation, *Science and Technology Indonesia*, Vol. 9, no. 2, Art. no. 2, Apr. 2024, doi: 10.26554/sti.2024.9.2.457-469.

6 M.M. Rao, B.R. Reddy, M. Jayalakshmi, V.S. Jaya, and B. Sridhar, Hydrothermal synthesis of Mg-Al hydrotalcites by urea hydrolysis, *Materials Research Bulletin*, Vol. 40, no. 2, pp. 347–359, Feb. 2005, doi: 10.1016/j.materresbull.2004.10.007.

7 Y. Zhou, H. Li, P. Guo, Y. Zhang, P. Zhou, Simultaneous enhancement of charge transfer and surface catalysis through a polymetallic oxide cocatalyst on BiVO4 photoanodes for highly efficient and stable water oxidation, *Chemical Engineering Journal*, Vol. 489, p. 151220, June 2024, doi: 10.1016/j.cej.2024.151220.

A DUAL-ACTION BIOCERAMIC WITH OSTEOGENIC, ANTIBACTERIAL, AND ANTICANCER POTENTIALS

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ABSTRACT

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NANOPROTAC PLATFORMS FOR TARGETED PROTEIN DEGRADATION: TOWARD EFFICIENT INTRACELLULAR DELIVERY

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ABSTRACT

Targeted protein degradation using Proteolysis Targeting Chimeras (PROTACs) has garnered significant interest in precision medicine by selectively eliminating disease-causing proteins through the recruitment of intracellular E3 ubiquitin ligases [1]. This catalytic approach overcomes the limitations of traditional small-molecule inhibitors that merely block protein function. Despite this potential, the clinical translation of many promising PROTAC candidates is frequently hampered by inherent physicochemical limitations, including high molecular weight, poor membrane permeability, and suboptimal pharmacokinetic properties [2].

Nanodrug delivery technologies represent a promising frontier to overcome these challenges. This work explores the emerging paradigm of "NanoPROTACs", the strategic integration of nanotechnology with targeted protein degradation. It examines how encapsulating, conjugating, or integrating PROTACs into functionalized nanocarriers can substantially enhance solubility and biostability. Furthermore, mechanisms by which these systems effectively alleviate the dose-limiting “hook effect” often associated with bivalent degraders and minimize off-target toxicity through controlled release profiles are discussed [3].

Innovative design strategies for current nano-PROTAC delivery systems are highlighted, ranging from physical encapsulation and precise chemical conjugation to emerging carrier-free self-assembly systems and intelligent “split-and-mix” platforms. The focus extends to the synergistic therapeutic potential of diverse carriers including lipid-based, polymeric, inorganic, and hybrid nanoparticles specifically addressing engineering approaches for efficient endosomal escape and stimuli-responsive designs that release cargo selectively within pathological microenvironments [4,5].

References

1. Refer K. Berkley, J. Zalejski, N. Sharma, A. Sharma. Journey of PROTAC: From bench to clinical trial and beyond, *Biochemistry*, Vol. 64, no. 3, pp. 563–580, Jan. 2025, doi: 10.1021/acs.biochem.4c00577.
2. K. Li, C.M. Crews. PROTACs: past, present and future, *Chemical Society Reviews*, Vol. 51, no. 12, pp. 5214–5236, Jan. 2022, doi: 10.1039/d2cs00193d.
3. N. Zhang et al. Nano Proteolysis Targeting Chimeras (PROTACs) with Anti-Hook Effect for Tumor Therapy, *Angewandte Chemie International Edition*, Vol. 62, no. 37, p. e202308049, Jul. 2023, doi: 10.1002/anie.202308049.
4. X. Wu et al. Recent advances in Nanomedicine: Cutting-Edge research on Nano-PROTAC delivery systems for cancer therapy, *Pharmaceutics*, Vol. 17, no. 8, p. 1037, Aug. 2025, doi: 10.3390/pharmaceutics17081037.
5. A.G. Baker, A.P. T. Ho, L.S. Itzhaki, L. Fruk, Nanoparticle-Mediated Targeted Protein Degradation: an emerging therapeutics technology, *Angewandte Chemie International Edition*, Vol. 64, no. 28, p. e202503958, May 2025, doi: 10.1002/anie.202503958.

AMYLOPECTIN XEROGEL WITH ONION CARBON DOTS AS A CHEMOSENSOR FOR CHROMIUM AND BIOSENSOR FOR MICROBIAL SPOILAGE IN TOMATOES

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ABSTRACT

This study presents the development of a multifunctional, biodegradable xerogel film based on amylopectin and poly(N-isopropylacrylamide) (poly(NIPAm)) incorporating sulfur and nitrogen-doped carbon quantum dots (S, N–CQDs) derived from red onion peels (ROP). The formation mechanism and stability of the composite film were investigated using DFT calculations, revealing enhanced interactions and stability in the S, N–CQDs-containing film (amylopectin-S, N–CQDs15). FTIR and SEM analyses confirmed the successful incorporation of S, N–CQDs and revealed a tighter pore structure in the composite film, leading to increased surface area. The amylopectin-S, N–CQDs15 film exhibited significantly improved antibacterial activity, with inhibition rates of 95.25% against Escherichia coli, 99.12% against Staphylococcus aureus, and 99.23% against Candida albicans. These findings were supported by molecular docking studies indicating strong binding affinities. Furthermore, the film demonstrated its potential as a smart sensor through distinct fluorescence responses to these microorganisms: it showed mixed green and red fluorescence with E. coli, blue dots with S. aureus, and a change from large red regions to numerous green dots with C. albicans. The film also exhibited a fluorescence shift from red to blue upon exposure to Cr(VI). Notably, the film displayed pH-responsive color transitions relevant to monitoring tomato spoilage. These findings highlight the potential of this bio-based composite film, prepared from a waste resource, as a sustainable and effective solution for active food packaging, offering antimicrobial properties and detection of spoilage and contamination.

Keywords: Amylopectin, Poly(N-isopropylacrylamide), Flavonoids, Colored chemosensor, Biosensor, pHsensing, Food packaging.

References

1. Hebat-Allah S. Tohamy. (2025). Amylopectin xerogel with onion based sulfur nitrogen doped carbon quantum dots as a chemosensor for chromium and biosensor for microbial spoilage in tomatoes. Sci Rep 15, 32667. https://doi.org/10.1038/s41598-025-19875-x

ANTIMICOTIC EFFECT OF GRAPHENE OXIDE ADITION ON THE HYDROGEL MATERIALS

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ABSTRACT

The study investigated procesing methods to improve the mechanical strength, and antibacterial properties of polymeric hydrogels, materials used in applications like medicine and wastewater treatment. Polymeric hydrogels are a large and complex class of materials used in medicine, electronics, and wastewater treatment. They consist of 3D polymeric network insoluble in water, with high water-absorbing properties doe to the large amount of functional groups linked to the polymeric chain. However, their primary drawback is its low mechanical stability in the hydratase state and in (acids or bases) harsh environments [1].

The study explored two manufacturing methods: freeze-thaw cycling and crosslinking via gamma irradiation. Graphene oxide was added during preparation to specifically enhance the hydrogels' mechanical strength and antibacterial properties. The graphene oxide was prepared by modified Hummer method [2], and was introduced in order to improve mechanical and antibacterial properties of synthetized hydrogels [1,3,4]..

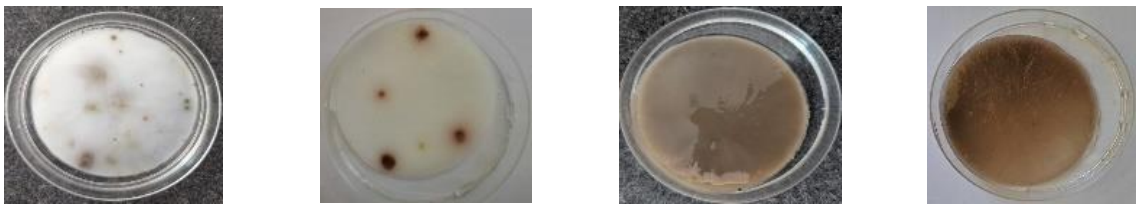

Figure 1. From left to right, are presented Petri dish with molds infested hydrogels: first obtained by freeze-thaw method and second obtained by mixt freeze-thaw and gamma irradiated method hydrogels; respectively hydrogels with graphene oxide.

Acknowledgments: This research was supported by the projects PN 231402100/42N-2023.

References

1. I. Ion, E. Stancu, C.M. Mitu, V. Marinescu, E. Lungulescu, *N.O. Nicula, Chem. Proc.*7,1(2022) 22.
2. G. Mogildea, I. Ion, O. Sandu et al. *OAM-RC* 5(2011) 973.
3. M. Popa, L. Măruţescu, I. Ion et al. Book: Fullerens, Graphenes and Nanotubes 1(2018)585.
4. Ion Ioana, Mitu Ciprian, Marinescu Virgil et al. *Romanian Journal of Materials 2025*, 55 (3), 291–300 291.

IN-SILICO AND *IN-VITRO* STUDY OF SYNTHESIZED IMIDAZOLE-HALO CHALCONES

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ABSTRACT

Chalcones are part of flavonoid family and act as precursor of diverse heterocyclic compounds. Due to the presence of α,β-unsaturated group, chalcones and its analogs possess a broad range of biological activities. Chalcone derivatives were synthesized using aromatic acetophenone and halogen substituted benzaldehydes using condensation method. Synthesized derivatives were characterized and tested for various biological activities. MTT assay reveals that synthesized derivatives were found to be effective on MCF-7 and HCT-116 cell lines and exhibit excellent cytotoxicity. Results of antimicrobial activity shows that the synthesized derivatives were effective on Gram positive S. aureus and not on Gram negative E.coli, while the synthesized imidazole-halo chalcones were effective on A. niger at 50µM concentration. All the synthesized analogs show very less antioxidant activity as compared to standard ascorbic acid. In silico studies reveals that the synthesized imidazole-halo chalcones has the potential to act as anticancer drugs.

Keywords: Chalcone, cell line, MTT assay, in silico, biological activity etc.

BIOACTIVE ZNO COMPOSITE SCAFFOLD FOR TISSUE REGENERATION

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ABSTRACT

This study explores the combined effect of zinc oxide nanoparticles (ZnO) and human albumin (HA) on the physicochemical parameters, cytocompatibility and antibacterial activity of demineralized bone matrix (DBM). The objective was to develop a multifunctional DBM-based composite combining structural reinforcement, cytocompatibility and antimicrobial protection for bone tissue regeneration using a rough vacuum pressure [1, 2]. DBM composites were loaded under rough vacuum pressure with aqueous solutions of 1, 5, and 10 mg/ml ZnO in the first step [1, 3]. After freeze-drying, the obtained samples were secondarily loaded with 10% and 20% HA [1]. The elastic modulus was determined by mechanical testing, enzymatic degradation was assessed in collagenase solution, and swelling capacity was expressed as a percentage of mass uptake. Cytocompatibility was evaluated using the MTT assay on bone marrow mesenchymal stem cells (BM-MSCs), and antibacterial properties were tested against *S. aureus*, *E. faecalis*, *K. pneumoniae*, *E. coli* and *P. aeruginosa*.

Loading DBM with ZnO increased its elastic modulus in a concentration-dependent manner, reaching maximal stiffness in the 10 mg/ml ZnO+dH_2O group, indicating enhanced crosslinking and matrix rigidity. Enzymatic degradation decreased progressively with higher ZnO content, reflecting improved collagenase resistance, while HA-modified samples displayed a moderate degradation rate, preserving bioresorbability. The swelling ratio peaked at 5 mg/ml ZnO, whereas the addition of HA reduced swelling, producing a denser and more stable matrix. Cytocompatibility assays revealed that high ZnO levels diminished cell viability; however, HA addition (10-20%) significantly restored metabolic activity, achieving values close to control DBM. The combination of 1 mg/ml ZnO+20% HA showed the most favorable cell response, demonstrating that albumin mitigates ZnO-induced oxidative stress. Antibacterial testing confirmed a strong antimicrobial effect of ZnO-containing composites. All ZnO groups completely inhibited *E. coli* and *S. aureus* growth at 24–48 h. *E. faecalis* showed pronounced bactericidal zones (25-30 mm) at 48 h in the 10 mg/ml ZnO+HA formulations. *K. pneumoniae* displayed minimal sensitivity (2-3 mm), while *P. aeruginosa* remained resistant.

The sequential dual loading of DBM scaffolds under vacuum with ZnO nanoparticles and HA enables tunable optimization of their physicochemical and biological properties. ZnO enhances stiffness, enzymatic

resistance and antibacterial activity, while HA restores flexibility, hydrophilicity and cytocompatibility. The 1 mg/ml ZnO+20%HA formulation achieved the most balanced performance, combining mechanical reinforcement, controlled degradation, strong antimicrobial activity and high cell viability.

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References

1. Cobzac V., Jian M., Baranețchi I., Marițoi T., Malcova T., Ficai D., Ficai A., Nacu V. Controlled release of bioactive agents from demineralized bone using sequential double vacuum loading. IFMBE Proceedings. 2025; 135:423–432. DOI: https://doi.org/10.1007/978-3-032-06497-4_42
2. Petrisor G., Ficai D., Motelica L., Trusca RD., Bîrcă AC., Vasile BS., Voicu G., Oprea OC., Semenescu A., Ficai A. et al. Mesoporous Silica Materials Loaded with Gallic Acid with Antimicrobial Potential. Nanomaterials. 2022; 12(10):1648. DOI: https://doi.org/10.3390/nano12101648
3. Braniste T., Cobzac V., Ababii P., Pleșco I., Raevschi S., Didencu A., Maniuc M., Nacu V., Ababii I., Tiginyanu I. The influence of semiconductor nanoparticles upon the activity of mesenchymal stem cells. IFMBE Proceedings. 2019; 77:607–611. DOI: https://doi.org/10.1007/978-3-030-31866-6_108

FABRICATION AND CHARACTERIZATION OF MAGNETIC FIELD ASSISTED 3D PRINTED FERROMAGNETIC NANOPARTICLE LOADED SCAFFOLDS FOR TISSUE ENGINEERING

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ABSTRACT

In this study, biodegradable methacrylated silk fibroin (SilkMA) scaffolds were developed, fabricated, and comprehensively characterized to evaluate their potential for tissue engineering applications. Silk fibroin was chemically modified with methacrylate groups to obtain a photocurable biomaterial suitable for stereolithographic fabrication. To introduce magnetic responsiveness and enable controlled internal alignment, iron oxide (Fe_3O_4) nanoparticles were homogeneously dispersed within SilkMA hydrogels. This approach aimed to guide polymer chain orientation and create anisotropic architectures that can mimic the hierarchical structure of native tissues. A custom-designed three-axis Helmholtz coil system was engineered and integrated into a 3D stereolithography (SLA) printer, generating a uniform 10 mT magnetic field during the printing process. The synchronized application of light polymerization and magnetic alignment enabled precise control over microstructural organization throughout the scaffold. Comprehensive physicochemical and biological analyses demonstrated that the printed SilkMA scaffolds possessed favorable rheological and electrical conductivity profiles, indicating their suitability for biomedical applications. Fibroblast cells cultured on magnetically oriented scaffolds exhibited more than 90% viability after 1, 3, and 7 days, confirming excellent cytocompatibility and the absence of cytotoxic effects. Scanning electron microscopy (SEM) and DAPI staining revealed enhanced cell adhesion and proliferation on the aligned structures, while atomic force microscopy (AFM) verified the anisotropic microstructural orientation. Mechanical compression, swelling, and degradation tests further showed that the scaffolds displayed high elasticity, stability, and a controlled degradation profile over 14 days. Collectively, these results demonstrate that magnetically assisted 3D printing provides an effective strategy for fabricating anisotropic, biocompatible SilkMA-based scaffolds with tunable mechanical and structural properties.

Acknowledgements: This study was supported by Marmara University, Scientific Research Projects Coordination Unit (BAPKO), under project number FYL-2022-10578.

References

1. Afshari, Pantea et al. Mechanical strain tailoring via magnetic field assisted 3D printing of iron particles embedded polymer nanocomposites. Macromolecular Materials and Engineering 308.11 (2023): 2300194.
2. Antman-Passig, Merav, Orit Shefi. Remote magnetic orientation of 3D collagen hydrogels for directed neuronal regeneration. Nano letters 16.4 (2016): 2567–2573.
3. Shiue, Sheng-Jie et al. Application of Helmholtz Coils and Superparamagnetic Nanocarrier in Localized Inhibition of Cancer Cell Migration and Invasion. Surfaces and Interfaces (2025): 106942.

3D PRINTED BONE SCAFFOLDS WITH COMPLEX ARCHITECTURES

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ABSTRACT

Traditional clinical treatments for bone healing challenges conditions like osteoporosis or complex fractures are often restricted by limitations associated with allografts and autografts, such as donor site morbidity and immune rejection.

Development of scaffolds for bone tissue regeneration has been investigated using both natural and synthetic polymers. Collagen is an extensively used material due to its biocompatibility, bodily presence, and resemblance to the natural extracellular matrix. Additionally, GelMA, a methacrylated gelatin form, can be employed to create 3D networks that stimulate cell proliferation in different combinations with other natural or synthetic polymers.

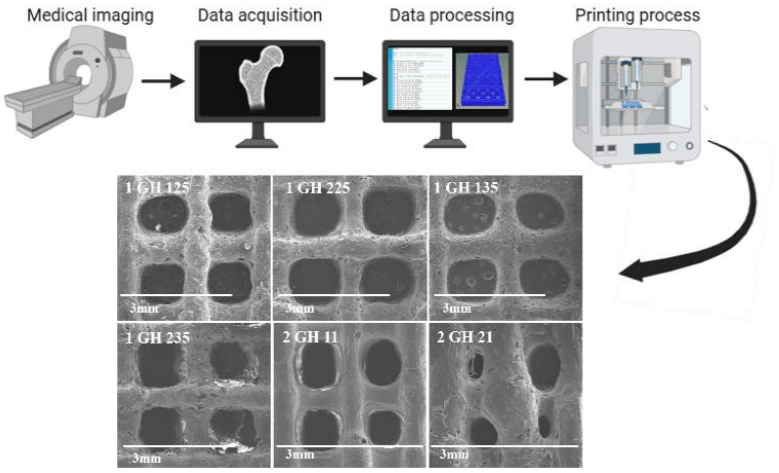

Figure 1: Steps for scaffolds 3D printing and their structure as SEM microscopy images.

The current study investigated the activity of new composite scaffolds for bone tissue engineering. In this regard, were obtained 3D printed scaffolds with biomimetic properties to provide structural support and facilitate cell proliferation [1–3]. The 3D composite architectures were based on a mixture of gelatin, sodium alginate and nanohydroxyapatite (nHA). Scaffolds were obtained through an extrusion printing method using a Cellink Inkredible 3D bio-printer.

The scaffolds' advantageous morphological, mechanical, and biological properties for bone tissue engineering applications were demonstrated by the results of *in vitro* evaluations. Initially, material stability was found to be highly dependent on the printing conditions; materials printed at 35°C maintained their structural integrity during swelling tests, whereas those printed at 25°C, underscoring the necessity of optimizing printing parameters.

The obtained porous architectures enable osteoblasts to migrate and proliferate, while compression testing revealed that scaffolds with higher nHA content exhibited superior mechanical strength. The materials' successful integration with the biological milieu is further demonstrated by the cytocompatibility testing. The results suggested that the composite scaffolds that were obtained are prommising for bone tissue regeneration applications, and indicate a good potential in the development of innovative therapies in regenerative medicine.

References

1. S. Kashte et al. Tissue Eng Regen Med, 14(1):1–14, 2017.
2. A. Farazin et. al. Biomed.Eng.Adv, 5:100075, 2023.
3. R.C. Weinschenk, et al. J. Orthopaedic Res. 42(12):2735–2742, 2024.

3D (BIO)PRINTING OF POLYMERIC SCAFFOLDS FOR SOFT TISSUE REGENERATION

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ABSTRACT

Regeneration and reconstruction of damaged tissues and organs remains an interesting subjects in the medical field, particularly in the context of dysfunctions caused by a variety of injuries, pathological conditions, or degenerative diseases. Tissue engineering is an interdisciplinary field that involves the development of three-dimensional structures, through different methods, with biomimetic properties using scaffolds based on polymeric biomaterials, cells, and signaling molecules to aid in the regeneration of damaged tissue or organs[1].

Among the various fabrication methods, extrusion-based 3D (bio)printing has emerged as a versatile and cost-effective technique for producing biomimetic scaffolds with controlled architecture [1]. Within the medical field, 3D (bio)printing uses biocompatible (bio)inks specifically formulated to address the requirements of individual applications [2]. This approach enables the fabrication of scaffolds that accurately replicate the morphology and structure of native tissue [3, 4].

This study presents the development and characterization of 3D printed scaffolds composed of natural polymers, gelatin, and xanthan gum, and their methacrylated derivatives (GelMA and XGMA), for soft tissue engineering. After the printing process, scaffolds were freeze-dryed, and subsequently exposed to extended visibile light to induce additional crosslinking chains to enhance the mechanical properties. The properties were evaluated through different *in vitro* analyses, for their morphology, physico-chemical characteristics, retention capacity of simulated biological fluid, enzymatic degradation, bioadhesivity, and cytocompatibility.

The investigations results revealed the acquisition of 3D printed networks with a porous structure based on gelatin-and xanthan gum, including their methacrylated forms, biodegradable, and biocompatible scaffolds with appropriate properties for soft tissue applications. Prolonged visible-light treatment increased mechanical stability without compromising biological compatibility. The printed scaffolds present arhitectures that facilitate nutrient flow and cellular growth, being cytocompatible to biologic media, a characteristic that endorses their usage as scaffolds in regenerative medicine for the regeneration of injured epithelial tissue.

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References

1. Krsek, A. et al. Medicina, 60 (2024). https://doi.org/10.3390/medicina60091384.
2. Zhang, J. et al. Bioprinting 19 (2020). https://doi.org/10.1016/j.bprint.2020.e00089.
3. Gogoi, D. et al. Ann. 3D Printed Med. 15 (2024). https://doi.org/10.1016/j.stlm.2024.100159.
4. Iervolino, F. et al. Bioprinting 31 (2023). https://doi.org/10.1016/j.bprint.2023. e00269.

BACTERIOPHAGE-ENCAPSULATED ALGINATE MICRO-SPHERES AS A CONTROLLED DELIVERY SYSTEM

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ABSTRACT

In recent years, antibiotic resistance has become a critical public health concern, significantly complicating the management of bacterial infections. In particular, the rising incidence of infected skin wounds, especially those unresponsive to conventional antibiotic treatments, presents a major obstacle in clinical practice. Bacteriophages, as cost-effective and highly specific antibacterial agents, have been increasingly utilized as an alternative therapy to address the growing threat posed by antibiotic-resistant bacteria. While bacteriophages show considerable promise in addressing such infections, their clinical application is limited by the lack of effective delivery systems capable of targeting infected wound tissues. One promising strategy to overcome this limitation is the use of encapsulation systems that enable the topical delivery of bacteriophages [1]. Microspheres can facilitate the localized transport of phages to infected tissues, thereby enhancing their antibacterial efficacy. In addition, they provide protective barrier properties and, support tissue regeneration. These features make microspheres a versatile and effective platform for advancing the treatment of wound infections [2].

To achieve controlled and sustained phage release while preserving bioavailability, novel carrier systems are necessary [2,3]. This study aimed to develop an alginate microsphere system with sizes ≤ 100 µm, encapsulating bacteriophage EAS1, which specifically targets Staphylococcus aureus, for topical antibacterial therapy in wound healing. The phages were encapsulated within polysaccharide-based alginate microspheres via ionic gelation to enhance phage stability and enable controlled release. The size and morphology of the microspheres were characterized using optical microscopy and scanning electron microscopy (SEM). Additionally, in vitro release studies assessed phage diffusion kinetics. The microsphere system exhibited significantly slower and more sustained phage release. In conclusion, the proposed approach offers a promising platform technology for the encapsulation of biologically active bacteriophages, potentially facilitating the integration of phage therapy into clinical wound care applications.

References

1. S.T. Abedon, Bacteriophage therapy: A reappraisal of bacteriophage treatment in the antibiotic era, Adv. Appl. Microbiol., Vol. 78, pp. 145, 2012.
2. S.H. Kim et al. Development of phage-loaded hydrogels for the treatment of bacterial infections, J. Control. Release, Vol. 280, pp. 10816, 2018.
3. X.L. Li, J.D. Li, Y.Z. Zhu, Alginate microspheres in drug delivery applications: A review, RSC Adv., Vol. 4, no. 34, pp. 17372-17380, 2014. [Data inferred from DOI: 10.1039/C4RA00788C]

APPLICATION OF HOLLOW MESOPOROUS HYDROXYAPATITE NANOPARTICLES IN DENTAL TISSUE ENGINEERING AND PERSPECTIVES OF DEVELOPMENT

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ABSTRACT

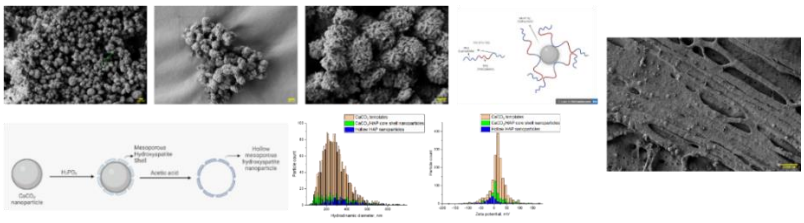

Figure 1. Graphical abstract.

According to the World Health Organization, dental diseases affect almost half (45%) [1] of the population worldwide, which implies the necessity of the development of novel effective and affordable treatment methods, especially for the restoration of the oral cavity after severe diseases which caused loss of the tissues. Due to the complex architecture of the oral cavity, guided tissue engineering methods are applied for the treatment, such as using barrier membranes which exclude growth of epithelial tissues into bone defect sites. Properties of barriers membranes would affect the quality of treatment significantly. Hereby we report on application of hollow mesoporous hydroxyapatite particles (m-hap) synthesized by ion-exchange method [2] for enhancing biocompatibility, bone adhesion and mechanical properties.

Morphology of m-hap is studied using SEM. DLS analysis shows size distribution of particles to be in a range of 320 ±30 nm and to be polydisperse with tendency to agglomerate. Chemical structure was evaluated using FTIR spectroscopy. Cytotoxicity tests established high biocompatibility with RAW 264.7 and L929 cell lines. Change of morphology of PLA gel-based membranes is indicated implying change of the crystallinity of a gel after addition of particles, presumably, due to hydrophilic and hydrophobic interactions of particles with gel. *In-vivo* tests are being currently performed. Possible directions of the development of this technology are being discussed.

References

1. *The Global Status Report on Oral Health 2022*. Who.int. https://www.who.int/team/noncommunicable-diseases/global-status-report-on-oral-health-2022? (accessed 2025-11-07).
2. C.-W. Wu, K., Yang, Y.-H., Liang, Y.-H., Chen, H.-Y., Sung, E., Yamauchi, Y., Lin, F.-H. Facile Synthesis of Hollow Mesoporous Hydroxyapatite Nanoparticles for Intracellular Bio-Imaging. *Current Nanoscience* 2011, 7 (6), 926–931. https://doi.org/10.2174/157341311798220763.

SENNA SIAMEA LEAF-DERIVED EXTRACT AS A SUSTAINABLE ANTIMICROBIAL AGENT IN THE FOOD INDUSTRY

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ABSTRACT

The search for natural alternatives to synthetic preservatives in the food industry has prompted studies on plant-derived extract antimicrobial agents. *Cassia* (now *Senna*) comes from Greek significance spice, while *siamea* originated from *Siam*, now Thailand. This plant is a indigenous of Southeast Asia, belongs to the family *Caesalpiniaceae*. Traditionally, they are used to treat various disorders, and their seeds, pods, and leaves are edible. Some parts of this plant including leaves and flowers are used as vegetables in Thai curry food. There emerge to be limited *in vivo* studies specifically testing *Senna siamea* directly for Shelf-life extension strategies. Published studies focuses on *in vitro* antimicrobial and antioxidant properties of *Senna siamea* leaves extracts, which serve as Key findings supporting its potential as a natural preservative [1,2].

This investigation, hydrodistillation and Soxhlet extraction methods were implemented to collect extracts from shade-dried *Senna siamea* leaves, with methanol used as the solvent for Soxhlet extraction due to its efficiency in isolating bioactive constituents. Phytochemical screening of the methanol extract verified the existence of tannins, flavonoids, alkaloids, cardiac glycosides, and saponins, which corresponded well with the observed antimicrobial activity [2].

This study evaluates the microbial inhibition capacity of methanol extract from *Senna siamea* leaves against common foodborne pathogens gram positive and gram negative bacteria such as *P. aeruginosa*, *S. aureus*, and *E. coli*. The methanol extract was tested using the well diffusion method on Mueller-Hinton Agar. Clear zones of inhibition around wells demonstrated the extract's potential to diffuse and hinder bacterial growth. Results indicated Emphasizes measurable and notable effectiveness, particularly strong against *S. aureus*, followed by *E. coli* and *P. aeruginosa*. These findings highlight *Senna siamea* methanol extract as a emerging plant-derived preservative with potential applications in extending the shelf life of food by preventing microbial contamination and presents an alternative to chemical preservatives, offering the food preservation industry a safer, eco-friendly option [3].

References

1. Alkali, K., Hamza, M.M., Shehu, M.M., Abdulhamid, M.B., Audu, H. (2025). Qualitative and Quantitative Phytochemical Screening of Aqueous, Methanol, and Hexane Leaf Extracts of Senna siamea. Sahel Journal of Life Sciences FUDMA, 3(1): 328-336.
2. Samuel Tamunoiyowuna Cockeye Brown, Usman Ikrimah Mohammed, Eze Emmanuel Onyemaechi, Shinggu Paula Paul Vol. 2, Issue 3, 2025; 474-486 https://ejournal.yasin-alsys.org/AJMSPHR.
3. Sri Fatmawati, Yuliana, Adi Setyo Purnomo, Mohd Fadzelly Abu Bakar Heliyon 6 (2020) e04396 Received 3 November 2019; Received in revised form 20 January 2020; Accepted 1 July 2020.

COPPER SELENIDE-CONTAINING HYDROGEL AS A PROACTIVE THERAPEUTIC AGENT FOR THE TREATMENT OF WOUND INFECTIONS

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ABSTRACT

Impaired wound healing contributes significantly to morbidity and mortality rates globally. The existing treatments have a number of complications. New strategies are required to address these clinical issues, and effective therapy for skin wound healing and scar evasion are crucial. Nanomaterials have drawn a lot of attention because of their particular physicochemical characteristics, which make them practical choices for tissue repair and wound healing. In order to illuminate their possible uses in tissue regeneration and repair, this study explores the dose-responsive effects of copper selenide on fibroblast cells. To thoroughly examine their impact on processes linked to wound healing, fibroblasts were exposed to a range of copper selenide concentrations (from 5 to 100 μg/mL) and the hydrogels with them as well. Our results show that gels and fibroblast behavior are dose-responsive; at lower concentrations (10 & 15 μg/mL), NP loaded gels showed stimulatory effects on fibroblast migration, proliferation, and viability, indicating their potential as regulators of wound healing. Additionally, the critically important process of collagen synthesis – which is crucial for tissue repair—was increased by this concentration. However, at concentrations more than 25 μg/mL, a change was observed as NP started to inhibit cellular functions, especially at high concentrations (50 μg/mL), leading to a reduction in angiogenesis, migration, and cell proliferation. Additionally, the gene expression study highlighted NP's regulatory impact on genes linked to tissue regeneration and repair. At lower concentrations, transforming growth factor (TGF-β) and collagen genes were found to be upregulated, which was associated with better healing responses. At larger levels, however, these genes were downregulated, which may have an impact on fibroblast function. These results highlight the significance of exact NP dosage in therapeutics and offer insightful information for crafting NP-based therapies that support tissue healing.

THE EVOLVING LANDSCAPE OF LIPID-BASED NANOPARTICLES: FROM STRUCTURAL DIVERSITY TO INTELLIGENT THERAPEUTIC PLATFORMS

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ABSTRACT

Lipid-based nanoparticles (LNPs) function as advanced nanomedicine delivery systems that employ biocompatible lipid matrices to encapsulate both hydrophilic and hydrophobic compounds. This review provides a comprehensive assessment of LNPs, encompassing liposomes and their subgroups, including solid lipid nanoparticles (SLNs), nanostructured lipid carriers (NLCs), lipid–polymer hybrids, micelles, and nanoemulsions.

The chemical composition, structural organization, manufacturing processes, and characterization methods of each LNP type are systematically discussed. Formulation parameters – such as lipid type, surfactant selection, and production technique – significantly influence particle size, encapsulation efficiency, and physicochemical stability. Morphological, crystalline, and lipid phase transition analyses rely on advanced techniques including dynamic light scattering (DLS), transmission electron microscopy (TEM), Fourier-transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), and zeta potential measurements.

The review highlights the biomedical relevance of LNPs as carriers for drugs, genetic materials, and bioactive compounds, as well as their emerging roles in vaccine development, cosmetics, and anti-ageing formulations. Finally, critical challenges – namely scale-up reproducibility, oxidation, and *in vivo* degradation – are discussed, and future perspectives on intelligent lipid nanoplatforms and hybrid bioinspired systems are presented to guide the design of safer and more effective targeted therapies.

References

1. Molla, A. (2025). Lipid Nanoparticles in Drug Delivery: Advances, Challenges, and Clinical Prospects. *Journal of Drug Design and Medicinal Chemistry*, 11(3), 48–54. https://doi.org/10.11648/j.jddmc.20251103.12.
2. Anselmo, A.C., Mitragotri, S. (2024). Chemistry and Art of Developing Lipid Nanoparticles for Drug Delivery of Biologics. *Pharmaceutics*, 16(1), 94. https://doi.org/10.3390/pharmaceutics16010094.
3. J. Wang, Y. Ding, K. Chong, M. Cui, Z. Cao, C. Tang, Z. Tian, Y. Hu, Y. Zhao, S. Jiang (2024). Recent Advances in Lipid Nanoparticles and Their Safety Concerns for mRNA Delivery. *Vaccines*, 12(10), 1148. https://doi.org/10.3390/vaccines12101148.
4. Gilleron, J., Querbes, W., Zeigerer, A. et al. (2021). Lipid nanoparticles for mRNA delivery. *Nature Reviews Materials*, 6(8), 1195–1213. https://doi.org/10.1038/s41578-021-00358-0.
5. Qiu, M., Liang, X., Liu, Y. (2021). Lipid Nanoparticles─From Liposomes to mRNA Vaccine Delivery, a Landscape of Research Diversity and Advancement. *ACS Nano*, 15(6), 9099-9115. https://doi.org/10.1021/acsnano.1c04996.

PET DERIVED POLYAMINES FOR FOAMS BASED ON AZA-MICHAEL REACTION

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ABSTRACT

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SYNTHESIS AND CHARACTERIZATION OF HIGHLY REACTIVE MESOPOROUS CATALYTIC SYSTEMS FOR THE ENHANCED UV-A PHOTOCATALYTIC OXIDATION OF AN EMERGENT WATER CONTAMINANT

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ABSTRACT

The synthesis of efficient and stable photocatalysts remains a key research direction for water purification. This study presents the preparation and characterization of mesoporous titanium dioxide (TiO_2) materials obtained through a sol-gel process assisted by a soft-templating approach. The aim was to correlate synthesis conditions, structural evolution, and photocatalytic performance during the degradation of clofibric acid, an emergent water contaminant under UV-A irradiation conditions.

Titanium isopropoxide was used as a precursor in the presence of ethanol or isopropanol and controlled amounts of water. Cetyltrimethylammonium bromide (CTAB) acted as a structure-directing agent to generate mesoporosity, while urea served as a pH regulator and stabilizer of the TiO_2 network. The obtained gels were calcined between 550 and 750°C to tune crystallinity and surface properties.

X-ray diffraction revealed that both the solvent and calcination temperature strongly influenced the anatase-to-rutile ratio. Ethanol favored the retention of anatase, whereas isopropanol promoted earlier rutile formation. The BET surface area decreased with temperature, ranging from 43 $m^2 \cdot g^{-1}$ at 550°C to 9 $m^2 \cdot g^{-1}$ at 750 °C, while microscopic analyses confirmed a mesoporous framework preserved after template removal.

Photocatalytic tests performed under UV-A light ($\lambda \approx 365$ nm) showed that the calcination temperature strongly affected the photo-reactivity. The sample treated at 750 °C exhibited the highest degradation and mineralization efficiency toward clofibric acid, attributed to improved crystallinity and the formation of mixed-phase anatase-rutile interfaces, enhancing charge separation. Total organic carbon analyses confirmed substantial mineralization, and recycling experiments demonstrated excellent stability and reusability without noticeable structural loss.

In summary, combining sol-gel and soft-templating routes enables effective control of TiO_2 texture and phase composition. The optimized catalyst exhibits high activity, robustness, and reusability, emphasizing its potential for advanced water treatment and as a basis for future design of doped or hybrid photocatalytic systems.

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NANOMATERIALS FOR SOLAR ENERGY ENHANCEMENT INVESTIGATION OF ZnO NANOFLUID APPLICATIONS FOR THERMAL ENHANCEMENT IN PARABOLIC TROUGH COLLECTORS

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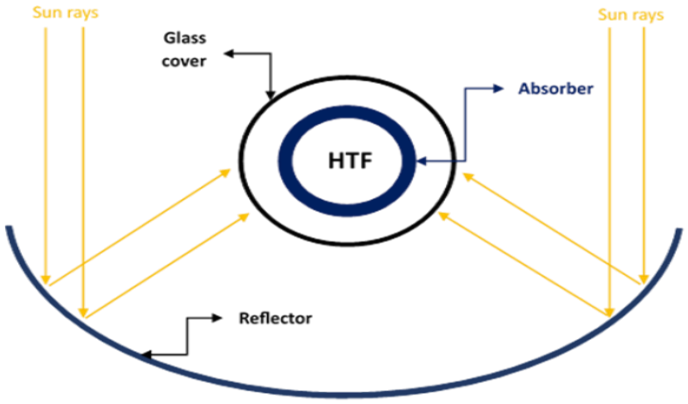
ABSTRACT

Parabolic trough collectors (PTCs) are widely utilized in solar thermal power systems due to their efficiency in harnessing solar energy. The utilization of nanofluids as heat transfer fluids (HTFs) can substantially enhance thermal conductivity relative to the base fluid, thereby enabling more efficient heat transfer processes. In this work, computational analysis was conducted to explore the improvement in thermal efficiency of a parabolic trough solar collector (PTC) using nanoparticles dispersed in a Conventional thermal oil-based fluid. The research utilized a hybrid methodology that combined the Monte Carlo Ray Tracing (MCRT) technique with the Finite Volume Method (FVM) from computational fluid dynamics (CFD) to evaluate the system's overall performance. The results have revealed the potential of using (ZnO, SiC, graphene oxide) nanoparticles in both standalone and hybrid nanofluids to improve the performance of the PTC. Additionally, the impact of nanofluids with different volume fractions on the base fluid thermal conductivity and viscosity is analyzed. Preliminary results suggest that the integration of nanofluids can significantly enhance heat transfer efficiency, enabling higher thermal performance at reduced operating temperatures.



References

1. Ali, F.M., Yunus, W.M.M. 2011. Study of the Effect of Volume Fraction Concentration and Particle Materials on Thermal Conductivity and Thermal Diffusivity of Nanofluids. Jpn. J. Appl. Phys. 50, 085201.
2. Allouhi, A., Benzakour Amine, M., Saidur, R., Kousksou, T., Jamil, A. 2018. Energy and exergy analyses of a parabolic trough collector operated with nanofluids for medium and high temperature applications. Energy Conversion and Management 155, 201–217.

FUNCTIONALIZATION OF TITANIUM IMPLANTS WITH MELITTIN-VITAMIN D3-BIOACTIVE GLASS THIN FILMS VIA MAPLE

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ABSTRACT

This research describes the fabrication of multifunctional bioactive coatings combining bioglass, vitamin D_3, and melittin, deposited onto titanium substrates via the Matrix-Assisted Pulsed Laser Evaporation (MAPLE) technique. The primary objective is to improve the biological response and physicochemical performance of titanium-based implants by enhancing osseointegration, corrosion resistance, and antibacterial efficacy.

Extensive characterization demonstrated that the composite layers maintained high chemical stability and exhibited a micro/nanostructured morphology favorable for cell adhesion and proliferation. Electrochemical tests revealed that the inclusion of bioglass, vitamin D_3, and melittin markedly increased titanium's corrosion resistance in simulated body fluid, suggesting enhanced long-term durability.

Biological evaluations confirmed that the coatings are biocompatible, non-cytotoxic, and non-immunogenic, while effectively supporting osteogenic differentiation. In addition, the laser-deposited films enabled a controlled release of bioactive molecules over a period of seven weeks and exhibited strong antibiofilm activity against common pathogens including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*.

Overall, these findings underscore the synergistic interaction between bioglass, vitamin D_3, and melittin, providing an integrated approach to overcoming persistent challenges in implantology. The proposed coatings represent a promising pathway toward next-generation titanium implants with improved biological functionality, antimicrobial protection, and long-term stability.

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SUPRAMOLECULAR NANOSTRUCTURES OF AGGREGATION-INDUCED EMISSION (AIE) DYE AND AMPHIPHILIC TERPOLYMERS

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ABSTRACT

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HARNESSING SLOW LIGHT AND PLASMONIC EFFECTS IN PHOTONIC CRYSTALS FOR UNPRECEDENTED H_2 EVOLUTION

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ABSTRACT

Efficient light harvesting remains a major challenge in photocatalytic H_2 evolution. While strategies like photocatalyst band gap engineering, heterojunction design, morphology modification and plasmonic enhancement have been actively investigated, the strategy of modifying light using photonic crystals has not been explored [1-2]. Photonic crystals, thanks to their periodic dielectric structures, can reduce the group velocity of light at specific frequencies. When these frequencies are tuned to match the spectral absorption of the photocatalyst, light harvesting can be significantly amplified [3–5]. In this work, we present a strategically designed composite photocatalyst involving an inverse opal (IO) TiO_2 photonic crystal integrated with Au, CdS, and Pt nanoparticles (NPs). The IO structure of TiO_2 photonic crystal reduces the group velocity of light at specific frequencies, while the CdS NPs and Au NPs enable visible light harvesting. Pt NPs serve as cocatalysts for the Hydrogen Evolution Reaction (HER). By precisely tuning the lattice parameter in IO TiO_2, slow-photon wavelengths were aligned with both CdS absorption and Au plasmonic resonance, resulting in an unprecedented hydrogen evolution rate of 103.96 mmol h^{-1} g^{-1} – 4.7 times higher than pristine IO TiO_2 with a hydrogen evolution rate of 22.27 mmol h^{-1} g^{-1}. This work establishes a new paradigm in solar-to-hydrogen conversion, highlighting the transformative potential of photonic-plasmonic synergy for scalable light-harvesting technologies.

References

1. Q. Wang, K. Domen; Particulate photocatalysts for light-driven water splitting: mechanisms, challenges and design strategies, *Chem. Rev.* 2019, 120, 919–985
2. D. Gunawan, J. Zhang, Q. Li, C. Toe, J. Scott, M. Antonietti, J. Guo, R. Amal; Material advances in photocatalytic solar hydrogen production: integrating systems and economics for a sustainable future, *Adv. Mater.* 2024, 2404618.
3. J. Liu, H. Zhao, M. Wu, B. Van der Schueren, Y. Li, O. Deparis, J.H. Ye, G.A. Ozin, T. Hasan, B.-L. Su; Slow photons for photocatalysis and photovoltaics, *Adv. Mater.* 2017, 29, 1605349.
4. T.L. Madanu, S.R. Mouchet, O. Deparis, J. Liu, Y. Li, B.-L. Su; Tuning and transferring slow photons from TiO_2 photonic crystals to $BiVO_4$ nanoparticles for unprecedented visible light photocatalysis. *J. Colloid Interface Sci.* 2023, 634, 290–299.
5. T. L. Madanu, L. Chaabane, S. R. Mouchet, O. Deparis, B.-L. Su; Manipulating multi-spectral slow photons in bilayer inverse opal TiO_2@ $BiVO_4$ composites for highly enhanced visible light photocatalysis. *J. Colloid Interface Sci* 2023**,** 647, 233–245.

BIOACTIVE COMPOSITES FOR OSSEOINTEGRATION: A STUDY USING MAPLE-DEPOSITED FILMS

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ABSTRACT

This study details the development of antimicrobial calcium phosphate-antibiotic thin films via Matrix Assisted Pulsed Laser Evaporation (MAPLE) using a KrF excimer laser.

The films' chemical structure was verified by FTIR spectroscopy, confirming consistency with the source materials. SEM imaging highlighted a nanoscale surface roughness, a valuable trait for medical use, which scaled directly with the chitosan concentration within the film. Functional assessment demonstrated potent antimicrobial activity against both Gram-negative (*E. coli*) and Gram-positive (*E. faecalis*) bacteria.

In vitro biocompatibility testing using human bone osteosarcoma cells confirmed positive effects on cellular health.

In conclusion, these findings validate that MAPLE is a suitable deposition method for creating composite films that significantly facilitate osseointegration and promote bone tissue regeneration.

Acknowledgements: This research was funded by a grant from the Ministry of Research, Innovation and Digitalization, CCCDI–UEFISCDI, project number PN-IV-P7-7.1-PED-2024-0137, within PNCDI IV. This research was also funded by the Romanian Ministry of Research, Innovation and Digitalization under the Romanian National Nucleu Program LAPLAS VII – contract no. 30N/2023.

PEDOT EUTECTOGELS AS A PROMISING CONDUCTIVE MATERIAL FOR TISSUE ENGINEERING

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ABSTRACT

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THE ROLE OF EXTRACELLULAR MATRIX GLYCATION AND THERAPEUTIC APPROACHES IN CANCER

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ABSTRACT

Cancer remains one of the most complex and challenging diseases in modern medicine. Although current treatments (chemotherapy, radiotherapy, immunotherapy, and surgery) show efficacy, they are often associated with severe side effects and do not always prevent recurrence. The relationship between the immune system and cancer, initially described by the immunosurveillance theory, was later refined into the cancer immunoediting concept (elimination, equilibrium, escape), transforming oncology into an immunological disease [1].

Chimeric Antigen Receptor T-cell (CAR-T) therapy has revolutionized cancer treatment. It involves collecting T lymphocytes from the patient's blood, followed by their *in vitro* engineering to express artificial receptors specific to a tumor-associated antigen. These receptors can directly recognize the tumor antigen without the involvement of the major histocompatibility complex (MHC). CAR-T therapy has shown significant efficacy in hematological malignancies, but its effectiveness in solid tumors remains limited. Current challenges include antigen escape, CAR-T cell trafficking to the tumor site, tumor infiltration, the immunosuppressive tumor microenvironment, and CAR-T–related toxicity [2]. Some of these limitations can be explained by extracellular matrix glycation, which promotes tumor invasion, metastasis, and reduces immune cell migration [3–5].

Glycation is a random, non-enzymatic reaction between the carbonyl groups of reducing sugars and the free amino groups of nucleic acids, proteins, or lipids, followed by additional chemical rearrangements that lead to the formation of stable and irreversible end products [6]. Such irreversible modifications in the human body can occur only in proteins with a long half-life (T1/2), such as hemoglobin (Hb), albumin, collagen, crystallins, and histone proteins [7,8]. The main source of advanced glycation end products (AGEs) in cancer is aerobic glycolysis, known as the Warburg effect [9]. Advanced glycation end products (AGEs) exert a profound impact on the structure and function of connective tissue, particularly by modifying collagen, an essential component of the extracellular matrix (ECM). In solid tumors, the ECM can account for up to 60% of the tumor mass, and collagen glycation contributes to increased stiffness and abnormal fiber reorganization [3,10]. This reduces T-cell migration by 30–60% [4].

Firstly, glycated collagen activates the receptor for advanced glycation end products (RAGE), stimulating NADPH oxidase and the production of superoxide anions, which lead to the activation of matrix metalloproteinases (MMPs) and ECM remodeling, particularly by increasing collagen turnover [11]. MMP-1, -8, and -13 (collagenases) contribute to tumor invasion through fibrillar collagen degradation. MMP-2 and MMP-9 activate latent transforming growth factor-beta (TGF-β), which initially inhibits cell proliferation but later promotes fibrosis and tumor progression [3,12].

Secondly, the molecular organization within collagen fibrils is determined by numerous non-covalent interactions between collagen molecules, in particular charge-charge interactions. Interestingly, the positions of lysine residues in fibrillar collagen are among the most conserved, even more so than those of proline or hydroxyproline, which are the major constituents after glycine. Glycation of lysine sidechains alters their length through the addition of sugar adducts and changes their charge distribution, which can disrupt the three-dimensional organization of fibrils. This molecular reorganization affects the accessibility of binding sites for integrins and their dynamics, negatively influencing collagen-mediated signaling via integrins [13]. As a result, these modifications alter cell-matrix interactions, reducing adhesion, cell migration, and cytoskeletal remodeling through the focal adhesion kinase (FAK) pathway and triggering E-cadherin internalization [14].

Normally, T cells preferentially migrate along long collagen fibers via an integrin-independent mechanism; however, when collagen structure becomes disorganized (as after glycation), migration becomes integrin-dependent and is significantly impaired. The attachment of epithelial cells to the extracellular matrix (ECM), mediated by integrins, is essential for cell growth and survival. Loss of attachment to the ECM leads to a type of apoptosis known as anoikis [15]. Nonetheless, within the tumor microenvironment, the AGEs–RAGE axis activates survival pathways (Janus Kinase / Signal Transducer and Activator of Transcription (JAK/STAT3), Phosphoinositide 3-Kinase/ Protein Kinase B (PI3K/Akt), and Mitogen-Activated Protein Kinase / Extracellular Signal-Regulated Kinase (MAPK/ERK)) and inhibits this form of apoptosis, thereby promoting cancer cell migration [16–18].

Thirdly, collagen glycation profoundly affects its interactions with other components of the extracellular matrix, such as proteoglycans and adherent cells (fibroblasts, endothelial cells, tumor cells). Cells can interact with collagen through at least six groups of receptors: 1) integrins, 2) the discoidin domain receptor family (DDR1 and DDR2), 3) the mannose receptor family, 4) glycoprotein VI (GPVI), 5) the osteoclast-associated receptor (OSCAR), and 6) the leukocyte-associated immunoglobulin-like receptor 1 (LAIR-1). These interactions regulate various cellular processes, including adhesion, matrix metalloproteinase (MMP) activity, thrombus formation, cell survival and proliferation, cytokine production, immune function, and collagen remodeling [3].

As a result, in the reviewed literature, the following original compounds, known as “AGE breakers,” have been mentioned: N-phenacylthiazolium bromide (PTB), its dimethylthiazolium analog alagebrium (ALT-711), as well as recently described pyridinium analogs TRC4186 and TRC4149, and the vasodilator hydralazine. These compounds were designed to cleave AGE cross-links formed between tissue proteins. Despite the lack of solid evidence supporting their true “cross-link breaking” activity, the so-called AGE breakers are potent chelating agents. Chelating agents are chemical compounds capable of binding and sequestering transition metal ions such as copper (Cu^{2+}) and iron (Fe^{3+}), which catalyze

oxidative and glycoxidative reactions. By forming stable complexes with these metal ions, chelating agents prevent metal- driven oxidative stress and the formation of new AGE cross-links. Chelation, by inhibiting glycoxidation reactions, limits the progression from AGE precursors to AGE cross-links, thereby allowing extracellular matrix renewal through the degradation of glycated proteins and the synthesis of native proteins [19–22].

Unfortunately, these compounds were withdrawn from clinical trials due to their observed toxicity. On other hand, recently, local bioactive compounds (BAC) – new Schiff bases with chelating and macrocyclic ligands derived from halogensemicarbazides – have been investigated in the Laboratory of Advanced Materials in Biopharmaceutics and Technology at the State University of Moldova, under the guidance of Academician Aurelian Gulea. Their complexes with non-platinized metals exhibited significant bioactive properties. Among the 70 studied BACs, CMA-2, CMC-6, CMJ-33, TIA-59, and TIA-70 demonstrated the highest AGE-capturing activity, reducing elevated AGE levels by 60–70% at concentrations of 50–100 μM/L [23–25].

In conclusion, collagen glycation not only alters the structural integrity and signaling dynamics of the tumor microenvironment but also impairs immune cell trafficking, contributing to therapeutic resistance. Therefore, targeting the AGEs–RAGE axis or using metal-chelating and anti-glycation agents – such as newly synthesized Schiff base-derived bioactive compounds - may represent a promising adjunctive strategy to enhance the therapeutic outcomes of immuno-oncological treatments.

References

1. Dunn GP, Old LJ, Schreiber RD. The three Es of cancer immunoediting. Annu Rev Immunol [Internet]. 2004 [cited 2025 Aug 3];22:329–360. Available from: https://pubmed.ncbi.nlm.nih.gov/15032581/.
2. Sterner RC, Sterner RM. CAR-T cell therapy: Current limitations and potential strategies. Vol. 11, Blood Cancer Journal. Springer Nature; 2021.
3. Borst R, Meyaard L, Pascoal Ramos MI. Understanding the matrix: Collagen modifications in tumors and their implications for immunotherapy. Vol. 22, Journal of Translational Medicine. BioMed Central Ltd; 2024.
4. Haucke E, Navarrete-Santos A, Simm A, Silber RE, Hofmann B. Glycation of extracellular matrix proteins impairs migration of immune cells. Wound Repair Regen. 2014;22:239–245.
5. Suh YJ, Hall MS, Huang YL, Moon SY, Song W, Ma M. et al. Glycation of collagen matrices promotes breast tumor cell invasion. Integr Biol (Camb). 2019 Mar;11:109–117.
6. Nakamura A., Kawaharada R. Advanced Glycation End Products and Oxidative Stress in a Hyperglycaemic Environment. Fundamentals of Glycosylation. IntechOpen; 2022.
7. Kumar Pasupulati A., Chitra P.S., Reddy G.B. Advanced glycation end products mediated cellular and molecular events in the pathology of diabetic nephropathy. Vol. 7, Biomolecular Concepts. Walter de Gruyter GmbH; 2016. p. 293–299.
8. Zahra H.A., Zahra H.A. Advanced glycation end products and human diseases. Journal of Biological Research – Bollettino della Società Italiana di Biologia Sperimentale [Internet]. 2025 Mar 21 [cited 2025 Sep 8];98(1). Available from: https://www.pagepressjournals.org/jbr/article/view/12656.
9. Kozal K., Jóźwiak P., Krześlak A. Contemporary Perspectives on the Warburg Effect Inhibition in Cancer Therapy. Vol. 28, Cancer Control. SAGE Publications Ltd; 2021.
10. Sloseris D., Forde N.R. AGEing of collagen: The effects of glycation on collagen's stability, mechanics and assembly. Matrix Biology [Internet]. 2025 Feb 1 [cited 2025 Jul 29];135:153–60. Available from: https://www.sciencedirect.com/science/article/pii/S0945053X24001495
11. Ciobanu L., Cobeţ V., Ciobanu N., Popovici M. Produsele finale ale glicării şi elasticitatea arterelor periferice în insuficienţa cardiacă. Curierul Medical. 2012; 4(328):31–36. ISSN 1875-0666.

12. El-Far A.H., Sroga G., Al Jaouni S.K., Mousa S.A. Role and mechanisms of rage-ligand complexes and rage-inhibitors in cancer progression. Vol. 21, International Journal of Molecular Sciences. MDPI AG; 2020.
13. Bansode S., Bashtanova U., Li R., Clark J., Müller K.H., Puszkarska A. et al. Glycation changes molecular organization and charge distribution in type I collagen fibrils. Sci Rep. 2020 Feb;10:3397.
14. Millet M, Messaoud R Ben, Luthold C, Bordeleau F. Coupling microfluidic platforms, microfabrication, and tissue engineered scaffolds to investigate tumor cells mechanobiology. Vol. 10, Micromachines. MDPI AG; 2019.
15. Yang X, Yu DD, Yan F, Jing YY, Han ZP, Sun K. et al. The role of autophagy induced by tumor microenvironment in different cells and stages of cancer. Cell Biosci [Internet]. 2015 Mar 28 [cited 2025 Aug. 11];5(1):1–11. Available from: https://cellandbioscience.biomedcentral.com/articles/10.1186/s13578-015-0005-2.
16. Wang J., Luo Z., Lin L., Sui X., Yu L., Xu C. et al. Anoikis-Associated Lung Cancer Metastasis: Mechanisms and Therapies. Cancers (Basel) [Internet]. 2022 Oct. 1 [cited 2025 Aug. 11]; 14(19):4791. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9564242/
17. Palanissami G., Paul S.F.D. AGEs and RAGE: Metabolic and molecular signatures of the glycation-inflammation axis in malignant or metastatic cancers. Explor Target Antitumor Ther. 2023; 4:812–849

SPECTROSCOPIC STUDIES OF MOLECULAR INTERACTIONS BETWEEN QUINIZARIN AND CUCURBIT[8]URIL MACROCYCLE

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ABSTRACT

The cucurbit[n]urils (CB[n], where n = 5-8, 10, 14 indicates the number of glycoluril units) are one of the three primary categories of macrocycles, alongside cyclodextrins and calixarenes, that received significant interest as potential drug delivery systems due to their capacity to non-covalently encapsulate drugs. Structurally, cucurbit[n]urils are cyclic oligomers made up of repeating glycoluril units connected by methylene bridges, with carbonyl oxygen atoms surrounding the openings of the macromolecule.

Quinizarin (1,4-dihydroxy-9,10-anthraquinone, QZ), selected in this study as a potential guest molecule, is part of the dihydroxyanthraquinones family and has shown a range of uses, including as a pesticide, fungicide, and lubricant additive [1]. It also offers health benefits such as anticancer and antiobesity properties [2] and acts as a competitive non-peptide inhibitor of HIV-1 proteinase [3]. Quinizarin represents the simplest model molecule of a chromophore found in certain anticancer drugs (doxorubicin, daunorubicin, mitoxantrone) that are extensively utilized in clinical treatments.

The present work investigate the interaction of QZ with CB[8] using spectroscopic methods (absorption and emission spectroscopy) [4]. The changes of spectral features of QZ on addition of CB[8] indicates that the interaction occurs and QZ forms 1:1 complex with CB[8]. The Benesi–Hildebrand relationship was used to calculate the stoichiometric ratio as well as the binding constant at four temperatures, which revealed a decrease in the binding constant with rising temperature. Analysis of the thermodynamic parameters associated with QZ – CB[8] complex formation revealed that the inclusion of neutral quinizarin molecule into CB[8] macrocycle is spontaneous ($\Delta G < 0$) and enthalpically driven process ($\Delta H<0$), accompanied by a small favourable change in entropy ($T\Delta S > 0$). The QZ – CB[8] complex shows higher antioxidant activity compared with free QZ.

The present results highlights that the CB[8] macrocycle may be used as a drug stabilizing agent in pharmaceutical formulations and it has good drug carrier properties for quinizarin, even better than other macrocycles like cyclodextrins.

References

1. V. Verebova, J. Benes, J. Stanicova. Molecules 25 (2020) 5666
2. S. Rossi, C. Tabolacci, A. Lentini et al. Anticancer Res. 30 (2010) 445
3. R. I. Brinkworth, D.P. Fairle, Biochim. Biophys. Acta 1253 (1995) 5
4. A.M. Toader, I. Dascălu, G. Ioniță, D.G. Angelescu, M. Enache, J. Mol. Liq. 434 (2025) 128044

DESIGN AND DEVELOPMENT OF CARDIAC OCCLUDER WITH ENHANCED PROPERTIES USING PLA-BASED BIOFUNCTIONAL STRUCTURES

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ABSTRACT

Conventional treatment methods for cardiac septal defects such as atrial septal defect (ASD) and ventricular septal defect (VSD) involve open-heart surgery under cardiopulmonary bypass. However, this approach carries high risks of trauma and complications and may cause long-term adverse effects on multi-organ development and psychomotor functions [1]. Therefore, minimally invasive interventional techniques have been developed as alternatives [2].

Among these, cardiac occluders composed of metallic frameworks and synthetic fabric membranes are the most widely used. Nevertheless, these permanent implants can lead to hemolysis, thrombosis, toxic reactions, valve damage, cardiac perforation, and severe arrhythmias. Thus, biodegradable occluders are preferred for next-generation applications.

An optimal occluder should function as a temporary matrix, effectively sealing the defect while supporting the regeneration of host cardiac tissue. Following complete endothelial layer formation, the structure is expected to decompose naturally, ensuring that only native tissue remains and eliminating risks of long-term complications. In the field of cardiovascular tissue engineering, diverse bioactive agents such as growth factors (e.g., VEGF), extracellular matrix-derived materials (e.g., collagen, fibrin), and synthetic peptide analogues are frequently utilized to promote repair [3]. Nonetheless, these large biomolecules often face challenges including instability, limited bioavailability, and the potential to elicit immune responses [4,5].

This study aims to design stable CNP-derived peptides that promote endothelial cell migration and accelerate endothelialization for cardiac occluders. These peptides will be modified with antithrombotic amino acid residues to obtain dual-functional and more stable forms. The bioactive peptides will be integrated into biodegradable PLA membranes produced by electrospinning and electrospraying to develop a biofunctional cardiac occluder. The resulting structure will undergo performance and safety evaluations, with strong potential for next-generation biodegradable occluders and broader biomedical applications.

References

1. Saxena, A., Relan, J., Agarwal, A. (2019). Atrial septal defect and ventricular septal defect: surgical management and outcomes. Annals of Pediatric Cardiology, 12(2), 115–121.
2. Butera, G., Carminati, M., Chessa, M., Youssef, R., Drago, M., Giamberti, A., Frigiola, A. (2006). Percutaneous closure of ventricular septal defects in children aged 12 years or younger: immediate and midterm results. Journal of the American College of Cardiology, 47(5), 1006–1012.
3. Lee, K., Silva, E.A., Mooney, D.J. (2011). Growth factor delivery-based tissue engineering: general approaches and a review of recent developments. Journal of the Royal Society Interface, 8(55), 153–170.
4. Wang, Y., Cui, C.B., Yamauchi, M., Miguez, P., Roach, M., Malaval, L., Sato, M. (2020). Biomimetic strategies for vascular tissue engineering. Frontiers in Bioengineering and Biotechnology, 8, 620.
5. Martino, M.M., Briquez, P.S., Guc, E., Tortelli, F., Kilarski, W. W., Metzger, S., Rice, J.J., Kuhn, G.A., Müller, R., Swartz, M.A., Hubbell, J.A. (2015). Growth factors engineered for super-affinity to the extracellular matrix enhance tissue healing. Science, 343(6173), 885–888.

SELECTIVE CYTOTOXIC EFFECTS OF RU(III) – SCHIFF BASE COMPLEXES AGAINST HUMAN TUMOR CELLS

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ABSTRACT

The search for new cytotoxic compounds that combine potent antitumor activity with high selectivity toward malignant cells remains a major objective in cancer research. Conventional chemotherapeutic drugs, such as platinum-based agents, while effective, often lack selectivity and are associated with severe systemic toxicity and resistance development. Metal-based complexes, particularly those of ruthenium, have gained attention as potential alternatives to traditional platinum drugs because of their tunable reactivity and reduced toxicity.

The present study investigates the antitumor and antiproliferative properties of three Ru(III) – Schiff base complexes, [Ru^{III}(Salen)(PPh_3)Cl] (RuSalen), [Ru^{III}(Salphen)(PPh_3)Cl] (RuSalphen), and [Ru^{III}(Salpn)(PPh_3)Cl] (RuSalpn), against three human tumor cell lines - HT29 (human colorectal carcinoma), Saos-2 (human osteogenic sarcoma), and HeLa (human cervical carcinoma), along with the non-tumor Lep3 (embryonal human fibroblast) line. All three Ru(III) complexes exhibited pronounced, dose-dependent inhibition of tumor cell growth, while the non-tumor Lep3 cells were considerably less affected, indicating a notable degree of selectivity toward malignant cells. The Annexin V assays confirmed that the cytotoxic effect of the complexes was mediated through apoptosis induction in all tumor cell lines in a concentration-dependent manner. Among the complexes, RuSalpn displayed the most potent antiproliferative and cytotoxic activity, with efficacy comparable to or exceeding that of standard chemotherapeutic agents such as cisplatin, oxaliplatin, epirubicin, and paclitaxel. The study revealed a cell-specific response pattern, suggesting that structural variations in the Schiff base ligands influence biological activity and cellular sensitivity. RuSalpn exhibited the strongest cytotoxic effect in the HT29 cell line, while RuSalen and RuSalphen showed notable activity against Saos-2 and HeLa cells, respectively. In addition to their antiproliferative effects, the Ru(III) complexes also impaired tumor cell migration in a dose-dependent manner.

The results obtained highlight the strong antitumor potential of Ru(III)–Schiff base complexes, characterized by selective cytotoxicity *via* apoptosis induction and suppression of cell migration. These findings support their further exploration as promising candidates for targeted cancer therapy.

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POTENTIAL HEALTH RISKS ASSOCIATED WITH HEAVY METAL LEACHING FROM METALLIC COOKWARE

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ABSTRACT

Heavy metals are trace elements that are essential for living organisms at low concentrations but become highly toxic when present above permissible limits [1]. Their migration into food products represents a major public health concern, particularly in regions where traditional cooking methods and metal utensils are widely used. This study aimed to evaluate the potential release of toxic metals from metallic containers during heating [2,3]. Two test protocols were applied using ultra-pure water and a food simulant. The results revealed the migration of several elements, particularly lead (Pb) and nickel (Ni), largely exceeding the specific release limits established by DGCCRFF regulations. Considerable amounts of copper (Cu) and zinc (Zn) were also detected. Factors such as prolonged contact time, repeated use, and poor coating quality were found to intensify metal leaching. Lead contamination was mainly attributed to soldering materials connecting metallic parts. The recorded levels of toxic metals are alarming and may cause serious health risks, including acute lead poisoning. Therefore, strict control of the materials and coating processes used in the manufacture of cooking utensils is strongly recommended to prevent heavy metal migration and ensure consumer safety.

References

1. Ali Boularbah, Christophe Schwartz, Gabriel Bitton, Wafae Aboudrar, Ahmed Ouhammou, Jean Louis Morel ,Heavy metal contamination from mining sites in South Morocco: 2. Assessment of metal accumulation and toxicity in plants. Chemosphere 63 (2006) 811–817.
2. Gomaa N. Abdel-Rahmana, Mohamed B.M. Ahmed, Bassem A. Sabrya, Safaa S.M. Alib, Heavy metals content in some non-alcoholic beverages (carbonated drinks, T flavored yogurt drinks, and juice drinks) of the Egyptian markets, Toxicology Reports 6 (2019) 210–214.
3. Zakia Aribou, Nidal Khemmou Rida Allah Belakhmima et al. Effect of polymer additive on structural and morphological properties of Cu-electrodeposition from an acid sulfate electrolyte: Experimental and theoretical studies. Journal of Electroanalytical Chemistry, 2023, Vol. 946, p. 117722.

ENHANCING COPPER CORROSION INHIBITION IN ACIDIC MEDIA THROUGH FUNCTIONALIZED INORGANIC – ORGANIC SYSTEMS

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ABSTRACT

Copper is extensively utilized across diverse industries owing to its exceptional attributes such as high thermal and electrical conductivity, ductility, and malleability [1]. Nonetheless, when subjected to treatment with a sulfuric acid solution to eradicate scale and oxide buildup, corrosion may ensue, leading to substantial financial setbacks for manufacturers [1,2]. Managing copper corrosion is therefore imperative from health, technical, environmental, and economic perspectives. Although organic and inorganic inhibitors are commonly employed to mitigate this issue, traditional inorganic products are increasingly less favored due to their adverse environmental effects [3]. In light of this, our research endeavors to enhance the efficacy of apatitic calcium phosphates, an environmentally friendly corrosion inhibitor, by incorporating polyphenolic compounds sourced from plant extracts. Through our investigation, we assessed the performance of these modified products against copper corrosion in a sulfuric acid solution, employing various electrochemical techniques including stationary polarization and electrochemical impedance spectroscopy. Encouragingly, our findings demonstrated a noteworthy reduction in the kinetics of copper corrosion processes with the utilization of grafting products, achieving efficiencies of up to 92.3% and 92.1% for the P1 and P2 samples, respectively. These results underscore the potential of polyphenolic compound grafting as a viable strategy for augmenting copper corrosion inhibition in corrosive environments containing sulfuric acid.

References

1. K. Mzioud, A. Habsaoui, S. Rached, E. Ech-chihbi, M. Ouakki, R. Salghi, M.E. Touhami, Experimental Investigation and Theoretical Modeling of Copper Corrosion Inhibition by *Urginea maritima* Essential Oil, Mater. Today Sustain. (2024) 100906. https://doi.org/10.1016/j.mtsust.2024.100906.
2. K. Mzioud, N. Ferraa, Z. Aribou, S. Rached, M. Ouakki, A. Habsaoui, M.E. Touhami, Green corrosion protection: Plant extracts as sustainable solutions, Emerg. Technol. Ind. Appl. Corros. Sci., 2025: pp. 215–254. https://doi.org/10.4018/979-8-3693-6341-6.ch008.
3. S. Rached, K. Mzioud, M. Er-rajy, A. Habsaoui, R. Lachhab, B. Hammouti, M. Ebn Touhami, Combined experimental and computational evaluation of *Mentha pulegium L.*, for sustainable corrosion protection, Hybrid Adv. 11 (2025) 100551. https://doi.org/10.1016/j.hybadv.2025.100551.

ANTIBACTERIAL AND ANTIFUNGAL ACTIVITIES OF CO-DOPED CALCIUM PHOSPHATE

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ABSTRACT

The increasing resistance of pathogenic microorganisms to conventional antibiotics has become a major global health concern, prompting the search for new antimicrobial materials that are both effective and biocompatible[1,2]. In this context, cobalt-based calcium phosphates have attracted considerable attention due to their chemical similarity to the mineral component of bone, excellent biocompatibility, and potential biological functionality. In the present work, a novel Co-doped apatite phosphate compound was synthesized via the coprecipitation method and characterized using FTIR spectroscopy, X-ray diffraction (XRD), and scanning electron microscopy coupled with energy-dispersive spectroscopy (SEM/EDX). The biological properties of the material were then evaluated against several pathogenic strains, including Gram-positive and Gram-negative bacteria, as well as one yeast strain[3]. Biological assays revealed that the synthesized phosphate exhibited remarkable antibacterial activity against both Gram-positive and Gram-negative bacteria, along with significant antifungal effectiveness against Candida albicans.These findings highlight the potential of the synthesized cobalt-based calcium phosphate as a multifunctional, biocompatible material with promising antibacterial and antifungal properties, opening new perspectives for its application in biomedical and environmental fields.

References

1. N. Ferraa, Z. Aribou, K. Mzioud, M. Ouakki, M. Cherkaoui, M.B. Ziatni, in: Y. El Kacimi, K. Alaoui (Eds.), Advances in Chemical and Materials Engineering, IGI Global, 2025: pp. 255–298. https://doi.org/10.4018/979-8-3693-6341-6.ch009.
2. N. Ferraa, M. Ouakki, M. Barbouchi, M. Cherkaoui, M. Bennani Ziatni, Biointerface Research in Applied Chemistry 14 (2024) 54.
3. K. Mzioud, A. Habsaoui, H. Imtara, S. Haida, S. Rached, S. Msairi, A. Douira, A.S. Alqahtani, O.M. Noman, M. Tarayrah, M.E. Touhami, Physicochemical characterization, antioxidant and antifungal activities of essential oils of Urginea maritima and Allium sativum, Open Chem. 21 (2023). https://doi.org/10.1515/chem-2023-0149.

THE MECHANISM OF ACTION OF OXYTOCIN ON THE UTERUS

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ABSTRACT

Oxytocin serves as the primary hormone responsible for managing uterine contractions before and during pregnancy. Its key mechanism involves attaching to the membrane oxytocin receptor (OXTR), which then activates the Gq protein and phospholipase Cβ (PLCβ). This process results in the breakdown of phosphatidylinositol-4,5-bisphosphate (PIP2), producing inositol trisphosphate (IP3) and diacylglycerol (DAG). IP3 subsequently leads to the release of Ca^{2+} from the sarcoplasmic reticulum, while DAG activates protein kinase C, leading to increased contraction of myocytes. The rise in intracellular Ca^{2+} activates myosin light chain kinase (MLCK), which leads to the phosphorylation of myosin and full contraction of the uterus [1,2,4].

Recent research has indicated that at the molecular level, the density and sensitivity of the OXTR increase during the third trimester. This reaction is linked to the elevated transcription of the receptor gene influenced by estrogens in the promoter region, coupled with a decrease in the inhibitory impact of progesterone, which typically limits this process. In a non-pregnant uterus, the expression of the receptor is lower, leading to diminished contractile function, whereas during pregnancy, the sensitivity of the uterus to oxytocin rises, which is crucial for effective labor [3,5,7].

Besides hormonal control, there are also epigenetic influences. The hypermethylation of the OXTR gene promoter results in the reduced receptor expression and diminished myometrial contractility. In contrast, demethylation of certain regions increases the uterine responsiveness to oxytocin. Single nucleotide polymorphisms (SNPs) within this gene can influence oxytocin's capacity to bind to its receptor and activate the signaling pathway, leading to individual differences in uterine reactions to the hormone [5,7,8].

Comparative investigations of uterine tissue from pregnant and non-pregnant women have highlighted notable differences. The pregnant uterus demonstrates higher amplitude of Ca^{2+} transients and enhanced contractile force, signifying the remodeling of ion channels and increased myometrial excitability. Transcriptomic and electrophysiological studies have validated the simultaneous increase in gene expression of OXTR, MLCK, and Ca^{2+}-sensitive proteins, which indicates the uterus's functional preparation for labor [3,6,9,10].

In conclusion, these findings demonstrate a complex, multi-step mechanism triggered by oxytocin at the intracellular level, which is enhanced during pregnancy, mediating a hormonal-epigenetic remodeling of the myometrium to facilitate the transition from a quiescent to an actively contractile state necessary for childbirth.

References

1. Reid, J.A., Patel, S., Cohen, D. (2024). *Oxytocin receptor expression and functional adaptation of human myometrium during pregnancy*, Contraception, 132, 109–118. PubMed
2. Maxey, A.P., Porter, B., Dunford, J.R. (2024). *Contractile responses of engineered human myometrium to inflammatory mediators and oxytocin.* Frontiers in Physiology, 15, 1224–1237. PMC
3. Porta, M., Rizo, J., Di Tullio, S. (2023). *The contractile response to oxytocin in non-pregnant versus proven-breeder rat uterus.* Reproductive Sciences, 30(4), 1002–1012.
4. Yin, Z., Li, J., Zhang, C. (2018). *Adaptive reduction of human myometrium contractile responsiveness: pregnant versus non-pregnant context.* American Journal of Physiology – Cell Physiology, 315(3), C346–C354.
5. Füeg, F., Albrecht, C., Rissman, E. F. (2019). *Influence of oxytocin receptor single nucleotide variants on oxytocin-induced stimulation of human myometrium contractility in vitro.* Molecular Human Reproduction, 25(11), 760–769.
6. Phung, J., Yudin, M.H., Maxwell, C. (2022). *Preterm labor is a distinct process from term labor: transcriptomic differences including OXTR expression.* American Journal of Obstetrics and Gynecology, 227(4), 642–655.
7. Kim, S.C., Park, S.H., Kang, M. S. (2017). *The regulation of oxytocin and oxytocin receptor in human gestational tissues.* Journal of Molecular Endocrinology, 59(3), 231–242.
8. Erickson, E.N., Wang, Y., Sones, J.L. (2023). *Oxytocin receptor DNA methylation is associated with OXTR expression and myometrial function.* Nature Communications Medicine, 4(1), 211.
9. Wang, H., Wei, J., Zhao, C. (2023). *Noninvasive electromyometrial imaging of human uterine electrical activation during term labor.* Nature Communications, 14, 6658.
10. Anukriti, K., Dey, A., Bhattacharya, P. (2020). *Maternal blood and amnionic oxytocin receptor gene expression and its relation to preterm birth.* medRxiv Preprint, DOI:10.1101/2020.05.28.20115300.

MODIFICATION OF PEDOT BY CURCUMIN: INFLUENCE ON SURFACE, ELECTROCHEMICAL AND BIOLOGICAL PROPERTIES

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ABSTRACT

Poly(3,4-ethylenedioxytiophene) [PEDOT] is a well-known conducting polymer recognized for its biocompatibility [1]. Recently, its application in the development of neural implants has gained considerable attention, as it allows for the combination of excellent electrical conductivity with favorable cell interactions. Moreover, PEDOT can serve as a matrix for drug immobilization, enabling active release upon electrical stimulation[2].

Despite huge improvements in maintaining sterility during surgery since Ignaz Semmelweis emphasized the importance of hand hygiene and subsequent studies by Louis Pasteur, implantation-related infections still remain major challenge in modern medicine. Especially in case of brain surgeries, inflammation caused by presence of microorganisms during implantation may lead to severe complications, including death. For this reason, researchers are developing new strategies to give polymers, such as PEDOT, antibacterial properties while maintaining their biocompatibility. For example, PEDOT layer can be modified by silver and gold particles [3].

This research presents a new strategy based on the immobilization of curcumin within a PEDOT layer. Curcumin is a natural compound derived from Curcuma longa, widely studied for its antibacterial and biocompatibility-enhancing properties [4]. PEDOT was synthesized by cyclic voltammetry in the presence of curcumin using different counterions and solvents. The resulting layers were analyzed using infrared spectroscopy, electrochemical characterization, wettability and roughness measurements. Antibacterial activity was evaluated using confocal microscopy and the AlamarBlue assay, which was also employed to examinate the biocompatibility of the coatings.

The obtained results demonstrated a significant effect of curcumin on surface properties such as wettability and roughness. Samples synthesized in organic media exhibited substantial losses in conductivity; however, this effect was less pronounced for the sample prepared under aqueous conditions. Similarly, antibacterial activity was not observed for samples synthesized in organic solvents, likely due to the instability of curcumin during electropolymerization. In contrast, when polymerized in aqueous conditions, curcumin retained stability, resulting in the preservation of its antibacterial activity against *Pseudomonas aeruginosa*. At the same time, all samples exhibited improved biocompatibility.

References

1 Y. Lu, R. Liu, X.C. Hang, D.J. Young, Biocompatible, flexible and conductive polymers prepared by biomass-derived ionic liquid treatment, *Polym Chem*, Vol. 12, no. 14, pp. 2115–2121, Apr. 2021, doi: 10.1039/D1PY00064K.

2 M.H. Malekoshoaraie et al. Fully flexible implantable neural probes for electrophysiology recording and controlled neurochemical modulation, *Microsyst Nanoeng*, Vol. 10, no. 1, pp. 1–17, Dec. 2024, doi: 10.1038/S41378-024-00685-6;SUBJMETA=1007,301,354,357,639,925,927;KWRD=ELECTRONIC+DEVICES,NANOPARTICLES.

3 S. Smołka et al. Antibacterial coatings for electroceutical devices based on PEDOT decorated with gold and silver particles, *Bioelectrochemistry*, Vol. 153, p. 108484, Oct. 2023, doi: 10.1016/j.bioelechem.2023.108484.

4 Y. Hussain et al. Antimicrobial Potential of Curcumin: Therapeutic Potential and Challenges to Clinical Applications," *Antibiotics*, Vol. 11, no. 3, p. 322, Mar. 2022, doi: 10.3390/ANTIBIOTICS11030322.

ENGINEERING GRAPHENE – GOLD NANOPARTICLE HYBRIDS FOR ENHANCED BIOSENSING INTERFACES

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ABSTRACT

With the growing demand for innovative diagnostic tools, the design of electrochemical biosensors has become a rapidly advancing field in biomedical engineering. These devices enable early, rapid, and highly sensitive detection of disease biomarkers. However, the development of such sensors requires careful engineering of electrode materials to ensure efficient electron transfer and provide suitable sites for biomolecule immobilization [1].

This study focused on optimizing the synthesis and modification of graphene- and gold-based materials for potential application in electrochemical biosensors. The properties of graphene oxide (GO) and reduced graphene oxide (rGO) were compared, and the reduction method of GO to rGO was optimized to obtain materials with high conductivity and retained functional groups. The electrodeposition of gold nanoparticles onto graphene was also optimized to form dendritic nanostructures by adjusting the deposition potential and time.

Electrochemical analyses confirmed that rGO deposition significantly increased the electroactive surface area, while Raman and AFM studies indicated the preservation of functional groups and improved surface morphology. A procedure for the fabrication of gold nanodendrites via chronoamperometry was established, and preliminary functionalization with antibodies was demonstrated.

In summary, optimized rGO and AuNP materials were successfully developed for integration into electrochemical biosensors. Future work will focus on biomolecule interactions, complete sensor fabrication, and electrode stability under storage conditions.

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References

1. Kumar, D.R., Banaś, A., Krukiewicz, K. (2024). Challenges and Advances in Biomarker Detection for Rapid and Accurate Sepsis Diagnosis: An Electrochemical Approach. *Biosensors*, 14(6), 309.

Green SYNTHESIS of COBALT-ZINC ALUMINATES USING PLANT-BASED EXTRACT

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ABSTRACT

In recent years, the implementation of Green Chemistry principles in the obtaining of nanomaterials has led to the development of environmentally friendly alternatives to traditional chemical methods [1]. Plants, as natural resources in the green synthesis of various materials, contain compounds that can play role of chelating/gelling agents and even fuel. For example, the hibiscus extract is a suitable non-toxic fuel due to its chemical composition (tannins, alkaloids, flavonoids, phenols, and glucosides) and its potential to reduce both environmental impact and synthesis costs [2]. Cobalt aluminate ($CoAl_2O_4$) is a very exciting material due to its properties such as high refractive index, color stability, thermal and chemical stability, being widely used as pigment. The color of cobalt aluminate can be changed by doping or substituting Co^{2+} with other metal ions [3].

In this study, $CoAl_2O_4$ and cobalt-zinc aluminate ($Co_{0.25}Zn_{0.75}Al_2O_4$) were synthesized by solution combustion method using an aqueous hibiscus leaf extract as fuel. The samples were characterized by different methods: X-ray diffraction (XRD), field-emission scanning electron microscopy (FE-SEM), energy dispersive X-ray spectroscopy (EDX), transmission electron microscopy (TEM), high-resolution transmission electron microscopy (HR-TEM), selected area electron diffraction (SAED), Fourier transform infrared spectroscopy (FTIR), Raman and ultraviolet–visible (UV–Vis) spectroscopy, and X-ray photoelectron spectroscopy (XPS). The results confirmed the formation of a single-phase spinel structure and revealed polyhedral nanoparticles with high aggregation tendency. The potential application of the obtained aluminates as a pigments was evaluated using CIELab color parameters. The study highlights that the use of plant-based extract serves as a valuable tool to synthesize materials for high-performance blue pigments in ceramics and coatings.

References

1. S. Dhahri, H. Shall, N. Thabet Mliki, Inorg. Chem. Commun. 168 (2024) 112872.
2. H. Hussein, S.S. Ibrahim, S.A. Khairy, J. Water Process Eng. 76 (2025) 107893.
3. N.T. Hien, N.T. Kien, V.H. Yen, T. Ngoc, P.V. Do, V.X. Phuc, N.X. Ca, Nanoscale Adv. 6 (2024) 5598.

EFFECTS OF THE KETOGENIC DIET ON MICROBIOTA COMPOSITION AND SHORT-CHAIN FATTY ACIDS IN OBESITY

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ABSTRACT

As an environmental factor, the gut microbiome has a role in obesity. The gut microbiota ferments carbohydrates that escape digestion in the small intestine into short-chain fatty acids (SCFAs), namely propionate, butyrate and acetate in the colon. The composition of the gut bacteria is thought to influence the quantity of energy harvested. At the same time, ketogenic diet is low in carbohydrate, moderate in protein and high in fats. It forces the body to burn fats rather than carbohydrates. It attempts to imitate fasting which actually fasting. However, in recent years it has become clear that this diet and the gut microbiota interact with which another and thus influence obesity. The goal of this review is to summarize the current state of knowledge regarding the metabolic effects of the ketogenic diet on microbiota composition and the role of SCFAs in management of obesity [1,2].

The ketogenic diet has gained popularity as a method to reduce weight, by inducing a metabolic switch towards fat oxidation which can subsequently reduce hunger by the production of ketone bodies. It tends to decrease the level of *Bifidobacterium* through ketone bodies, one of the most important being beta-hydroxybutyrate. As result, proinflammatory Th17 cells decrease in visceral and intestinal fat. This is an important finding as insulin resistance and obesity are characterized by low-grade inflammation and reducing Th17 cells may help in reversing this process [2].

Another study reports that the microbiota associated with obesity increases the ability to obtain energy from the diet, and the increase in the *Firmicutes/Bacteroidetes* ratio in the microbiota was associated with an obese phenotype. In obese individuals there was a reduction in *Bifidobacterium* level compared to healthy individuals, suggesting a possible inverse association between *Bifidobacterium* and obesity. Bacteria from *Bacteroidetes* produces SCFAs, mainly butyrate and propionate, which may perform an important role in obesity. Additionally, SCFAs can avoid digestion in the small intestine and be an additional energy source. The ketogenic diet tends to decrease *Bifidobacterium* level, which in turn decrease SCFAs. SCFAs stimulate the release of key gut hormones involved in satiety, such as GLP-1 (glucagon like peptide 1) and PYY (peptide YY). These hormones reduce food intake, enhance insulin sensitivity and improve glucose homeostasis. SCFAs suppress pro-inflammatory cytokines (IL-6, TNF-alfa) and inhibit NF-κB, mitigating the low-grade inflammation asociated with obesity. Additionally, they promote hepatic and muscular fatty acid oxidation, contributing to reduced fat mass [2,3].

In conclusion, the ketogenic diet induces profound shifts in gut microbiota, leading to reduced production of butyrate and propionate while increasing the abundace of mucin-degrading bacteria. Although this alteration decreases total SCFAs output, it enhances metabolic flexibility, insulin sensitivity and lipid oxidation. These adaptations contribute to weight loss and improved metabolic profiles in obese individuals. However, the long-term reduction of SCFAs-producing taxa may compromise intestinal barrier integrity and anti-inflammatory protection, emphasizing the need for dietary strategies that combine ketogenic principles with prebiotic fiber support to sustain microbiome [3].

References

1. Baylie, T. et al. (2024) Effect of Ketogenic Diet on Obesity and Other Metabolic Disorders: Narrative Review, *Diabetes, Metabolic Syndrome and Obesity*, 17, pp. 1391–1401. Available at: https://doi.org/10.2147/DMSO.S447659.
2. Attaye, I. et al. (2022) The role of the gut microbiota on the beneficial effects of ketogenic diets, *Nutrients*, 14(1). Available at: https://doi.org/10.3390/nu14010191.
3. M. Güzey Akansel et al. (2024) Effects of the Ketogenic Diet on Microbiota Composition and Short-Chain Fatty Acids in Women with Overweight/Obesity, *Nutrients*, Vol. 16, no. 24. Available at: https://doi.org /10.3390/nu16244374.

COMPENSATORY HYPERINSULINEMIA: MOLECULAR CONSEQUENCES ON HEPATIC AND MUSCULAR METABOLISM

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ABSTRACT

In recent decades, the incidence of metabolic disorders has increased considerably, primarily due to significant lifestyle changes that have profoundly altered dietary habits. Consequently, individuals, constrained by a lack of time and exposed to chronic stress, tend to consume a greater proportion of refined carbohydrates. These carbohydrates, characterized by a monomeric or dimeric chemical structure, are readily hydrolyzed, rapidly absorbed, and exhibit a strong propensity to participate in redox reactions, forming phosphorylated derivatives involved in energy metabolism [1,2]. As a result of their rapid absorption, postprandial blood glucose levels rise, prompting the pancreas to secrete excessive amounts of insulin as a compensatory mechanism aimed at normalizing glycemia. Although compensatory hyperinsulinemia initially counteracts hyperglycemia, over time it induces disturbances in insulin signaling pathways, thereby creating a vicious cycle with detrimental consequences for hepatic function and overall metabolism [3].

Simple carbohydrates induce recurrent glycemic spikes that stimulate insulin secretion from pancreatic β-cells through ATP/ADP-dependent mechanisms and K^+-ATP channel modulation. The increased reactivity of β-cells enhances INS gene expression and, over time, leads to β-cell exhaustion, as well as alterations in the expression of key pancreatic transcription factors [4]. Hyperinsulinemia repeatedly activates the IRS–PI3K–Akt metabolic pathway, resulting in excessive Akt phosphorylation and subsequent activation of mTORC1 and SREBP-1c. Gluconeogenesis is transiently inhibited through suppression of FOXO1 activity [5]. However, abnormal serine phosphorylation occurs, which disrupts insulin signal transduction, thereby reducing the activation of PI3K and Akt. The consequence is insufficient glucose uptake by skeletal muscle and uncontrolled hepatic lipogenesis [6].

As a result, lipotoxicity and proteolysis develop, characterized by the accumulation of diacylglycerols (DAGs) and ceramides within muscle tissue, along with enhanced protein catabolism. These processes contribute to progressive loss of muscle mass and the long-term development of metabolic syndrome [7,8]. In adipose tissue, insulin fails to adequately inhibit lipolysis, leading to continuous release of free fatty acids (FFAs), which perpetuate a vicious cycle of insulin resistance [9].

Portal hyperinsulinemia increases CD36 expression through the activation of the transcription factor PPARγ, thereby promoting hepatic triglyceride synthesis and lipid accumulation in the liver, ultimately leading to the development of hepatic steatosis [10].

Triglycerides contribute to the activation of PKCε and serine phosphorylation of IRS-2, which reduces hepatic insulin sensitivity, further enhancing lipogenesis and disrupting the normal inhibition of gluconeogenesis [9].

In conclusion, compensatory hyperinsulinemia, although initially protective, becomes a central factor in the pathogenesis of systemic metabolic dysfunction, emphasizing the importance of nutritional and lifestyle interventions in preventing the progression of metabolic diseases.

Rerefences

1. Ludwig D.S., Hu FB, Tappy L,. Brand-Miller J. Dietary carbohydrates: role of quality and quantity in chronic disease. BMJ [Internet]. 2018 Jun 13 [cited 2025 Oct 26];361:2340. Available from: https://www.bmj.com/content/361/bmj.k2340.
2. Stanhope K.L. Sugar consumption, metabolic disease and obesity: The state of the controversy. Crit Rev Clin Lab Sci [Internet]. 2016 Jan 2 [cited 2025 Oct 26];53(1):52–67. Available from: https://pubmed.ncbi.nlm.nih.gov/26376619/.
3. Petersen M.C., Shulman G.I. Mechanisms of Insulin Action and Insulin Resistance. Physiol Rev [Internet]. 2018 Oct. 1 [cited 2025 Oct 1];98(4):2133. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC6170977/.
4. Galicia-Garcia U., Benito-Vicente A., Jebari S., Larrea-Sebal A., Siddiqi H., Uribe K.B. et al. Pathophysiology of Type 2 Diabetes Mellitus. Int J Mol Sci [Internet]. 2020 Sep. 1 [cited 2025 Oct. 23];21(17):1–34. Available from: https://pubmed.ncbi.nlm.nih.gov/32872570/.
5. Hotamisligil GS. Inflammation, metaflammation and immunometabolic disorders. Nature [Internet]. 2017 Feb 8 [cited 2025 Oct 26];542(7640):177–185. Available from: https://pubmed.ncbi.nlm.nih.gov/28179656/.
6. Luukkonen P.K., Zhou Y., Sädevirta S., Leivonen M., Arola J., Orešič M. et al. Hepatic ceramides dissociate steatosis and insulin resistance in patients with non-alcoholic fatty liver disease. J. Hepatol [Internet]. 2016 May 1 [cited 2025 Oct. 26];64(5):1167–1175. Available from: https://pubmed.ncbi.nlm.nih.gov/26780287/.
7. Petersen M.C., Shulman G.I. Mechanisms of Insulin Action and Insulin Resistance. Physiol Rev [Internet]. 2018 Oct. 1 [cited 2025 Sep. 28]; 98(4):2133–223. Available from: https://pubmed.ncbi.nlm.nih.gov/30067154/.
8. Rozance P.J., Jones A.K., Bourque S.L., D'Alessandro A., Hay W.W., Brown L.D. et al. Effects of chronic hyperinsulinemia on metabolic pathways and insulin signaling in the fetal liver. Am J Physiol Endocrinol Metab [Internet]. 2020 Oct. 1 [cited 2025 Oct 26];319(4):E721–33. Available from: https://pubmed.ncbi.nlm.nih.gov/32830555/.
9. Softic S., Cohen D.E., Kahn C.R. Role of Dietary Fructose and Hepatic De Novo Lipogenesis in Fatty Liver Disease. Dig Dis Sci [Internet]. 2016 May 1 [cited 2025 Oct 23];61(5):1282–93. Available from: https://pubmed.ncbi.nlm.nih.gov/26856717/.
10. Steneberg P., Sykaras A.G., Backlund F., Straseviciene J., Söderström I., Edlund H. Hyperinsulinemia Enhances Hepatic Expression of the Fatty Acid Transporter Cd36 and Provokes Hepatosteatosis and Hepatic Insulin Resistance. J. Biol Chem [Internet]. 2015 Jul 31 [cited 2025 Oct. 23];290(31):19034. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4521028/.

SMART BIOMATERIALS' POTENTIAL APPLICATIONS IN TISSUE ENGINEERING

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ABSTRACT

The purpose of this study is to highlight the growing improvements of smart biomaterials and new medical devices.

Despite the multitude of available options, new medical devices incorporating unique biomaterials and advanced technologies are in high demand for wound therapy and skin regeneration. Bioglasses are bioactive and biocompatible materials that can interact with living systems. They have an important function in skin regeneration by stimulating fibroblast proliferation, collagen formation, angiogenesis, and resisting antimicrobial action. Since their introduction, a number of formulations have been proposed based on clinical objectives.According to recent study, bioactive glasses (BGs) are an appropriate material for the development of innovative wound dressings. Retinal illnesses are among the most recent challenges that must be addressed using biomaterials. Cerium oxide nanoparticles, also known as nanoceria, have recently gained prominence because to their exceptional activity and regeneration antioxidant qualities in a number of conditions, including eye disorders.

Topical eye drops are the most accessible and preferred technique of ocular delivery. Developing a topical eye drop containing nanoceria may lead to clinical success, however nanoceria's poor aqueous solubility and corneal penetration restrict its development.

Nanoceria are "pan-disease" effective, shielding cells and tissues against ROS damage in a wide range of pathological conditions, including retinal disease.

Several studies have shown that nanoceria are safe, biocompatible, and well tolerated by retinas, but have a negative impact on retinal structure and function.

Furthermore, as data is being collected regarding nanoceria and retinal disease, some challenge arise that need to be addressed in order to fully achieve these materials' potential.

References

1. Rather, H.A., Thakore, R., Singh, R., Jhala, D., Singh, S., Vasita, R. Antioxidative study of Cerium Oxide nanoparticle functionalised PCL-Gelatin electrospun fibers for wound healing application. *Bioact. Mater.* 2018, 3, 201–211.
2. Ma, X.; Cheng, Y.; Jian, H.; Feng, Y.; Chang, Y.; Zheng, R.; Wu, X.; Wang, L.; Li, X.; Zhang, H. Hollow, Rough, and Nitric Oxide-Releasing Cerium Oxide Nanoparticles for Promoting Multiple Stages of Wound Healing. *Adv. Healthc. Mater.* 2019, 8, 1900256.
3. Wu, H., Li, F., Wang, S., Lu, J., Li, J., Du, Y., Sun, X., Chen, X., Gao, J., Ling, D. Ceria nanocrystals decorated mesoporous silica nanoparticle based ROS-scavenging tissue adhesive for highly efficient regenerative wound healing. *Biomaterials* 2018, 151, 66–77.

DYSFUNCTION OF THE GLUTATION-GLUTATION PEROXIDASE 4 ANTIOXIDANT SYSTEM MEDIATED BY p53 AND ITS IMPACT ON NEURONAL FERROPTOSIS IN AGING

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ABSTRACT

Brain aging is a biological and inevitable process characterized by the accumulation of molecular and cellular damage throughout life. At the cerebral level, these changes contribute to a decline in cognitive, motor, and sensory functions, affecting the brain's ability to function optimally and independently [2,11].

An essential process that induces aging in neuronal cells is **ferroptosis**. Ferroptosis is a form of non-apoptotic, Fe-dependent programmed cell death, characterized by the accumulation of lipid hydroperoxides and intense oxidative stress that lead to neuronal membrane destruction and cell death [1,5]. This process is driven by three interconnected mechanisms. The first involves an increase in the concentration of intracellular free Fe, which promotes the formation of free radicals through oxidative reactions. The second mechanism involves the depletion of antioxidant systems, particularly of the reduced glutathione (GSH) system, through inhibition of glutathione peroxidase 4 (GPX4) activity and dysfunction of the system xc^-. The third factor represents the peroxidation of polyunsaturated fatty acids in the cell membrane, compromising their integrity and leading to cell death [6].

As mentioned earlier, during the induction of ferroptosis in neuronal cells, a key role is played by the depletion of the glutathione antioxidant system. The **xc^-–GSH–GPX4 pathway** is one of the most important mechanisms involved in protection against oxidative damage caused by excessive accumulation of reactive oxygen species (ROS). The xc^- system is a heterodimeric amino acid antiporter composed of two subunits: the solute carrier family 7 member 11 (SLC7A11) and the solute carrier family 3 member 2 (SLC3A2). Under oxidative stress conditions, it ensures the exchange of cystine and glutamate across the membrane [4]. Cystine is converted into cysteine, an essential precursor for GSH synthesis. GSH functions as a cofactor for GPX4, a selenoenzyme responsible for neutralizing lipid hydroperoxides, thereby maintaining membrane integrity [7].

A factor that induces ferroptosis by regulating antioxidant factors is the **tumor suppressor** protein **p53**. A key role of p53 is the reduction of mRNA expression responsible for SLC7A11 protein synthesis, thus compromising the xc^- channel function, reducing the cystine uptake, and causing a significant decrease in GSH and GPX4 levels. This leads to the accumulation of toxic lipid peroxides, membrane damage, and cell death via ferroptosis [10]. Besides its action on the xc^- system, p53 can induce ferroptosis by regulating the synthesis of the enzymes **glutaminase 2 (GLS2)** and **spermidine/spermine N1-acetyltransferase 1 (SAT1)**. p53 can directly bind to the promoter region of GLS2 and induce its transcription. GLS2 is a

mitochondrial glutaminase involved in the glutaminolysis of glutamine to glutamate. In the absence of cystine import due to xc^- dysfunction, GSH synthesis does not occur, reducing cellular antioxidant capacity. The excessive accumulated glutamate is converted to α-ketoglutarate, which stimulates mitochondrial metabolism and leads to ROS and lipid peroxide accumulation, promoting ferroptosis [3,8].

Another mechanism through which the transcription factor p53 induces ferroptosis is the **spermidine/spermine N1-acetyltransferase 1 -** 15-lipoxygenase **(SAT1–ALOX15) pathway**, involved in enzymatic peroxidation. Under cellular stress, p53 activates SAT1. SAT1 activation, in turn, increases the expression of 15-lipoxygenase (ALOX15), an enzyme from the lipoxygenase (LOX) family that catalyzes the peroxidation of polyunsaturated fatty acids (PUFAs), particularly arachidonic acid, generating toxic lipid peroxides (L-OOH). These oxidized compounds (L-OOH) accumulate in cell membranes, causing irreversible damage and initiating ferroptosis, especially when antioxidant enzymes such as GPX4 are depleted and cannot provide cellular protection [9,12].

In conclusion, during neuronal aging, dysfunction of the GSH–GPX4 antioxidant axis, amplified by p53 activation, promotes ferroptosis through the accumulation of toxic lipid peroxides. By inhibiting the xc^- system and activating GLS2 and SAT1 genes, p53 enhances oxidative stress and cell death. In this context, targeting the molecular pathways involved in ferroptosis regulation – such as reactivating GPX4, supplementing with antioxidants, or controlled inhibition of p53 – represents promising directions for developing neuroprotective therapies for age-related degenerative diseases.

References

1. Abigail Weiland1, Yamei Wang2, Weihua Wu2, Xi Lan1, Xiaoning Han1, Qian Li2, 3, and Jian Wang1. Ferroptosis and its Role in Diverse Brain Diseases. *Physiology & behavior*. 2017. Vol. 176, no. 1, pp. 139–148. DOI 10.1007/s12035-018-1403-3.Ferroptosis.
2. Gaspar-Silva, Filipa, Trigo, Diogo et al. Ageing in the brain: mechanisms and rejuvenating strategies. *Cellular and Molecular Life Sciences*. 2023. Vol. 80, no. 7, pp. 1–21. DOI 10.1007/s00018-023-04832-6.
3. Hirschhorn, Tal, Stockwell, Brent R. The Development of the Concept of Ferroptosis. 2020. pp. 130–143. DOI 10.1016/j.freeradbiomed.2018.09.043.The.
4. Li, Feng Jiao, Long, Hui Zhi et al. System Xc−/GSH/GPX4 axis: An important antioxidant system for the ferroptosis in drug-resistant solid tumor therapy. *Frontiers in Pharmacology*. 2022. Vol. 13, no. August, pp. 1–26. DOI 10.3389/fphar.2022.910292.
5. Li, Yuyao, Xiao, Dongqiong et al. The emerging roles of ferroptosis in cells of the central nervous system. *Frontiers in Neuroscience*. 2022. Vol. 16, no. December, pp. 1–15. DOI 10.3389/fnins.2022.1032140.
6. Li, Zihao, Zhang, Ye et al. Biomedicine & Pharmacotherapy Targeting ferroptosis in neuroimmune and neurodegenerative disorders for the development of novel therapeutics. *Biomedicine & Pharmacotherapy*. 2024. Vol. 176, no. March, p. 116777. DOI 10.1016/j.biopha.2024.116777.
7. Li, Zihao, Zhang, Ye et al. Targeting ferroptosis in neuroimmune and neurodegenerative disorders for the development of novel therapeutics. *Biomedicine and Pharmacotherapy*. 2024. Vol. 176, no. March, p. 116777. DOI 10.1016/j.biopha.2024.116777.
8. Minghui Gao1, Prashant Monian1, Nosirudeen Quadri2, Ravichandran Ramasamy2, and Xuejun Jiang1. Glutaminolysis and Transferrin Regulate Ferroptosis Minghui. *Physiology & behavior*. 2017. Vol. 176, no. 10, pp. 139–148. DOI 10.1016/j.molcel.2015.06.011.Glutaminolysis.
9. Ou, Mengmeng, Jiang, Ying et al. Role and mechanism of ferroptosis in neurological diseases. *Molecular Metabolism*. 2022. Vol. 61, no. April, p. 101502. DOI 10.1016/j.molmet.2022.101502.
10. Teng, Pang-ning, Bateman, Nicholas W. et al. Ferroptosis as a P53 mediated activity during tumor suppression. *Nature*. 2015. Vol. 136, no. 3, pp. 554–561. DOI 10.1038/nature14344.Ferroptosis.
11. Wrigglesworth, Jo, Ward, Phillip et al. Factors associated with brain ageing - a systematic review. *BMC Neurology*. 2021. Vol. 21, no. 1. DOI 10.1186/s12883-021-02331-4.
12. Yang, Huihuang, Li, Yingmin et al. SAT1/ALOX15 Signaling Pathway Is Involved in Ferroptosis After Skeletal Muscle Contusion. *International Journal of Molecular Sciences*. 2024. Vol. 25, no. 20, pp. 1–15. DOI 10.3390/ijms252011317.

THE HEDGEHOG MOLECULAR SIGNALING PATHWAY AND ITS ROLE IN THE INITIATION OF CERTAIN TYPES OF CANCER

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ABSTRACT

The **Hedgehog (HH) signaling pathway** represents a complex network of ligands that coordinate embryonic development, cellular differentiation, and the maintenance of tissue homeostasis. Dysregulation of this pathway is closely associated with the initiation and progression of multiple cancers, including **basal cell carcinoma, medulloblastoma and pancreatic cancer** [1,2,7]. HH signaling can proceed through two main mechanisms: **canonical** and **non-canonical.**

In the canonical pathway, activation begins with the interaction of HH ligands – Sonic (SHH), Desert (DHH), and Indian (IHH) – with the Patched (PTCH) receptor, which, in its inactive state, suppresses the activity of the G-protein-coupled 7-transmembrane protein Smoothened (SMO). Upon ligand binding to PTCH1, this inhibition is relieved, allowing SMO to become activated and translocate into the primary cilium, where it triggers a sequential signaling cascade involving the Suppressor of Fused (SUFU), kinesin-like protein Kif7, protein kinase A (PKA), and cyclic adenosine monophosphate (cAMP). In vertebrates, HH signaling is entirely dependent on the presence of a highly specialized cellular organelle – the primary cilium — which serves as the essential platform for SMO activation and GLI processing. This cascade leads to the activation of glioma-associated oncogene (GLI) transcription factors. These activated GLI proteins migrate to the nucleus and induce transcription of target genes involved in cell cycle regulation, proliferation, and survival. Aberrant GLI activation promotes uncontrolled cell division, resistance to apoptosis, and maintenance of stem-like characteristics, driving malignant transformation. Cancers driven by canonical HH signaling include basal cell carcinoma, medulloblastoma, small-cell lung carcinoma, and pancreatic ductal adenocarcinoma [4,5,8,13].

Non-canonical HH activation can occur independently of HH ligands or SMO activity, through either SMO-dependent or SMO-independent routes, including direct activation of GLI proteins or crosstalk with other signaling cascades. This mechanism has been implicated in **esophageal adenocarcinoma, glioblastoma, squamous cell lung carcinoma,** and **malignant rhabdoid tumors** [6,7].

Investigations into the molecular basis of HH signaling have led to the development of **SMO inhibitors,** such as *Vismodegib* and *Sonidegib*, which are approved for the treatment of **basal cell carcinoma.** Nevertheless, clinical outcomes remain limited due to the emergence of **drug resistance**, resulting from mutations in SMO or other pathway components, activation of non-canonical signaling routes, and loss of primary cilium [10,11,12].

In conclusion, dysregulation of HH signaling is strongly associated with the initiation and dissemination of various malignant tumors, making it one of the most promising targets in modern anticancer therapy. To date, several drugs such as vismodegib and sonidegib have been developed to block key components of this pathway, and some have already received clinical approval. Nevertheless, the efficacy and safety of most HH inhibitors remain a matter of debate. Consequently, further comprehensive studies on the mechanisms of HH pathway inhibition are essential for improving therapeutic efficacy and developing new clinical strategies for cancer treatment.

References

1. Teglund S., Toftgård R. Hedgehog beyond medulloblastoma and basal cell carcinoma. Biochim. Biophys. Acta. 2010;1805:181–208. doi: 10.1016/j.bbcan.2010.01.003.
2. Briscoe J., Thérond P.P. The mechanisms of Hedgehog signalling and its roles in development and disease. Nat. Rev. Mol. Cell Biol. 2013;14:416–429. doi: 10.1038/nrm3598.
3. Dusek O.C., Hadden M.K. Targeting the GLI family of transcription factors for the development of anti-cancer drugs. Expert Opin. Drug Discov. 2020;16:289–302. doi: 10.1080/17460441.2021.1832078.
4. Teglund S., Toftgård R. Hedgehog beyond medulloblastoma and basal cell carcinoma. Biochim. Biophys. Acta. 2010;1805:181–208. doi: 10.1016/j.bbcan.2010.01.003.
5. Pietrobono S, Gagliardi S, Stecca B. Non-canonical Hedgehog Signaling Pathway in Cancer: Activation of GLI Transcription Factors Beyond Smoothened. Front Genet. 2019;10:556. Epub 2019/06/28. doi: 10.3389/fgene.2019.00556.
6. Shevde L.A., Samant R.S. Nonclassical hedgehog-gli signaling and its clinical implications. Int. J. Cancer. 2013;135:1–6. doi: 10.1002/ijc.28424.
7. Wang Y., Ding Q., Yen C.-J., Xia W., Izzo J.G., Lang J.-Y., Li C.-W., Hsu J.L., Miller S.A., Wang X. et al. The Crosstalk of mTOR/S6K1 and Hedgehog Pathways. Cancer Cell. 2012;21:374–387. doi: 10.1016/j.ccr.2011.12.028.
8. Kumari, S., Mitra, A. & Bulusu, G. Structural dynamics of Smoothened (SMO) in the ciliary membrane and its interaction with membrane lipids. *Biochim. Biophys. Acta Biomembr.*1864, 183946 (2022).
9. 195.Gruber Filbin M., Dabral S.K., Pazyra-Murphy M.F., Ramkissoon S., Kung A.L., Pak E., Chung J., Theisen M.A., Sun Y., Franchetti Y. et al. Coordinate activation of Shh and PI3K signaling in PTEN-deficient glioblastoma: New therapeutic opportunities. Nat. Med. 2013;19:1518–1523. doi: 10.1038/nm.3328.
10. Axelson, M. et al. U.S. Food and Drug Administration approval: vismodegib for recurrent, locally advanced, or metastatic basal cell carcinoma. *Clin. Cancer Res.*19, 2289–2293 (2013).
11. Burness, C. Sonidegib: first global approval. *Drugs*75, 1559–1566 (2015).
12. Sharma, U. et al. Role of Hedgehog and Hippo signaling pathways in cancer: a special focus on non-coding RNAs. *Pharmacol. Res.*186, 106523 (2022).
13. Bangs F. et al. *Primary Cilia and Mammalian Hedgehog Signaling.* Developmental Biology. 2017.

ANTIBACTERIAL ACTIVITY OF 3*D* METAL COMPLEXES WITH 3-(MORPHOLIN-4-YL)PROPANE-2,3-DIONE 4-PHENYLTHIOSEMICARBAZONE AGAINST *BACILLUS CEREUS*

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ABSTRACT

Bacillus cereus is a Gram-positive, spore-forming bacterium responsible for foodborne intoxications and various opportunistic infections. The increasing resistance of *B. cereus* to commonly used antibiotics represents a serious public health concern. Therefore, the synthesis and investigation of new antibacterial agents are essential to identify compounds with enhanced activity and novel mechanisms of action. Such studies contribute to the development of effective alternatives to conventional antibiotics and help combat the growing problem of antimicrobial resistance.

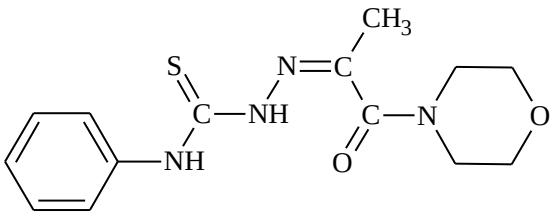

Figure 1. The structure of HL.

The aim of this study was to investigate the antibacterial activity of 3*d* metal complexes with 3-(morpholin-4-yl)propane-2,3-dione 4-phenylthiosemicarbazone (HL) (Fig. 1) against *Bacillus cereus* (ATCC 11778). For this purpose, 4-phenylthiosemicarbazone was first synthesized via the condensation reaction between 3-(morpholin-4-yl)propane-2,3-dione and 4-phenylthiosemicarbazide in ethanol at a 1:1 molar ratio. The obtained compound was characterized using ^{1}H, ^{13}C NMR and FTIR spectroscopy to confirm its structure and purity. Subsequently, a series of 3*d* metal complexes were synthesized by reacting the corresponding metal salts with 4-phenylthiosemicarbazone in a 1:2 molar ratio in hot ethanol. As a result, the following complexes were obtained: $[Zn(L)_2]$, $[Ni(HL)_2](NO_3)_2$, $[Co(L)_2]NO_3$, $[Co(L)_2]Cl$, $[Fe(L)_2]NO_3$. The synthesized compounds were studied using FTIR spectroscopy, elemental analysis, and molar conductivity measurements.

The results of the antibacterial tests revealed that all synthesized metal complexes exhibited higher antibacterial activity than the thiosemicarbazone ligand. The cobalt complexes demonstrated the strongest activity, and the nature of the counterion did not influence the antibacterial effect – both cobalt complexes showed comparable activity values of MIC 31.25 µg/mL and MBC 62.50 µg/mL.

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SYNTHESIS AND ANTIFUNGAL ACTIVITY OF 2-BENZOYLPYRIDINE 4-NORBORNYLTHIOSEMICARBAZONE AND ITS 3*d* METAL COMPLEXES

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ABSTRACT

Candida albicans is one of the most common opportunistic fungal pathogens in humans, responsible for a wide range of infections from superficial mucosal candidiasis to severe systemic infections, particularly in immunocompromised individuals. The growing resistance of *C. albicans* to conventional antifungal drugs such as azoles and echinocandins represents a major global health concern. This increasing resistance, combined with the limited number of effective antifungal agents available, highlights the urgent need to develop new compounds with improved efficacy and lower toxicity. Therefore, the synthesis and investigation of novel antifungal agents, including metal-based complexes and thiosemicarbazone derivatives, represent a promising direction in the search for alternative therapeutic strategies against *Candida albicans* infections.

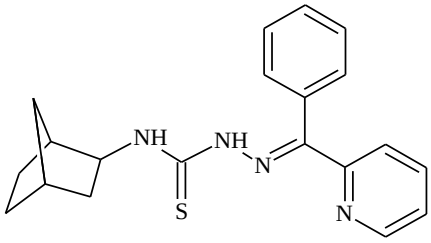

Figure 1. The structure of HL.

The aim of this study was to synthesize and investigate the antifungal activity of several 3*d* metal complexes with 2-benzoylpyridine 4-norbornylthiosemicarbazone (HL) (Fig. 1) against *Candida albicans* (ATCC 10231). The ligand was first synthesized by the condensation reaction between 2-benzoylpyridine and 4-norbornylthiosemicarbazide in ethanol, in a 1:1 molar ratio. The structure and purity of the obtained ligand were confirmed by ^{1}H, ^{13}C NMR and FTIR spectroscopy. Metal complexes were then prepared by reacting the corresponding metal salts with the HL in a 1:2 molar ratio in ethanol. As a result, the following complexes were obtained: $[Ni(HL)_2](NO_3)_2$, $[Fe(L)_2]NO_3$, $[Co(L)_2]NO_3$. All synthesized compounds were characterized using FTIR spectroscopy, elemental analysis, and molar conductivity measurements.

The evaluation of antifungal activity revealed that coordination of the ligand to the metal atoms enhanced its biological effectiveness, with all metal complexes showing higher antifungal activity than the ligand. The cobalt complex exhibited the strongest antifungal effect, with activity values of MIC 15.60 µg/mL and MBC 31.20 µg/mL.

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THE ROLE OF SIRTUINS IN MOLECULAR ANTI-AGING MECHANISMS: BIOCHEMICAL AND THERAPEUTIC PERSPECTIVES

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ABSTRACT

Aging is a progressive biological process characterized by a gradual decline in cellular and organ function, accompanied by oxidative stress, mitochondrial dysfunction, and cumulative DNA damage. Recent findings have identified sirtuins (SIRT1–SIRT7), a family of NAD^+-dependent deacetylases, as master regulators of longevity and energy metabolism. These enzymes modulate multiple signalling cascades responsible for DNA repair, apoptosis, and antioxidant defence, thereby contributing to cellular resilience and homeostasis [1].

The results demonstrate that SIRT1 regulates transcription factors such as Forkhead box O proteins (FOXO), *nuclear factor kappa B* (NF-κB,) and p53 tumor suppressor protein, influencing gene expression related to apoptosis, oxidative stress, and inflammation. SIRT3 deacetylates mitochondrial enzymes, enhancing respiratory efficiency and reducing reactive oxygen species production, while SIRT6 contributes to genomic stability through histone modification and chromatin remodelling. SIRT7 has been linked to ribosomal biogenesis and cellular stress adaptation, highlighting the interconnection between sirtuins and cellular longevity [3]. Natural polyphenols such as resveratrol, fisetin, and quercetin have been shown to activate sirtuin signalling, mimicking the beneficial effects of caloric restriction. Their activity enhances autophagy, decreases pro-inflammatory cytokines, including interleukin-6 (IL-6) and tumor necrosis factor -α (TNF-α), and delays senescence by improving mitochondrial biogenesis and oxidative defence mechanisms [1,2].

Importantly, emerging evidence suggests that sirtuin modulation extends beyond isolated enzyme activation to encompass interplay with NAD^+ metabolism, epigenetic regulation and non-coding RNA circuits. For example, ageing-related decline in NAD^+ availability impairs sirtuin activity and thereby undermines the maintenance of chromatin architecture and DNA repair fidelity. Moreover, genetic variants in sirtuin genes (for instance SIRT3 or SIRT6) correlate with cardiovascular risk and longevity outcomes, underscoring the clinical relevance of these pathways [4,5].

In conclusion, sirtuins represent fundamental components of the molecular network governing aging, stress resistance, and longevity. Their pharmacological activation offers a promising strategy for the prevention of neurodegenerative, cardiovascular, metabolic, and oncological disorders. Modulating these pathways could significantly improve healthspan and quality of life, making sirtuins key targets in future anti-aging interventions [1,3].

References

1. Hwang, J.W. et al. Sirtuins and Aging: Molecular Mechanisms and Therapeutic Opportunities. Frontiers in Aging, 2023; 4: 112–124.
2. Singh, C.K., Chhabra, G., Ahmad, N. The Role of Sirtuins in Cellular Senescence and Longevity Regulation. Molecular Biology Reports, 2022; 49(12): 11847–11859.
3. Gomes, A.P., Price, N.L., Sinclair, D.A. Sirtuins as Therapeutic Targets in Aging and Disease. Nature Reviews Molecular Cell Biology, 2021; 22(3): 146–163.
4. Wu, Q.J. et al. The sirtuin family in health and disease. Signal Transduction and Targeted Therapy, 2022; 7: 289.
5. Zhao, L. et al. Sirtuins and their Biological Relevance in Aging and Age-Related Diseases. Aging and Disease, 2020; 11(4): 927–945.

GUT MICROBIOTA-DERIVED METABOLITES AS MOLECULAR REGULATORS OF APPETITE

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ABSTRACT

The gut microbiota forms a complex microecosystem that continuously interacts with its host. It influences appetite hormone secretion through metabolites and directly communicates with the central nervous system via neural pathways, thus regulating the host's feeding behavior [1]. Major microbial metabolites, such as short-chain fatty acids (SCFAs), bile acids, gamma-aminobutyric acid (GABA), indole derivatives, and branched-chain amino acids, act as signaling molecules involved in appetite regulation. These metabolites influence the secretion of the main hormones associated with the control of food intake, such as glucagon-like peptide-1 (GLP-1), peptide YY (PYY), ghrelin and leptin, and can act directly on hypothalamic neurons or through the vagus nerve, modulating food intake regulation and satiety signaling [2]. In this context, modulation of the microbiota represents a promising strategy for addressing appetite disorders and metabolic dysfunctions.

As complex carbohydrates such as dietary fiber, resistant starch, inulin, and oligosaccharides are fermented in the colon, they generate SCFAs (acetate, propionate, butyrate) that act as metabolic, immune, and signaling mediators. These SCFAs bind to G-protein-coupled receptors, for example, FFAR2 (GPR43) on intestinal L cells and FFAR3 (GPR41) on vagal fibers. Thus, propionate stimulates secretion of the satiety peptides PYY and GLP-1, through activation of FFAR2. In animal studies, systemic administration of acetate reduced food intake via a direct hypothalamic effect [3]. SCFAs also activate the vagal pathway: absence of the FFAR3 receptor on vagal nerves abolishes the anorexigenic effect of propionate. In addition, butyrate increases the excitability of vagal afferents and induces cholecystokinin (CCK) release, contributing to the sensation of satiety [4]. Similarly, intestinal microbiota transform primary bile acids into secondary derivatives that activate the TGR5 receptor on L cells and amplify postprandial GLP-1 secretion, strengthening the microbiota-gut-brain connection [5,6]. Through these processes, gut-derived SCFAs and bile acids influence gastrointestinal motility and satiety signaling by means of hormonal and neural pathways.

Other microbial metabolites extend appetite control to the central level. Indoles, metabolites of intestinal tryptophan, interact with the intestinal aryl hydrocarbon receptor (AhR) and can stimulate GLP-1 secretion. In parallel, indoles inhibit potassium channel activity in L cells, acutely enhancing the GLP-1 response, and over the long term may modulate intestinal serotonin synthesis [7]. Regarding amino acids, products of protein fermentation include branched-chain amino acids (leucine, valine, isoleucine) and tryptophan metabolites (serotonin, melatonin). Circulating leucine activates the hypothalamic mTOR pathway, signaling protein sufficiency, while tryptophan, the precursor of brain serotonin, regulates appetite and mood. Changes in the levels of these amino acids can affect insulin sensitivity and hypothalamic orexigenic signaling. Furthermore, GABA, a neurotransmitter produced by certain Lactobacillus species and other microbes, exerts orexigenic effects: microbial GABA suppresses peripheral secretion of satiety

hormones (PYY and GLP-1), favoring food intake. Recent studies have shown that enteral administration of GABA increases appetite and that variations in the GABA-producing microbiota lead to significant differences in feeding behavior [8].

In conclusion, current evidence strongly indicates that metabolites produced by the intestinal microbiota serve as key modulators of appetite regulation, acting through hormonal, neural, and metabolic pathways. Targeting these metabolites represents a promising approach for managing appetite-related disorders and obesity.

References

1. Yu M.., Yu B., Chen D. The effects of gut microbiota on appetite regulation and the underlying mechanisms. Gut Microbes. 2024; 16(1):2414796. doi:10.1080/19490976.2024.2414796.
2. Han H., Yi B., Zhong R., Wang M., Zhang S., Ma J. et al. From gut microbiota to host appetite: gut microbiota-derived metabolites as key regulators. Microbiome. 2021; 9(1):162. doi:10.1186/s40168-021-01093-y.
3. Mansuy-Aubert V., Ravussin Y. Short chain fatty acids: the messengers from down below. Front Neurosci. 2023; 1197759. doi:10.3389/fnins.2023.1197759.
4. Borgmann D., Ciglieri E., Biglari N., Brandt C., Cremer A.L., Backes H. et al. Gut-brain communication by distinct sensory neurons differently controls feeding and glucose metabolism. Cell Metab. 2021; 33(7):1466-1482.e7. doi:10.1016/j.cmet.2021.05.001.
5. Wang Q., Lin H., Shen C., Zhang M., Wang X., Yuan M. et al. Gut microbiota regulates postprandial GLP-1 response via ileal bile acid-TGR5 signaling. Gut Microbes. 2023; 15(2):2274124. doi:10.1080/19490976.2023.2274124.
6. Zeng Y., Wu Y., Zhang Q, Xiao X. Crosstalk between glucagon-like peptide 1 and gut microbiota in metabolic diseases. mBio. 2024; 15(1):e02032-23. doi:10.1128/mbio.02032-23.
7. Lou X., Li P., Luo X., Lei Z., Liu X., Liu Y. et al. Dietary patterns interfere with gut microbiota to combat obesity. Front Nutr. 2024; 11:1387394. doi:10.3389/fnut.2024.1387394.
8. Li S., Liu M., Han Y., Liu C., Cao S., Cui Y. et al. Gut microbiota-derived gamma-aminobutyric acid improves host appetite by inhibiting satiety hormone secretion. mSystems. 2024; 9(10):e01015-24. doi:10.1128/msystems.01015-24.

CYTOTOXIC EVALUATION OF NOVEL Cu(II) – SCHIFF BASE COMPLEXES DERIVED FROM *o*-VANILLIN AND AMINO ACIDS AGAINST HUMAN MELANOMA AND CERVICAL CANCER CELLS

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ABSTRACT

Metal-based compounds continue to play a crucial role in the development of novel anticancer agents, as transition metals can interact with biomolecules and influence key cellular processes. Copper, in particular, has emerged as a promising alternative to platinum drugs due to its lower toxicity and essential biological functions.

In this study, three novel mononuclear Cu(II) complexes with mixed ligands, [Cu(VTr)(Dp)], [Cu(VS)(Dp)]·(CH_3OH), and [Cu(VTyr)(Dp)], were synthesized and biologically investigated. The Schiff base ligands were obtained through condensation reactions between *o*-vanillin and the corresponding amino acids DL-tryptophan (VTr), L-serine (VS), and L-tyrosine (VTyr). These Schiff base ligands were subsequently used to prepare Cu(II) mixed-ligand complexes using 2,2'-dipyridylamine (Dp) as auxiliary ligand.

Their cytotoxic and potential antitumor activities were evaluated in human tumor cell lines A375 (melanoma) and HeLa (cervical carcinoma), and in non-tumor Lep-3 cells. Short-term assays (MTT test, Neutral Red uptake assay, Crystal Violet staining, double staining with acridine orange and propidium iodide, Scratch Test) and long-term 3D colony formation experiments revealed that all complexes reduced cell viability, growth, and migration in a concentration - and time-dependent manner. The most potent compound, Cu(VS)Dp, showed cytotoxicity comparable to or greater than that of cisplatin and oxaliplatin, indicating promising potential as a new antitumor agent.

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INNOVATIVE NANOPARTICLES BASED ON HUMAN SERUM ALBUMIN, WITH CO-ENCAPSULATED ACTIVE PRINCIPLES THAT HAVE SYNERGISTIC EFFECTS AND CAN OVERCOME THE BLOOD-BRAIN BARRIER.

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ABSTRACT

Crossing the blood-brain barrier (BBB), the most impermeable physiological barrier in the human body, remains a significant challenge for those working to treat central nervous system diseases, especially brain cancers such as glioblastoma. The most promising approach identified so far involves developing nanocarriers that can cross the blood–brain barrier (BBB) via functionalization, enabling them to bind to receptors on the BBB or to be taken up by nutrient transporters. These mechanisms facilitate their passage into the brain and subsequent accumulation in the tumor, where the encapsulated drugs are released in a controlled and sustained manner [1]. This study presents a targeted therapy for glioblastoma by enhancing nanomedicine through the development and testing of self-assembled human serum albumin nanocarriers. These carriers are modified with low-molecular-weight protamine (LMWP) to improve their ability to cross the BBB. The nanocarriers are designed to co-encapsulate curcumin (Cc) and temozolomide (TMZ) for targeted delivery to brain tumors. To enhance their structural integrity, they were subsequently cross-linked with oxidized gellan (OG). The synthesized nanocarriers facilitated the co-encapsulation of Cc and TMZ, which have complementary therapeutic effects. FT-IR and NMR spectroscopy confirmed the modification of HSA through the attachment of LMWP to the Cys34 residue's free SH group.

Additionally, the reduction of disulfide bonds from HSA using β-mercaptoethanol facilitated hydrophobic interactions between the active principles and the exposed hydrophobic domain of HSA, leading to the formation of self-assembled nanoparticles with sizes smaller than 200 nm. FT-IR spectroscopy also confirmed the formation of Schiff bases between the NH_2 groups of HSA and the CHO groups of OG. Release studies showed a more effective release of TMZ at pH 4 and Cc at pH 7.4. *In vitro* tests demonstrated higher cytotoxicity against the C6 tumor cell line than against the VT-79 normal cell line after treatment with nanoparticles encapsulating TMZ and Cc. An increase in antioxidant activity was

observed for the encapsulated curcumin compared with free curcumin. Tests using an artificial membrane that simulates the BBB (PAMPA-BBB) showed that HSA-LMWP nanoparticles can cross the BBB, with enhanced permeability observed for formulations containing both co-encapsulated active principles.

References

1. Tincu, C.E., Andrițoiu, C.V., Popa, M., Ochiuz, L. Recent Advancements and Strategies for Overcoming the Blood-Brain Barrier Using Albumin-Based Drug Delivery Systems to Treat Brain Cancer, with a Focus on Glioblastoma. *Polymers* 2023, 15, 3969. https://doi.org/10.3390/polym15193969Reference.

INTEGRATING NANOTECHNOLOGY AND NATURAL COMPOUNDS IN ALTERNATIVE APPROACHES FOR THYROID DISORDERS

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ABSTRACT

Thyroid diseases are a major part of the world's endocrine pathology and they need new techniques to solve the problems that current diagnostic and treatment methods face. The field of nanotechnology has made remarkable progress in the understanding and treatment of endocrine diseases by facilitating targeted delivery, better bioavailability, and combined diagnostics and therapeutics application [1]. Curcumin and selenium have taken center stage as natural compounds that possess powerful antioxidant, anti-inflammatory, and antitumoral effects [2–4]. Nano-encapsulation of curcumin leads to its enhanced solubility, bioavailability, and controlled release, thus making it even more potent in modulating oxidative stress and apoptosis in thyroid tissue [5]. Selenium, a trace element that is vital for the synthesis of thyroid hormones, has been shown to have physiological benefits when delivered through nanoparticles, which improve systemic absorption and lower toxicity [3,6].

Nanomaterials are multi-functional platforms for the diagnosis and treatment of thyroid cancer, allowing for dual imaging and therapy (theranostic) [7,8]. Reports on the biocompatibility of selenium nanoparticles synthesized with green chemistry are paired with their potential in stress management [9]. The introduction of nanocomposites with medicinal plants has yielded good results in the treatment of endocrine disorders, bringing traditional medicine and modern nanomedicine closer together [10]. New drug delivery methods, such as long-circulating nanocapsules with a combination of therapeutic agents and radioisotopes, have been able to increase cytotoxicity and retain it in anaplastic thyroid carcinoma.

The conjunction of nanotechnology and bioactive natural compounds such as curcumin and selenium provides a potent substitute for thyroid disease treatment. The new method improves drug delivery, therapeutic selectivity, conventional and alternative medicine with evidence-based nanoplatforms. Research

on toxicology, pharmacokinetics, and clinical trials, among others, will continue to be critical in ensuring the safe introduction of these natural therapies powered by nano technology into the practice of endocrinology.

References

1. Yan Y., Cai H., Yang M. The Application of Nanotechnology for the Diagnosis and Treatment of Endocrine Disorders: A Review of Current Trends, Toxicology and Future Perspective. Int J Nanomedicine. 2024 Sep. 25;19:9921-9942. doi: 10.2147/IJN.S477835. PMID: 39345911; PMCID: PMC11439355.
2. Chen Y., Lu Y., Lee R.J., Xiang G. Nano Encapsulated Curcumin: And its Potential for Biomedical Applications. Int J Nanomedicine. 2020 May 1;15:3099-3120. doi: 10.2147/IJN.S210320. PMID: 32431504; PMCID: PMC7200256.
3. Au A., Mojadadi A., Shao J.Y., Ahmad G., Witting P.K. Physiological Benefits of Novel Selenium Delivery via Nanoparticles. Int J Mol. Sci. 2023 Mar. 23; 24(7):6068. doi: 10.3390/ijms24076068. PMID: 37047040; PMCID: PMC10094732.
4. Brtko J., Podoba J., Macejova D. Selenium – its role in physiology and endocrinology and as organoselenium compounds in oncology: A minireview. Endocr Regul. 2024 Nov. 21; 58(1):233–241. doi: 10.2478/enr-2024-0028. PMID: 39572874.
5. Shakeri F, Bibak B, Safdari M.R. et al. Cellular and Molecular Mechanisms of Curcumin in Thyroid Gland Disorders. *Curr Med Chem*. 2022; 29(16):2878–2890. doi:10.2174/0929867329666220210145033.
6. Mikhailova E.O. Selenium Nanoparticles: Green Synthesis and Biomedical Application. *Molecules*. 2023; 28(24):8125. Published 2023 Dec. 15. doi:10.3390/molecules28248125.
7. Li L., Wang Z., Guo H., Lin Q. Nanomaterials: a promising multimodal theranostics platform for thyroid cancer. *J Mater Chem B*. 2023; 11(32):7544–7566. Published 2023 Sep 6. doi:10.1039/d3tb01175e.
8. Fröhlich E., Wahl R. Nanoparticles: Promising Auxiliary Agents for Diagnosis and Therapy of Thyroid Cancers. *Cancers (Basel)*. 2021; 13(16):4063. Published 2021 Aug. 12. doi:10.3390/cancers13164063.
9. Al Zarzour R.H., Kamarulzaman E.E., Saqallah F.G., Zakaria F., Asif M., Abdul Razak K.N. Medicinal plants' proposed nanocomposites for the management of endocrine disorders. *Heliyon*. 2022; 8(9):e10665. Published 2022 Sep. 18. doi:10.1016/j.heliyon.2022.e10665.
10. Zhang L., Zhu C, Huang S. et al. Efficient delivery of anlotinib and radioiodine by long circulating nano-capsules for active enhanced suppression of anaplastic thyroid carcinoma. *J Nanobiotechnology*. 2025; 23(1):180. Published 2025 Mar. 6. doi:10.1186/s12951-025-03223-2.

4D PRINTING: SMART, ADAPTIVE SOLUTIONS FOR NEXT-GEN BIOMEDICAL ENGINEERING

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ABSTRACT

Recent advances in additive manufacturing have led to a paradigm shift from static 3D prints to dynamic, adaptive systems via four-dimensional (4D) printing. In 4D printing, time is a programmed dimension: printed structures change shape, properties, or function in response to external stimuli [1,2]. This approach employs stimuli-responsive smart biomaterials, such as shape-memory polymers, hydrogels, and composites, that react to cues like temperature, pH, light, or moisture [2,4]. Combined with advanced printing and design strategies, these materials enable constructs that self-assemble, self-repair, or undergo functional transformations over time [4,5]. Key fabrication strategies include gradient cross-linking, anisotropic architectures, and multi-material printing for controlled motion and adaptability [5,6].

In biomedical fields, 4D printing enables self-expanding stents, dynamic scaffolds, stimuli-triggered drug-release systems, and morphing implants [1,8]. In bone engineering, 4D-printed scaffolds adapt to defect geometries, promote osteogenic differentiation, and release growth factors [9]. Likewise, 4D-printed vascular constructs mimic the pulsatile mechanics of blood vessels and enhance vascularization [10]. Shape-memory biomaterials and hydrogels are crucial for creating adaptive scaffolds evolving with native tissues [6,9].

At the forefront of regenerative medicine, 4D bioprinting integrates cell-laden bioinks with programmable, stimuli-sensitive matrices to create constructs that self-organize or reshape in response to biological cues [7,10]. This spatial - temporal control - aided by multi-material designs and computational modeling - enhances natural tissue mimicry and supports adaptive biomedical devices [1,3,5].

Despite advances, challenges persist regarding material biocompatibility, dynamic cell–material interactions, scalability, and precise morphing control [3,6]. Developing multi-stimuli biomaterials, improving fidelity, and validating 4D constructs *in vivo* remain priorities.

In summary, 4D printing transforms static implants into adaptive systems. As smart materials and computational tools progress, it will drive next-generation regenerative medicine toward personalized, dynamic biomedical solutions [1,7].

Keywords: 4D bioprinting, smart biomaterials, regenerative medicine, tissue engineering, stimuli-responsive materials.

References

1. Yarali E., Mirzaali M.J., Ghalayaniesfahani A., Accardo A., Diaz-Payno P.J., Zadpoor A.A. 4D printing for biomedical applications. *Adv Mater*. 2024; 36(31):e2402301. doi:10.1002/adma.202402301.
2. Lui Y.S., Sow W.T., Tan L.P., Wu Y., Lai Y., Li H. 4D printing and stimuli-responsive materials in biomedical aspects. *Acta Biomater*. 2019; 92:19–36. doi:10.1016/j.actbio.2019.05.005.
3. Ashammakhi N., Ahadian S., Zengjie F., Suthiwanich K., Lorestani F., Orive G. et al. Advances and future perspectives in 4D bioprinting. *Biotechnol J*. 2018; 13(12):e1800148. doi:10.1002/biot.201800148.
4. Amukarimi S., Rezvani Z., Eghtesadi N., Mozafari M. Smart biomaterials: From 3D printing to 4D bioprinting. *Methods*. 2022; 205:191–199. doi:10.1016/j.ymeth.2022.07.006.
5. Wan X., Xiao Z., Tian Y., Chen M., Liu F., Wang D. et al. Recent advances in 4D printing of advanced materials and structures for functional applications. *Adv Mater*. 2024; 36(34):e2312263. doi:10.1002/adma.202312263.
6. Kumar D., Malviya R., Sridhar S.B., Wadhwa T., Talath S., Shareef J. Trends in 4D printed shape memory biomaterials for tissue engineering applications. *Curr Pharm Des.* 2025; 31(41):3285-3302. doi:10.2174/0113816128374450250502051929.
7. Abolhassani S., Fattahi R., Safshekan F., Saremi J., Hasanzadeh E. Advances in 4D bioprinting: The next frontier in regenerative medicine and tissue engineering applications. *Adv Healthc Mater*. 2025; 14(4):e2403065. doi:10.1002/adhm.202403065.
8. Zhou Z., Tang W., Yang J., Fan C. Application of 4D printing and bioprinting in cardiovascular tissue engineering. *Biomater Sci*. 2023; 11(19):6403-6420. doi:10.1039/d3bm00312d.
9. Wan Z., Zhang P., Liu Y., Lv L., Zhou Y. Four-dimensional bioprinting: Current developments and applications in bone tissue engineering. *Acta Biomater*. 2020; 101:26–42. doi:10.1016/j.actbio.2019.10.038.
10. Zeenat L., Zolfagharian A., Bera A.K., Adhikari J., Pati F. 4D bioprinting of self-forming tubular structures for enhanced vascular tissue engineering. *Int J Biol Macromol*. 2025; 324(Pt 2):147088. doi:10.1016/j.ijbiomac.2025.147088.

OPTIMISING THE PURIFICATION OF SCOBY NANOCELLULOSE FROM KOMBUCHA FERMENTATION TO BIOMATERIAL

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ABSTRACT

SCOBY-derived nanocellulose (SNC) is a promising biomaterial produced during the kombucha fermentation process by a symbiotic culture of bacteria and yeasts (SCOBY). Within this consortium, acetic acid bacteria belonging mainly to the Komagataeibacter genus are responsible for nanocellulose biosynthesis [1]. It is evident that SNC's physicochemical and biocompatible properties make it a promising candidate for utilisation in biomedicine and tissue engineering, such as artificial skin, bone implants etc. A notable disadvantage associated with the obtained SNC is the presence of residues and microorganisms after the fermentation process, which can potentially induce inflammation [1,2].

This research focused on developing an optimal method for purifying SNC from microorganisms without negatively affecting its basis properties. Sodium hydroxide (NaOH) solutions with concentrations of 1 mol/L, 2 mol/L, 3 mol/L and 4 mol/L were used for the purification process. The samples, which had been subjected to a process of cleaning and drying, were characterised in a number of ways. This included the observation of their microstructure (SEM), mechanical properties, spectroscopic analysis (FTIR), angle measurement and compatibility tests.

The utillisation of NaOH solutions whithing the concentration range of 1–4 mol/L resulted in the complete removal of nitrogen-carbon bonds, thus indicating the effective elimination of microbial cell residues. An improvement in tensile strength was observed, without any significant deterioration in the hydrophilic properties that are essential for biomaterials. Biocompatibility tests showed that SCOBY nanocellulose purified by this method is non-toxic and suitable for medical applications. These results confirmed the effectiveness and reliability of the purification process, providing a solid foundation for the future functional modification of SCOBY nanocellulose and paving the way for its use in medicine.

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References

1. Eskandari F. et al. Sustained antibacterial activity of orthodontic elastomeric ligature ties coated with a novel kombuchaderived bacterial nanocellulose: An *in-vitro* study. PLoS ONE. 2024; 19(2):e0292966.
2. Paramasivan M. et al. Microbial Synthesis of Hydroxyapatite-Nanocellulose Nanocomposites from Symbiotic Culture of Bacteria and Yeast Pellicle of Fermented Kombucha Tea. Sustainability. 2022; 14(13):8144.

NANOSTRUCTURED ENDOVASCULAR MATERIALS FOR DURABLE CEREBRAL ANEURYSM REPAIR

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ABSTRACT

Cerebral aneurysms are localized dilations that occur along the arterial circulation, caused by weak points. The treatment methods involve platinum coiling, balloon-assisted coiling and stent-assisted coiling. The materials used in these endovascular methods have some limitations, such as recanalization high risk, slow neointimal healing, reduced biocompatibility, recurrence of trombosis risk and incomplete endothelialization. Nanostructured endovascular materials are an innovative solution that can help improve vascular endothelium, enhance cell adhesion and promote tissue regeneration [1,2].

The current standard material for endovascular coiling is platinum, due to its radiopacity, biocompatibility and flexibilty propreties. However, it shows poor endothelialization and thrombosis risk because of unstable neointima formation. New nanotube arrays produced on titanium surfaces by anodization (TiO_2 nanotubes) modulate protein adsorbtion and reduce platelet activation, therefore promoting endothelial cell adhesion [3,4].

Nickel-Titanium stents are used for aneurysm neck coverage, due to their elasticity and resistantance to corrosion, nonetheless the cytotoxicity and inflammation caused by the nickel release and the suboptimal hemocompatibility are proving to limit their usage. Materials based on TiO_2 nanotubes and graphene-based nanolayers can reduce nickel ion diffusion, by acting as an oxide barrier, preventing direct contact between the biological medium and the nickel atoms, thus reducing the inflammation [3,5].

The current polymeric coatings: PTFE (Polytetrafluoroethylene), PCL (Poly(ε-caprolactone) and PLA (Polylactic acid) are found in drug-eluting stents, grafts and microcatheters, releasing drugs in a controlled manner, while also being hydrophobig - causing poor cell adhesion, and having limited control over microsurfaces. Endovascular nanomaterials such as electrospun nanofibers of biodegradaabile polymers (PLGA (Poly-lactic-co-glycolic acid), PCL blended with chitosan particles and collagen) provide better drug delivery control and bioactivity [6,7].

Bare metal and polymer flow-diverters are a crucial element in the endovascular treatment of aneurysms, redirecting the blood flow away from the pathological area. It relies on passive flow and has no active biointeraction. Innovative nanomaterials such as silver, gold, cerium oxide and hydroxyapatite coating can stimulate endothelial repair and have a strong antibacterial effect, by disrupting bacterial cell membrane and biofilms, neutralizing oxidative stress and device deployement, thus reducing trombosis risks [8,9,10,11].

An innovative way to avoid thrombosis through nanostructures is the use of anticoagulant nanocoatings, that reduce platelet adheseion and activation, preventing thrombus formation, allowing for a lower thrombotic signature. It is combined with heparin for a double function coating [12].

Nanostructured materials offer a transformative approach to endovascular cerebral aneurysm repair by enhancing biocompatibility, promoting endothelial regeneration, and improving long-term stability of implants, marking an important step toward safer and more effective aneurysm therapies.

Keywords: nanostructured materials; endovascular repair; cerebral aneurysm; endothelialization; biocompatibility.

References

1. Adamou, A., Alexandrou, M., Roth, C., Chatziioannou, A., Papanagiotou, P. (2021). Endovascular Treatment of Intracranial Aneurysms. Life, 11(4), 335. https://doi.org/10.3390/life11040335.
2. Liang D. Endovascular treatment of intracranial aneurysms: Past and present. J Cerebrovasc Endovasc Neurosurg. 2024 Sep;26(3):249–259. doi: 10.7461/jcen.2024.E2023.09.005. Epub 2024 Jan 19. PMID: 38247034; PMCID: PMC11449534.
3. Ma W., Liu X., Yang M., Hong Q., Meng L., Zhang Q., Chen J., Pan C. Fabrication of CO-releasing surface to enhance the blood compatibility and endothelialization of TiO_2 nanotubes on titanium surface. *Bioact Mater Adv.* 2023; 3:213393. doi:10.1016/j.bioadv.2023.213393.
4. Raymond J., Klink R., Chagnon M., Barnwell S.L., Evans A.J., Mocco J., Hoh B.H., Turk A.S., Turner R.D., Desal H., Fiorella D., Bracard S., Weill A., Guilbert F., Lanthier S., Fox A.J., Darsaut T.E., White P.M., Roy D. Hydrogel versus Bare Platinum Coils in Patients with Large or Recurrent Aneurysms Prone to Recurrence after Endovascular Treatment: A Randomized Controlled Trial. AJNR Am J Neuroradiol. 2017 Mar.; 38(3):432–441. doi: 10.3174/ajnr.A5101. Epub 2017 Jan. 12. PMID: 28082261; PMCID: PMC7960015.
5. Wasyluk, Ł., Hreniak, D., Boiko, V., Sobieszczańska, B., Bologna, E., Zingales, M., Pasławski, R., Arkowski, J., Sareło, P., Wawrzyńska, M. Functional Mechanical Behavior and Biocompatible Characteristics of Graphene-Coated Cardiovascular Stents. *Int. J. Mol. Sci.* 2024, 25, 13345. https://doi.org/10.3390/ijms252413345
6. Robles K.N., Zahra F.T., Mu R., Giorgio T. Advances in Electrospun Poly(ε-caprolactone)-Based Nanofibrous Scaffolds for Tissue Engineering. Polymers (Basel). 2024 Oct. 10; 16(20):2853. doi: 10.3390/polym16202853. PMID: 39458681; PMCID: PMC11511575.
7. Rezvova M.A., Ovcharenko E.A., Klyshnikov K.Y., Glushkova T.V., Kostyunin A.E., Shishkova D.K, Matveeva V.G., Velikanova E.A., Shabaev A.R., Kudryavtseva YA. Electrospun bioresorbable polymer membranes for coronary artery stents. *Front Bioeng Biotechnol.* 2024; 12:1440181. doi:10.3389/fbioe.2024.1440181
8. Eker F., Duman H., Akdaşçi E., Witkowska A.M., Bechelany M., Karav S. Silver Nanoparticles in Therapeutics and Beyond: A Review of Mechanism Insights and Applications. *Nanomaterials.* 2024; 14(20):1618. https://doi.org/10.3390/nano14201618.
9. Singh N., Kulkarni P.P., Tripathi P., Agarwal V., Dash D. Nanogold-coated stent facilitated non-invasive photothermal ablation of stent thrombosis and restoration of blood flow. Nanoscale Adv. 2024 Jan 30;6(5):1497-1506. doi: 10.1039/d3na00751k. PMID: 38419863; PMCID: PMC10898437.
10. Shcherbakov A.B., Reukov V.V., Yakimansky A.V., Krasnopeeva E.L., Ivanova O.S., Popov AL, Ivanov VK. CeO_2 Nanoparticle-Containing Polymers for Biomedical Applications: A Review. *Polymers*. 2021; 13(6):924. https://doi.org/10.3390/polym13060924
11. Rajtar A., Kaluza G.L., Yang Q., Hakimi D., Liu D., Tsui M. et al. Hydroxyapatite-coated cardiovascular stents. EuroIntervention. 2006 May; 2(1):113–115.
12. Farzaneh S., Jiménez J.M. Heparin Coating Decreases the Thrombotic Signature of Flow Diverter Stents. Ann Biomed Eng. 2025 Jul.; 53(7):1627–1637. doi: 10.1007/s10439-025-03724-z. Epub 2025 Apr 17. PMID: 40244551.

ENDOGENOUS ANTIOXIDANT SYSTEMS AND REDOX IMBALANCE IN THE PATHOGENESIS OF CATARACT

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ABSTRACT

The present review explores the fundamental contribution of endogenous antioxidant systems in maintaining lens transparency and delaying cataractogenesis, emphasizing their biochemical mechanisms, enzymatic coordination, and vulnerability to oxidative imbalance. The ocular lens is uniquely susceptible to oxidative stress because of its avascular structure and continuous exposure to light and oxygen, which promote the generation of reactive oxygen species (ROS) such as superoxide anions ($O_2^{\bullet -}$), hydrogen peroxide (H_2O_2), and hydroxyl radicals (•OH). Under physiological conditions, antioxidant enzymes—superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and glutathione reductase (GR)—work synergistically to neutralize ROS and maintain a reduced intracellular environment dominated by glutathione (GSH). However, evidence from biochemical and clinical studies reveals a significant decline in these antioxidant defenses within cataractous lenses [1–3].

In senile and diabetic cataracts, GSH concentration decreases by more than 50%, severely impairing the redox buffer capacity and promoting the oxidation of lens crystallins, resulting in protein aggregation and loss of transparency [1]. SOD and CAT activities are reduced by approximately 30–40%, compromising the detoxification of $O_2^{\bullet -}$ and H_2O_2 [2]. In diabetic lenses, GPx activity decreases by nearly 60%, amplifying oxidative stress and leading to the accumulation of H_2O_2 and malondialdehyde (MDA), a marker of lipid peroxidation [3]. Additionally, increased levels of 4-hydroxynonenal (4-HNE) and advanced glycation end products (AGEs) contribute to irreversible protein cross-linking and pigment formation.

Therapeutic interventions using antioxidant supplementation have shown partial restoration of redox balance. N-acetylcysteine (NAC) replenishes intracellular GSH by 25–30% in animal models [2], while vitamin C and alpha-lipoic acid reduce MDA concentrations by 15–20% in clinical studies [3]. Nonetheless, these compounds demonstrate limited efficacy in advanced cataract stages, suggesting that oxidative damage may become irreversible beyond a critical threshold.

Overall, maintaining the integrity of endogenous antioxidant systems is essential for lens homeostasis. Their dysfunction accelerates structural and biochemical deterioration of lens proteins, reinforcing oxidative stress as a central mechanism in cataract pathogenesis. Continued translational research into antioxidant-based and redox-modulating therapies may offer promising preventive strategies for both age-related and diabetic cataracts [1–3].

References

1. Thiagarajan R., Manikandan R. Antioxidants and cataract. Free Radic Res. 2013; 47(5):337–345.
2. Wang L. et al. Research progress on antioxidants and protein aggregation in cataract formation. Mol Med Rep. 2024.
3. Giglio R., Milan S., Inferrera L., Tognetto D., Visalli F., Gagliano C. et al. Nutrient-Driven Antioxidant Interventions for Prevention of Age-Related and Diabetic Cataracts. Nutrients. 2025; 17(11):1885.

THE INFLUENCE OF EXTRACTS FROM VITICULTURAL WASTE AND PHYTOSYNTHESIZED SILVER NANOPARTICLES ON THE PHENOLIC COMPOSITION OF FETEASCĂ REGALĂ 72 ST. STUM.

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ABSTRACT

In the context of modern viticulture, the valorization of waste originating from vineyards, such as grapevine canes and leaves, represents a priority direction in promoting the circular economy and sustainable biotechnologies. These residual materials constitute important sources of phenolic compounds and natural antioxidants, which can be used for the ecological synthesis of silver nanoparticles (AgNPs) with biostimulant and antimicrobial properties [1,2]. The application of foliar treatments based on viticultural extracts enriched with AgNPs has demonstrated the ability to induce the accumulation of secondary metabolites, especially flavonoids and tannins, by activating phenolic biosynthetic pathways [3]. In the case of the Fetească Regală 72 St genotype, these treatments can positively influence the phenolic composition of the stum, contributing to the increase of antioxidant potential and to the improvement of the quality of the raw material intended for winemaking [4].

Thus, the use of nanostructured viticultural extracts offers an innovative and sustainable solution for optimizing the quality of viticultural products through the valorization of secondary grapevine resources.

The natural extracts were obtained from viticultural waste, namely grapevine canes and leaves, using the classical solid–liquid extraction method, subsequently enhanced with silver nanoparticles. The obtained extracts and the ecological product Growspore LF (G) were applied foliarly to grapevine plants from the Fetească regală 72 St. genotype maintained under protected conditions.The experimental variants within this research are identified by a specific coding system as follows: V1 (hydroalcoholic extract of leaves); V2 (hydroalcoholic extract of leaves enhanced with silver nanoparticles); V3 (hydroalcoholic extract of canes from Fetească Neagră 6 St.); V4 (hydroalcoholic extract of canes from Fetească Neagră 6 St. enhanced with silver nanoparticles); V5 (hydroalcoholic extract of canes from Fetească Regală 72 St.); V6 (hydroalcoholic extract of canes from Fetească Regală 72 St. enhanced with silver nanoparticles); C_N (negative control).

The total content of phenolic compounds varied considerably between the variants, indicating the influence of technological and biochemical factors on the composition of the stum. High-Performance Liquid Chromatography (HPLC) analysis allowed the identification and quantification of the main phenolic compounds present in the stum, with values expressed as means and standard deviation (mg/L), (table 1). The results obtained show that the V2 variant recorded the highest tannic acid content in the stum, while the V3 variant was distinguished by its epicatechin and hyperoside content.

Following the HPLC analyses, a decrease in the identified compounds can be observed in the suspensions containing phytosynthesized silver nanoparticles, which leads to the conclusion that these compounds are involved in the phytosynthesis process, being consumed during the process.

Table 1. Concentration of phenolic compounds

Nr. Crt.	Determined compound / Experimental variant	Mean ± Standard Deviation (mg/L)							
		V1	V2	V3	V4	V5	V6	G	C_N
1	Tannic acid	28.50 ± 0.84^{f}	95.00 ± 2.51^{a}	66.70 ± 2.00^{b}	56.20 ± 1.66^{c}	63.40 ± 1.74^{bc}	44.90 ± 1.33^{de}	37.50 ± 1.12^{e}	90.50 ± 2.72^{a}
2	Gallic acid	0.32 ± 0.01^{b}	0.32 ± 0.01^{b}	0.43 ± 0.01^{ab}	0.42 ± 0.01^{ab}	0.45 ± 0.012^{ab}	0.37 ± 0.01^{ab}	0.35 ± 0.10^{b}	0.52 ± 0.02^{a}
3	Protocatechuic acid	2.77 ± 0.08^{cd}	3.45 ± 0.10^{b}	2.99 ± 0.09^{bc}	2.28 ± 0.06^{de}	5.88 ± 0.16^{a}	2.13 ± 0.06^{e}	2.10 ± 0.06^{e}	5.76 ± 0.18^{a}
4	Catechin	0.23 ± 0.005^{cd}	0.334 ± 0.01^{b}	0.25 ± 0.006^{c}	0.17 ± 0.004^{e}	0.20 ± 0.004^{de}	0.59 ± 0.02^{a}	0.25 ± 0.007^{c}	0.13 ± 0.004^{f}
5	Vanillic acid	0.77 ± 0.02^{d}	1.2 ± 0.03^{b}	0.99 ± 0.02^{c}	0.84 ± 0.02^{cd}	2.24 ± 0.06^{a}	0.95 ± 0.02^{c}	0.47 ± 0.02^{e}	0.83 ± 0.02^{cd}
6	Caffeic acid	0.34 ± 0.01^{d}	0.34 ± 0.009^{d}	0.50 ± 0.01^{b}	0.32 ± 0.007^{d}	0.40 ± 0.01^{c}	0.25 ± 0.006^{e}	0.35 ± 0.01^{d}	0.57 ± 0.02^{a}
7	Syringic acid	0.20 ± 0.005^{c}	0.16 ± 0.004^{d}	0.28 ± 0.007^{b}	0.34 ± 0.009^{a}	0.32 ± 0.008^{a}	0.26 ± 0.006^{b}	0.07 ± 0.002^{e}	0.05 ± 0.002^{e}
8	Epicatechin	13.30 ± 0.40^{e}	18.00 ± 0.54^{cd}	22.90 ± 0.67^{a}	16.80 ± 0.50^{d}	21.60 ± 0.60^{ab}	2.49 ± 0.07^{f}	12.90 ± 0.40^{e}	14.40 ± 0.43^{e}
9	Ferulic acid	0.80 ± 0.02^{ab}	0.77 ± 0.02^{ab}	1.00 ± 0.03^{a}	0.67 ± 0.02^{ab}	0.94 ± 0.03^{ab}	0.27 ± 0.006^{b}	0.73 ± 0.02^{ab}	1.09 ± 0.43^{a}
10	Hyperoside	3.77 ± 0.10^{d}	5.14 ± 0.16^{bc}	7.22 ± 0.22^{a}	5.55 ± 0.17^{b}	5.82 ± 0.163	6.79 ± 0.21^{a}	4.55 ± 0.13^{c}	5.17 ± 0.16^{bc}
11	Luteolin	N.D.	N.D.	0.43 ± 0.01^{c}	N.D.	0.76 ± 0.02^{a}	N.D.	0.17 ± 0.005^{d}	0.10 ± 0.003^{e}

References

1. Baroi, A.M., Fierascu, I., Ghizdareanu, A.I., Trica, B., Fistos, T., Matei, R.I., Avramescu, S.M. (2024). Green approach for synthesis of silver nanoparticles with antimicrobial and antioxidant properties from grapevine waste extracts. International Journal of Molecular Sciences, 25(8), 4212.
2. Michailidu, J., Maťátková, O., Kolouchová, I., Masák, J., Čejková, A. (2022). Silver nanoparticle production mediated by Vitis vinifera cane extract: Characterization and antibacterial activity evaluation. Plants, 11(3), 443.
3. Costa-Pérez, A., Medina, S., Sánchez-Bravo, P., Domínguez-Perles, R., García-Viguera, C. (2023). The (poly) phenolic profile of separate winery by-products reveals potential antioxidant synergies. Molecules, 28(5), 2081.
4. Vizitiu, D.E., Sardarescu, D.I., Fierascu, I., Fierascu, R.C., Soare, L.C., Ungureanu, C., Buciumeanu, E.C., Guta, C.I., Pandelea, L.M. (2022). Grapevine plants management using natural extracts and phytosynthesized silver nanoparticles. Materials, 15(22), 8188.

INTEGRATING CYTOTOXICITY AND CALCIUM IMAGING ASSAYS TO ASSESS THE BIOCOMPATIBILITY AND FUNCTIONAL PERFORMANCE OF NEUROTRANSMITTER-LOADED COATINGS

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ABSTRACT

Neurological disorders represent one of the major causes of disability and premature death in Europe, primarily due to impaired neurotransmission involving glutamate, GABA, dopamine, or acetylcholine. Current pharmacological therapies rely on systemic drug delivery, often leading to non-specific distribution, tolerance, and numerous side effects. Neurotransmitter-loaded microelectrode coatings (MECs) based on conducting polymer matrices with hierarchical structures offer a promising strategy to overcome these limitations by enabling electrically triggered and spatially controlled release of neurotransmitters [1]. Such systems are expected to reproduce, at least partially, the dynamic regulation of synaptic signalling while minimising systemic drug exposure. One of the key steps in developing a successful MEC is evaluating both the biocompatibility and the functional performance of these coatings at the neural interface.

MEC biocompatibility is evaluated using *in vitro* cultures of human neuroblastoma SH-SY5Y and glioblastoma U87 cell lines, which represent neuronal and glial models, respectively, thereby capturing the primary cellular components of the neural environment. An integrated series of assays, including Alamar Blue metabolic activity tests (based on resazurin reduction), is employed to quantify the effects of MECs on cell viability, proliferation, and morphology [2]. Functional performance is assessed through calcium imaging, a non-invasive fluorescence-based technique that monitors intracellular calcium transients as indicators of neuronal or glial activation.

Our results indicate that *in vitro* models of neuroblastoma and glioblastoma exhibited slightly reduced metabolic activity on PEDOT:GABA coatings compared to PEDOT controls. This decrease suggests a modulated cellular response to the presence of GABA within the polymer matrix, potentially reflecting a more regulated metabolic state rather than cytotoxicity. Such an effect is consistent with the known inhibitory and neuroprotective roles of GABA, which can suppress excessive excitatory signaling and limit uncontrolled cell proliferation. The coatings therefore maintain good cytocompatibility, while introducing functional bioactivity capable of influencing cellular metabolism in a controlled manner. Moreover, calcium imaging performed on U87 glial cultures revealed stimulus-dependent changes in intracellular calcium levels following electrically triggered GABA release from PEDOT:GABA coatings. These responses

indicate receptor-mediated glial activation and confirm the functional capability of the coatings to modulate astrocyte-like signalling, highlighting their potential for localised and controllable neuromodulation [3].

Our results demonstrate that neurotransmitter-loaded conducting polymer coatings can simultaneously ensure high biocompatibility and functional responsiveness, paving the way for the rational design of next-generation biointerfaces for localised neuromodulation and neural tissue repair.

References

1. Krukiewicz K., Chudy M., Gregg S., Biggs M.J.P. The Synergistic Effects of Gold Particles and Dexamethasone on the Electrochemical and Biological Performance of PEDOT Neural Interfaces. Polymers. 2019 Jan. 5; 11(1):67.
2. Krukiewicz K., Kowalik A., Czerwinska-Glowka D., Biggs M.J.P. Electrodeposited poly(3,4-ethylenedioxypyrrole) films as neural interfaces: Cytocompatibility and electrochemical studies. Electrochimica Acta. 2019 Apr.; 302:21–30.
3. Skorupa M., Więcławska D., Czerwińska-Główka D., Skonieczna M., Krukiewicz K. Dopant-Dependent Electrical and Biological Functionality of PEDOT in Bioelectronics. Polymers. 2021 June 11;13(12):1948.

ADVANCES IN BIORESORBABLE STENT TECHNOLOGIES FOR PANCREATIC FLUID COLLECTIONS

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ABSTRACT

Introduction: Pancreatic fluid collections are frequent complications of pancreatitis, and their classification based on the Atlanta criteria guides the appropriate therapeutic approach [14]. Current management includes early enteral nutrition and drainage of symptomatic collections [7]. Ultrasound-guided transgastric endoscopic drainage is the gold standard, decreasing the necessity for classic surgical intervention [8]. Recently, researchers have turned their attention to the use of biomaterial stents, including bioresorbable and self-expanding metallic stents coated with antibacterial nanopolymers, which can improve biocompatibility and prevent postoperative infections [5].

Objective: To analyse the use of bioresorbable and metallic stents in the drainage of pancreatic collections, evaluate technical safety, procedure efficiency and clinical success, focusing on reducing complications and optimizing therapeutic outcomes [5].

Materials and Methods: A narrative synthesis based on specialized literature from 2020 to 2025 was conducted, using the PubMed, StatPearls, and ScienceDirect databases. The inclusion criteria targeted synthesis articles, meta-analyses, and experimental studies on endoscopic drainage of pancreatic collections and the use of stents. The data was comparatively synthesized to highlight current technological tendencies [2].

Results: The studies analysis highlights significant progress in the development of bioresorbable stents intended for the pancreatic fluid collections drainage. Self-expanding metallic stents remain the gold standard [3], but new bioresorbable prototypes made of polydioxanone and polylactide prove excellent biocompatibility and the potential to eliminate the need for a second endoscopic procedure for stent extraction. In addition, antibacterial nanopolymer coatings reduce microbial colonization and the risk of post-drainage infections. These results suggest a promising direction for future clinical implementation of bioresorbable stents in the management of pancreatic fluid collections [6].

Conclusions: The development of bioresorbable stents and nanopolymer coatings prove to be an efficient alternative, offering a personalized and minimally invasive approach to endoscopic drainage of pancreatic collections. By reducing the risk of infection, migration, and reintervention, these technologies could become a superior alternative to conventional stens.

Keywords: Pancreatic pseudocyst, bioresorbable stent, nanopolymers, endoscopic drainage, pancreatic collections.

References

1. Bansal A., Gupta P., Singh A.K. et al. Drainage of pancreatic fluid collections in acute pancreatitis: A comprehensive overview. *World J Clin Cases*. 2022; 10(20):6769–6783. doi:10.12998/wjcc.v10.i20.6769.
2. Cai, Q.C., Zhang, Y.X., Liao, Y., Gong, J.P., Xiong, B. (2021). Is endoscopic drainage better than percutaneous drainage for patients with pancreatic fluid collections? A comparative meta-analysis. *Revista Espanola de Enfermedades Digestivas* (Vol. 113, Issue 6, pp. 454–462). ARAN Ediciones S.A. https://doi.org/10.17235/reed.2020.7170/2020.
3. Ge, P.S., Weizmann, M., Watson, R.R. (2021). Pancreatic Pseudocysts: Advances in Endoscopic Management. *Gastroenterology Clinics of North America*, *45*(1), 9–27. https://doi.org/10.1016/J.GTC.2015.10.003.
4. Koo, J.G., Liau, M.Y.Q., Kryvoruchko, I.A., Habeeb, T.A., Chia, C., Shelat, V. G. (2024). Pancreatic pseudocyst: The past, the present, and the future. World Journal of Gastrointestinal Surgery, 16(7), 1986–2002. https://doi.org/10.4240/wjgs.v16.i7.1986.
5. Maieron, A., Erhart, L., Pramhofer, P., Schöfl, R., Spaun, G., Steiner, E., Wewalka, F., Ziachehabi, A. (2023). Biodegradable biliopancreatic stents could help conserve health care resources during the COVID-19 pandemic: An observational multicenter study. *Digestive and Liver Disease*, 55(3), 310–315. https://doi.org/10.1016/j.dld.2022.12.011.
6. Marra, P., Barnes-Navarro, D., Fernández-Rodríguez, L., Barbiero, G., McGuirk, S.P., Gonzalez-Junyent, C., Díez-Miranda, I., Quintero-Bernabeu, J., Hernández-Cabrero, T., Novo-Torres, J., Ponce-Dorrego, M. D., Gonzalez-Nieto, J., Battistel, M., Minà, M.C., Groff, S., Aleman, C.J.A., Warren, R.L., Sharif, K., Ceriani, C., … Perez-Lafuente, M. (2025). Biodegradable stents for biliary strictures after pediatric liver transplantation: a multicenter retrospective study. *European Radiology*. https://doi.org/10.1007/s00330-025-11930-5.
7. Misra D, Sood T. Pseudochist pancreatic. [Actualizat 8 august 2023]. În: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; ianuarie 2025. Disponibil la: https://www.ncbi.nlm.nih.gov/books/NBK557594/.
8. Wu, T., Yang, Y., Su, H., Gu, Y., Ma, Q., Zhang, Y. (2022). Recent developments in antibacterial or antibiofilm compound coating for biliary stents. *Colloids and Surfaces B: Biointerfaces*, 219, 112837. https://doi.org/10.1016/J.COLSURFB.2022.112837.

PEDOT EUTECTOGELS AS A PROMISING CONDUCTIVE MATERIAL FOR TISSUE ENGINEERING

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ABSTRACT

Deep eutectic solvents (DESs) represent a new class of conductive compounds that have recently gained attention as sustainable and cost-effective alternatives to ionic liquids. Owing to their tunable physicochemical properties, low toxicity and biodegradability, DESs are increasingly investigated for applications in bioelectronics and tissue engineering[1].

In this work, we developed novel mixed ionic – electronic conducting eutectogels based on poly(3,4-ethylenedioxythiophene): poly(styrenesulfonate) (PEDOT: PSS) and DESs at different concentrations.

The developed eutectic gel indicated both ionic and electronic conductivity, as confirmed by electrochemical impedance spectroscopy (EIS) and four-point probe measurements. Rheological analysis also revealed shear-thinning behavior, facilitating extrusion-based processing. Among all formulations, the PEDOT: PSS/DES 50/50 wt% eutectogel exhibited the highest electronic conductivity (89.20 ± 29.7 S/cm), maximum charge storage capacity (8.77 C/cm^{-2}), and optimal printability. Taking advantage of these properties, this formulation was successfully 3D printed into defined structures.

The combination of improved electrochemical performance and processability highlights the suitability of PEDOT: PSS/DES eutectogels for biofabrication. This work demonstrates a simple yet effective strategy to bridge ionic and electronic conductivity, offering a new class of printable, conductive gels with strong potential for applications in tissue engineering, soft bioelectronics, and next-generation biomedical devices.

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References

1. Aguzin, Ana et al. Direct ink writing of PEDOT eutectogels as substrate-free dry electrodes for electromyography. Materials Horizons 10.7 (2023):2516–2524.

NANO-ASSAY INTEGRATION IN VITAMIN D AND ENDOCRINE BIOMARKER PROFILING: A BIOCHEMICAL PERSPECTIVE

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ABSTRACT

Vitamin D, once considered solely a fat-soluble vitamin, is now recognised as a secosteroid prohormone essential for endocrine regulation. Its activation—from skin (7-dehydrocholesterol) to liver [25-hydroxyvitamin D_3; $25(OH)D_3$] to kidney [1,25-dihydroxyvitamin D_3; $1,25(OH)_2D_3$]—integrates environmental, metabolic, and hormonal signals. Disruptions in vitamin D metabolism or receptor signalling affect the function of the parathyroid, thyroid, pancreatic, and adrenal glands, making an understanding of these pathways crucial for early diagnosis and targeted therapy [1,3,4].

The biochemical markers of vitamin D metabolism represent – calcidiol (25(OH)D3), calcitriol ($1,25(OH)_2D3$), parathormon (PTH), calcium, phosphate, fibroblast growth factor 23 (FGF-23), and vitamin D binding protein (DBP)—in common endocrine disorders. Fibroblast growth factor 23 (FGF23) and vitamin D binding protein (DBP) are key regulators of vitamin D metabolism. FGF-23 secreted by osteocytes and osteoblasts is the main regulator of renal phosphate excretion. It inhibits tissue phosphate reabsorption by repressing the expression of electrogenic Na^+-dependent Pi cotransportors (NaPi-IIa and NaPi-IIc) and decreases 1α-renal hydroxylase activity, reducing calcitriol synthesis. Vitamin D binding protein (DBP), produced in the liver, transports vitamin D metabolites and controls their bioavailability and tissue distribution. Aside from its sterol-binding capacity, DBP has been shown to possess antioxidant and anti-inflammatory properties [2].

Vitamin D deficiency (<20 ng/mL) contributes to secondary hyperparathyroidism in chronic kidney disease, worsens autoimmune thyroiditis, and influences insulin secretion/resistance in type 2 and gestational diabetes [3,4]. Altered vitamin D signalling increases fracture risk in hypogonadism and post-menopausal osteoporosis [1,4]. Nano-diagnostic advances – including plasmonic and electrochemical biosensors – offer superior analytical sensitivity (<1 ng/mL detection limits) compared with conventional immunoassays. These nano-assays enable multiplexed quantification of vitamin D metabolites, PTH, and FGF23 in minimal serum volumes, facilitating early diagnosis and real-time monitoring of endocrine dysfunction. Integration with nanoporous silicon, carbon nanotubes, and microfluidic lab-on-chip devices promises scalable point-of-care endocrine diagnostics.

In conclusion**,** vitamin D has evolved beyond its classical skeletal role, emerging as a biochemically traceable nexus of endocrine and metabolic regulation. Coupling vitamin D metabolomics with nano-enabled biosensing platforms marks a transformative step toward precision endocrinology. Routine assessment of vitamin D status – integrated with calcium, phosphate, PTH, and bone turnover markers – combined with nano-assay technology ensures early, cost-effective detection and monitoring of endocrine disorders.

References

1. Babić Leko M. et al. Vitamin D and the thyroid: a critical review of the current evidence. Int J Mol Sci. 2023; 24(4):3586.
2. Charlotte Delrue, Marijn M. Speeckaert. Vitamin D and Vitamin D-Binding Protein in Health and Disease. *Int. J. Mol. Sci.*2023, 24(5), 4642; https://doi.org/10.3390/ijms24054642.
3. Li L. et al. Performance evaluation of two immunoassays for 25-hydroxyvitamin D. J Clin Biochem Nutr. 2016; 58(3):186–192.
4. Mousa A. et al. 25-hydroxyvitamin D is associated with adiposity and cardiometabolic risk factors in a predominantly vitamin D-deficient and overweight/obese but otherwise healthy cohort. J Steroid Biochem Mol Biol. 2017; 173:258–264..

SCANNING ELECTRON MICROSCOPY (SEM) IN A COMPARATIVE STUDY OF *SORBUS DOMESTICA* LEAVES FROM DIFFERENT GEOGRAPHICAL REGIONS OF ROMANIA

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ABSTRACT

Introduction: The fruits of the species *Sorbus domestica (Rosaceae family)* are used in food but the species is also known for its traditional uses in treating various diseases. The micromorphology of the epicuticular wax [1, 2], the type and distribution of stomata and tector hairs represent criteria for taxonomic identification. If the structural diversity of the epicuticular wax depends rather on its chemical composition, the density of tector hairs and the particularities of the stomata are closely related to environmental factors.

The purpose of the study: The purpose of this study is to follow: the arrangement of wax on the leaf surface, the type of stomata, the presence or absence of hairs and their density on the two sides (adaxial, abaxial) of *Sorbus domestica* leaves in correlation with environmental factors (altitude, climate).

Material and methods: The leaves of the species *Sorbus domestica* were collected from different geographical areas of Gorj (SG) and Prahova (ST) and were analyzed using Scanning Electron Microscopy (SEM) [3]

Results and Discussion: Epicuticular wax is deposited in unbranched tubular formations without specific orientations. No significant differences were observed in the micromorphology of the wax on the upper and lower surfaces of the leaves between the two samples analyzed. Anomocytic stomata were observed only on the lower epidermis; a higher stomatal density was observed in ST samples compared to SG. The sample from Gorj presented bristles on the upper epidermis located especially in the area of the veins. The sample from Prahova presented a higher density of bristles on the lower epidermis compared to the one from Gorj. We assumed that this difference was determined by environmental conditions.

Conclusions: The morphological types of epicuticular wax deposits, stomata types, their distribution and tector hairs were highlighted. These characteristics may be useful in further pharmacognostic research to establish species identity.

References

1. Dickison W, Integrative Plant Anatomy. Academic Press, San Diego. California, 2000; 69–71
2. Ganeva T., Stefanova M., Koleva K., Ruiz S.R., Isolation and recrystallization of epicuticular waxes from *Sorbus* and *Cotoneaster* leaves. Open Life Sci. 10, 2015; 497–504
3. Dinu M., Ancuceanu R., Rădulescu V., Ilieș D.-C., Munteanu C., Aramă C. A comparative morphological and chemical study of the seeds from *Trigonella foenum graecum* (L.) and *T. caerulea* (L.) ser. species. Farmacia, 2013, Vol. 61, 6: 1069–1081.

IN SILICO MOLECULAR INTERACTION OF EXPLORING INDIAN MILLETS PHYTOCHEMICALS AS DPP-IV INHIBITORS FOR TYPE II DIABETES MELLITUS TREATMENT

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ABSTRACT

This study uses the Insilco study to identify potential inhibitors of diptidyl-peptidase-IV in Indian millets with the aim of alleviating the progression of type 2 diabetes mellitus through targeted molecular interactions. Dipeptidyl peptidase IV (DPP-IV) is an enzyme that degrades incretins to reduce the abnormal metabolism of visceral adipose tissue and the secretion of insulin. DPP-IV inhibitors increase GLP-1 and GIP, which are involved in the secretion of insulin by beta cells in the pancreas, reducing postprandial and fasting hyperglycaemia and improving blood glucose control without causing hypoglycaemia. Some evidence has shown that natural compounds have therapeutic effects in the treatment of diseases in humans. The aim of this study was to determine the phytochemical properties of Indian millets as practically DPP-IV inhibitors for the treatment of type 2 diabetes mellitus (DM). In silico study using molecular docking between DPP-IV (PDB: 5J3J), and Indian millet phytochemicals (Lupeol, Stigmasterol and Campestrol). The phytochemicals were obtained from pubchem and met the criteria for Lipinski's rule for drug availability. Macromolecule preparation was done using AutoDock, while the molecular docking process used PyRx. Protein-ligand interaction was visualized using Pymol. The data obtained after docking as Vina score for ligand-protein complexes were scored for Stigmasterol (-9.4), and Campestrol (-7.9) root-mean-square deviation (RMSD) score ≤2 Å, and bound with DPP-1V residues. The docking results showed that Stigmasterol, Campestrol and Lupeol had better potential activity to inhibit DPP-IV, due to their low binding scores. These phytochemicals of Indian millets may be considered as potential inhibitors to treat type II diabetes mellitus.

BIOCHEMICAL MECHANISMS OF APOPTOSIS IN CANCER

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ABSTRACT

Apoptosis or programmed cell death is a fundamental biological process that maintains tissue homeostasis and prevents the accumulation of damaged or abnormal cells. In cancer, however, the apoptotic machinery is frequently disrupted, enabling malignant cells to evade cell death, accumulate mutations, and develop therapeutic resistance [1–4].

Apoptosis proceeds through two main pathways. The extrinsic pathway is triggered by death receptors (First Apoptosis Signal receptor (FAS), Tumor Necrosis Factor Receptor 1 (TNFR1), Tumor Necrosis Factor-Related Apoptosis-Inducing Ligand Receptor 2 (TRAIL-R2)) upon ligan binding, leading to the formation of the death-inducing signaling complex (DISC) and activation of caspase-8, which in turn activates downstream caspases-3 and -7 [5].

The intrinsic (mitochondrial) pathway is regulated by the BCL-2 family of proteins, which balance pro-apoptotic (BCL-2-associated X protein (Bax), BCL-2 homologous antagonist/killer (Bak), BH3-interacting domain death agonist (Bid), BCL-2-interacting mediator of cell death (Bim), p53 upregulated modulator of apoptosis (Puma)) and anti-apoptotic members (B-cell lymphoma 2 (Bcl-2), B-cell lymphoma-extra large (Bcl-xL), Myeloid cell leukemia-1 (Mcl-1)). Upon cellular stress or DNA damage, mitochondrial outer membrane permeabilization occurs, releasing cytochrome c and triggering apoptosome formation (Apaf-1 + cytochrome c + dATP + procaspase-9). During the execution phase, caspase-3 and -7 cleave key cellular substrates, activate CAD (Caspase-Activated DNase), induce chromatin condensation, DNA fragmentation, and formation of apoptotic bodies for phagocytic clearance [6–9].

Cancer cells acquire resistance to apoptosis by overexpressing anti-apoptotic proteins (Bcl-2, Bcl-xL, Mcl-1), inactivating tumor suppressors like p53, activating pro-survival signaling pathways (Phosphoinositide 3-kinases / Protein kinases B (PI3K/Akt), Nuclear factor kappa-light-chain-enhancer of activated B cells (NF-kB), Mitogen-activated protein kinase / Extracellular signal-regulated kinases (MEK/ERK)), and upregulating inhibitors of apoptosis (Inhibitors of Apoptosis Proteins (IAPs), Baculoviral inhibitor of apoptosis repeat-containig 5 (Survivin)). This resistance is a major obstacle for radiotherapy and chemotherapy, which typically rely on apoptosis induction [10].

Recent studies (2023 y.) have also highlighted the complex interplay between apoptosis and autophagy in cancer: White emphasizes that beyond simple death-pathway activation, tumour cells exploit autophagy

as a cytoprotective buffer against DNA damage and apoptotic triggers, suggesting that effective pro-apoptotic therapies must also account for autophagic escape mechanisms [11].

Emerging therapies aim to restore apoptotic signaling. BH2 mimetics (e.g., Venetoclax) inhibit anti-apoptotic Bcl-2 proteins, SMAC mimetics (e.g., LCL161) neutralize IAPs, MDM2 inhibitors (e.g., Nutlin-3) reactivate p53, and TRAIL receptor agonists promote extrinsic apoptosis [12–14].

Combining apoptosis-targeted agents with chemotherapy or immune checkpoint inhibitors has shown enhanced efficacy and may overcome therapeutic resistance [15].

In conclusion, understanding the biochemical regulation of apoptosis – involving caspases, anti-apoptotic members – B-cell lymphoma 2 family, Inhibitors of Apoptosis Proteins, and p53 tumor suppressor protein – provides critical insight into cancer biology and offers a promising foundation for designing molecularly targeted therapies that selectively restore programmed cell death in tumor cells.

References

1. Elmore S. Apoptosis: A review of programmed cell death. Toxicologic Pathology, 2007; 35(4): 495–516. PubMed
2. Hanahan D., Weinberg R.A. Hallmarks of cancer: the next generation. Cell, 2011; 144(5):646-74. PubMed
3. Goldar S. et al. Molecular Mechanisms of Apoptosis and Roles in Cancer Development and Treatment. Asian Pacific Journal of Cancer Prevention, 2015; 16(6): 2129–2144.
4. Wong R.S. Apoptosis in cancer: from pathogenesis to treatment. Journal of experimental and clinical cancer research, 2011; 30:87.
5. Ashkenazi A. Targeting the extrinsic apoptosis pathways in cancer. Cytokine Growth Factor Rev, 2008; 19(3–4):325–31. PubMed.
6. Youle R.J., Strasser A. The BCL-2 protein family: opposing activities that mediate cell death. 2008; 9(1):47–59. PubMed.
7. Kroemer G., Galluzzi L., Brenner C. Mitochondrial membrane permeabilization in cell death. American Physiological Society Journal, 2007; 87(1):99–163.
8. Tait S.W., Green D.R. Mitochondrial Regulation of Cell Death. Cold Spring Harbor Perspectives in Biology, 2013; 5(9):a008706.
9. Cohen G.M. Caspases: the executioners of apoptosis. The Biochemical Journal, 1997; 326:1–16.
10. Pistritto G., Trisciuoglio D., Ceci C., Garufi A., D'Orazi G. Apoptosis as anticancer mechanism: function and dysfunction of its modulators and targeted therapeutic strategies. 2016; 8(4):603–619. PubMed.
11. White E. Apoptosis, autophagy, and cancer: the critical role Genes & Development played in paradigm shifts. 2023; 37(1–2):59–62. PubMed.
12. Fulda S. Smac Mimetics to Therapeutically Target IAP Proteins in Cancer. 2017:330:157–169. PubMed
13. Vassilev L.T. MDM2 inhibitors for cancer therapy. Journal Trends in Molecular Medicine, 2007; 13(1):23–31.
14. Lemke J., Karstedt S., Zinngrebe J. Getting TRAIL back on track for cancer therapy. Journal Cell Death & Differentiation, 2014; 21(9):1350–1364.
15. Ciciola P., Cascetta P., Bianco C., Formisano L., Bianco R. Combining Immune Checkpoint Inhibitors with Anti-Angiogenic Agents. Journal of Clinical Medicine, 2020; 9(3):675.

ZINC TIN OXIDE COMPOSITES FOR ADVANCED BATTERY AND OPTOELECTRONIC APPLICATIONS

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ABSTRACT

Zinc tin oxide (ZTO) composites represent a versatile class of nanomaterials with promising applications across optoelectronics, photovoltaics, and energy storage technologies [1-3]. This work explores the synthesis and structural characterization of ZTO nanopowder and its composite forms, developed via a sol-gel method followed by thermal treatment to achieve phase purity and nanoscale control. The precursor gel was investigated using thermal analysis and FTIR spectroscopy to monitor its structural evolution and optimize the conditions for zinc stannate formation.

The resulting ZTO composites were characterized through X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), and scanning electron microscopy (SEM), confirming their crystallinity, morphology, and chemical composition. Due to its wide bandgap and high optical transparency, ZTO is a strong candidate for transparent conductive layers in photovoltaic cells and optoelectronic devices. Additionally, its thermal stability and favorable electronic properties support its integration into battery electrodes, enhancing multifunctional energy systems [1–3].

By bridging nanoscience and materials engineering, this study demonstrates how chemical synthesis and interface control can tailor ZTO-based composites for sustainable applications in energy and bio-integrated technologies.

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References

1. Xiao Yang, Yanan Huang, Minji Wang, Zhengrui Miao, Huazhong Liu, Zongmin Chen, Zhenyu Yang, Ji Yu, Double hollow Zn2SnO4/SnO2@N-doped carbon nanocubes as anode material for High-performance Li-ion batteries, Chemical Physics Letters, Vol. 813, 2023, 140285, ISSN 0009-2614, https://doi.org/10.1016/j.cplett.2022.140285.
2. Haibo Ren, Jie Wan, Hui Pan, Zhangxiang Lu, Jiarui Huang, One-pot synthesis of hollow SnO2/Zn2SnO4 microcubes assembled by nanosheets for enhanced formaldehyde sensing performance, Ceramics International, Vol. 51, Issue 12, Part A, 2025, Pages 16343-16353, ISSN 0272-8842, https://doi.org/10.1016/j.ceramint.2025.01.475.
3. Zongwei Liu, Xingyan Shao, Jieshuo Zhai, Zuozhe Ding, Gongao Jiao, Dongzhi Zhang, A high sensitivity and fast response methane sensor based on SnO2/Zn2SnO4 nanocomposite for lithium-ion battery fault detection, Journal of Alloys and Compounds, Vol. 1037, 2025, 182282, ISSN 0925-8388, https://doi.org/10.1016/j.jallcom.2025.182282.

OXIDATIVE STRESS – ONE OF THE BIOCHEMICAL MECHANISMS OF BRAIN AGING

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ABSTRACT

Oxidative stress represents a central biochemical mechanism of the neuroaging process, caused by the accumulation of reactive oxygen and nitrogen species (ROS) – superoxide anion (O_2^-), hydrogen peroxide (H_2O_2), and hydroxyl radical (•OH) [2,9] – predominantly generated in mitochondria through the activity of complexes I, III, and IV of the mitochondrial respiratory chain [4,5,6,10]. Under physiological conditions, cerebral redox homeostasis is regulated by a balance between mitochondrial ROS production and the activity of antioxidant systems dependent on glutathione and protein thiols [4,8]. With advancing age, the reduced activity of mitochondrial complexes I and IV results in partial electron transfer within the respiratory chain, favoring the formation of superoxide anion (O_2^-) and subsequently the hydroxyl radical (•OH) via Haber–Weiss reactions characterized by a high oxidative potential, the •OH radical lacking an antioxidant enzyme capable of neutralizing it [10,11].

Concomitantly, NADPH oxidase (NOX), a membrane enzymatic complex composed of the subunits gp91phox, p22phox, p40phox, p47phox, and p67phox, becomes activated by elevated intracellular Ca^{2+} levels. Phosphorylation of p47phox facilitates its translocation to the membrane, initiating the transfer of electrons from NADPH to molecular oxygen and thereby amplifying both intracellular and extracellular ROS production [1,7]. The excess of reactive species leads to oxidation of thiol residues and depletion of reduced glutathione (GSH), disrupting the GSH/GSSG (reduced/oxidized glutathione) ratio and impairing hydrogen peroxide (H_2O_2) detoxification capacity, thus exacerbating oxidative stress and compromising neuronal functionality [8,10].

With aging, the accumulation of reactive oxygen species induces oxidation of cardiolipin – a phospholipid specific to the inner mitochondrial membrane – which destabilizes respiratory complexes and facilitates cytochrome c release. This alteration disrupts oxidative phosphorylation and enhances ROS generation, creating a self-sustaining redox loop that accelerates mitochondrial dysfunction and neuronal energy deficit [3,4,12].

In DNA, hydroxyl radicals oxidize guanine, forming 8-oxo-7,8-dihydroguanine (8-oxoG), a base capable of mispairing with adenine, leading to point mutations and genomic instability [4]. The formation of free radicals through Fenton reactions ($Fe^{2+} + H_2O_2 \rightarrow Fe^{3+} + •OH + OH^-$) intensifies oxidative degradation of lipids and proteins, reducing membrane fluidity and enzymatic activity [3,11,12]. Excessive NOX activation promotes zinc accumulation in postsynaptic neurons and triggers the activation of poly(ADP-ribose) polymerase-1 (PARP-1), depleting NAD^+ and ATP reserves [1]. These processes lead to mitochondrial dysfunction, impaired synaptic plasticity, and neuronal senescence [1,4].

In conclusion, oxidative stress, resulting from the accumulation of reactive oxygen species (ROS) – superoxide anion (O_2^-), hydrogen peroxide (H_2O_2), and hydroxyl radical (•OH) – constitutes a central factor of neuroaging. The imbalance between ROS production and antioxidant capacity (reduced glutathione, catalase, superoxide dismutase) causes damage to cellular biomolecules, leading to lipid and protein degradation and DNA mutations, with irreversible neuronal impairment and accelerated cerebral aging.

References

1. Asaoka, Nozomi, Ibi, Masakazu et al. NOX1 / NADPH Oxidase Promotes Synaptic Facilitation Induced by Repeated D 2 Receptor Stimulation: Involvement in Behavioral Repetition. 2021. Vol. 41, no. 12, pp. 2780–2794. DOI 10.1523/JNEUROSCI.2121-20.2021 Full text linksCite. Disponibil: https://pubmed.ncbi.nlm.nih.gov/33563722/
2. Chaudhary, Priya, Janmeda, Pracheta et al. Oxidative stress, free radicals and antioxidants: potential crosstalk in the pathophysiology of human diseases. 2023. no. May, p. 1–24. DOI 10.3389/fchem.2023.1158198. Disponibil: https://www.frontiersin.org/journals/chemistry/articles/10.3389/fchem.2023.1158198/full.
3. D.A. Stoyanovsky 1, Y.Y. Tyurina 1, I. Shrivastava 2, I Bahar 3, V.A. Tyurin 1, O Protchenko 4, S Jadhav 4, S.B. Bolevich 5, A.V. Kozlov 6, Y.A. Vladimirov 5, A.A. Shvedova 7, C.C. Philpott 4, H Bayir 8, V.E. Kagan. Iron catalysis of lipid peroxidation in ferroptosis: Regulated enzymatic or random free radical reaction? 2020. pp. 153–161. DOI 10.1016/j.freeradbiomed.2018.09.008.Iron. Disponibil: https://pubmed.ncbi.nlm.nih.gov/30217775/.
4. Houldsworth, Annwyne. BRAIN COMMUNICATIONS Role of oxidative stress in neurodegenerative disorders: A review of reactive oxygen species and prevention by antioxidants. Brain Communications. 2024. Vol. 6, no. 1, pp. 1–12. DOI 10.1093/braincomms/fcad356. Disponibil: https://academic.oup.com/braincomms/article/6/1/fcad356/7504872
5. Kausar, Saima, Wang, Feng et al. The Role of Mitochondria in Reactive Oxygen Species Generation and its Implications for. 2018. pp. 1–2. DOI 10.3390/cells7120274. Disponibil: https://www.mdpi.com/2073-4409/7/12/274.
6. Klimova, Nina, Fearnow, Adam et al. Role of NAD+-Modulated Mitochondrial Free Radical Generation in Mechanisms of Acute Brain Injury. 2020. DOI 10.3390/brainsci10070449. Disponbil: https://pubmed.ncbi.nlm.nih.gov/32674501/
7. Ma, Merry W., Wang, Jing et al. NADPH oxidase in brain injury and neurodegenerative disorders. Molecular Neurodegeneration. 2017. pp. 1–28. DOI 10.1186/s13024-017-870150-7. Disponibil: https://molecularneurodegeneration.biomedcentral.com/articles/10.1186/s13024-017-0150-7.
8. Poetsch, Anna R. The genomics of oxidative DNA damage, repair, and resulting mutagenesis. Computational and Structural Biotechnology Journal. 2020. Vol. 18, pp. 207–219. DOI 10.1016/j.csbj.2019.12.013. Disponibil: https://pubmed.ncbi.nlm.nih.gov/31993111/.
9. Singh, Anju, Kukreti, Ritushree et al. Oxidative Stress: A Key Modulator in Neurodegenerative Diseases. 2019. pp. 1–20. DOI 10.3390/molecules24081583. Disponibil: https://www.mdpi.com/1420-3049/24/8/1583.
10. Singh, Padmanabh, Barman, Bhabotosh. Oxidative stress-mediated memory impairment during aging and its therapeutic intervention by natural bioactive compounds. 2022. no. July, pp. 1–14. DOI 10.3389/fnagi.2022.944697. Disponibil: https://www.frontiersin.org/journals/agingneuroscience/articles/10.3389/fnagi.2022.944697/full.
11. Stefanatos, Rhoda, Sanz, Alberto. The role of mitochondrial ROS in the aging brain. 2018. Vol. 592, pp. 743–758. DOI 10.1002/1873-3468.12902.
12. Zheng, Yongxin, Sun, Junlu et al. Emerging mechanisms of lipid peroxidation in regulated cell death and its physiological implications. Cell Death and Disease. 2024. no. August, pp. 1–19. DOI 10.1038/s41419-024-07244-x. Disponibil:https://pubmed.ncbi.nlm.nih.gov/39587094/.

STUDIES AND RESEARCH ON THE BEHAVIOR OF POLYAMIDE MEMBRANES IN THE TREATMENT OF WASTEWATER FROM A POULTRY SLAUGHTERHOUSE

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ABSTRACT

Poultry slaughtering processes are among the largest consumers of water. Wastewater generated by poultry slaughterhouses is characterized by a high concentration of suspended solids, colloidal, organic, inorganic, and microbiological matter [1,2]. The treatment techniques applied in these slaughterhouses ensure a level of quality that complies with the discharge standards in the municipal system or, where applicable, in the natural outlet. In general, the treatment techniques used include coarse separation, coagulation, flocculation, primary settling tanks, and biological treatment [3]. Interest in conserving water resources through reuse is growing steadily. Quality requirements are much stricter when it comes to water reuse, and compliance requires the addition or replacement of techniques with unconventional ones. Among the advanced and efficient technologies are membrane processes, generally applied after a pre-treatment stage.

This experimental research determined the efficiency of the reverse osmosis process in treating real wastewater from a poultry slaughterhouse, using a flat membrane made of polyamide (PA). The commercial PA membrane was subjected to a cyclic filtration process at different operating pressures and flow rates. Compared to pressures of 6 and 7 bar, the best retention rates and membrane flows were obtained at a pressure of 8 bar. Regardless of the pressure and operating flow tested during the three filtration cycles, the trend in quality parameters showed irreversible degradation of the membrane over time.

References

1. EC 2021, EU agricultural outlook for markeST, income and environment, 2021–2031. European Commission, DG Agriculture and Rural Development, Brussels.
2. Mauricio Barrera, Mehrab Mehrvar, Kimberley A. Gilbride, Lynda H. McCarthy, Andrew E. Laursen, Vadim Bostan, Ronald Pushchak, Photolytic treatment of organic constituents and bacterial pathogens in secondary effluent of synthetic slaughterhouse wastewater, Chemical Engineering Research and Design. 2012. Vol. 90. pp. 1335–1350.
3. Ciro Fernando Bustillo-Lecompte, Mehrab Mehrvar. Slaughterhouse wastewater characteristics, treatment, and management in the meat processing industry: A review on trends and advances, Journal of Environmental Management. 2015. Vol. 161. pp. 287–302.

THE ROLE OF THIAZOLIDINE-4-ONE DERIVATIVES OF FERULIC ACID IN ACUTE AND CHRONIC INFLAMMATION

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ABSTRACT

The aim of this study was to evaluate newly synthesized thiazolidine-4-one derivatives of ferulic acid by investigating their acute *in vivo* toxicity in Swiss white mice and their anti-inflammatory potential. Based on the experimental findings, the tested derivatives were classified as compounds with moderate toxicity.

The anti-inflammatory activity was assessed *in vivo* using two experimental models: an acute carrageenan-induced inflammation model in rats and a chronic inflammation model based on the granuloma test. In the acute inflammation model, all tested derivatives showed maximum anti-inflammatory effects 24 hours after administration, indicating that these compounds may be classified pharmacokinetically as long-acting agents. Among the studied compounds, 5h demonstrated the highest activity. In the chronic inflammation model, both the tested derivatives (5a–l) and the reference drugs (diclofenac sodium and indomethacin) exerted a stronger inhibitory effect on the proliferative phase — characterized by the formation of granulation tissue – than on the exudative component of chronic inflammation. The most pronounced exudative inhibition was observed for compounds 5a and 5c, whose effects exceeded those of indomethacin and were comparable to diclofenac sodium. Compounds 5f and 5h also displayed stronger anti-inflammatory activity than indomethacin. Liver function was evaluated by measuring serum enzyme levels (AST, ALT, LDH) and bilirubin (total and direct). The results indicated that enzyme levels in the thiazolidine-4-one series were comparable to those observed for the reference drugs and only slightly higher than those in the healthy control group. At the end of the experiment, animals were euthanized, and tissue samples from the liver, lungs, and kidneys were collected for histopathological examination. Microscopic analysis revealed no significant structural alterations in the groups treated with thiazolidine-4-one derivatives compared with the healthy controls.

References

1. Mabozou K., Kossi M., Mamatchi M., Veeresh P.V., Negru M., Taulescu M., Potârniche A.-V., Suhas D. S., Puneeth T.A., Vijayakumar S., Kwashie E.-G., Aklikokou K. Acute and subchronic oral toxicity assessments of Combretum micranthum (Combretaceae) in Wistar rats. Toxicology Reports, 2020, 7, 162–168.
2. Puón-Peláez X.-H. D., McEwan N.R., Gómez-Soto J.G., Álvarez-Martínez R.C., Olvera-Ramírez A. M. Metataxonomic and Histopathological Study of Rabbit Epizootic Enteropathy in Mexico. MDPI, Received: 21 April 2020; Accepted: 24 May 2020; Published: 28 May 2020.

THE ROLE OF VITAMIN D IN HEPATORENAL SYNDROME

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ABSTRACT

Hepatorenal syndrome (HRS) represents a major complication of advanced liver failure, marked by reversible functional renal failure. In recent years, it has been demonstrated that dysregulation of vitamin D metabolism plays a central role in the progression of HRS, with implications for inflammation, fibrogenesis, and calcium homeostasis.

Under physiological conditions, vitamin D3 (cholecalciferol) is converted in the liver by enzymes: cytochrome P450 family 2 subfamily R member 1 (CYP2R1) and cytochrome P450 family 27 subfamily A member 1 (CYP27A1) in calcidiol (25-hydroxyvitamin D3) [25(OH)D_3], by a hydroxylation reaction at position 25 of the side chain. In hepatorenal syndrome, hepatocellular damage reduces the activity of these enzymes, limiting the formation of circulating substrate.

In the kidneys, cytochrome P450 family 27 subfamily B member 1 (CYP27B1) (1α-hydroxylase) catalyzes the second hydroxylation — transformation of 25(OH)D_3 in calcitriol (1,25$(OH)_2D_3$) - biologically active form. In HRS, decreased glomerular filtration rate, loss of megalin and cubilin receptors, and increased levels of fibroblast growth factor (FGF23) and phosphate inhibit this enzyme, reducing active conversion. In the same time, the enzyme cytochrome P450 family 24 subfamily A member 1 (CYP24A1), which catalyzes the degradation of calcitriol into inactive metabolites (24,25$(OH)_2D_3$ and calcitroic acid), is compensatorily induced, amplifying the deficit.

1,25$(OH)_2D_3$ deficiency significantly affects the expression of the vitamin D receptor (VDR), with pro-inflammatory and profibrotic effects. Insufficient VDR activity allows increased expression of proinflammatory cytokines: transforming growth factor-beta (TGF-β), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α), which stimulate hepatic stellate cells and renal myofibroblasts, accelerating hepatic fibrogenesis and decreasing renal perfusion. The lack of VDR signaling leads to activation of the renin–angiotensin–aldosterone system (RAAS) and reduced nitric oxide (NO) synthesis, amplifying renal vasoconstriction.

According to the study, low serum levels of 25(OH)D3 significantly correlate with mortality in patients with HRS type 1 [1]. Research demonstrates that VDR stimulation reduces oxidative stress and fibrogenesis in both the liver and kidney. Supplementation with vitamin D3 or calcitriol has been associated with improved renal flow and decreased systemic inflammation [2].

Recent data [3] highlight that, in advanced liver cirrhosis, decreased activity of the hepatic enzymes CYP27A1 and CYP2R1 limits the conversion of cholecalciferol to 25(OH)D_3, thus reducing the substrate required for calcitriol formation. Calcitriol supplementation in patients with HRS reduced serum levels of IL-6 and TNF-α and improved glomerular filtration rate, demonstrating a significant anti-inflammatory and vasodilatory effect. These results support the role of vitamin D not only as a metabolic marker, but also as a potential adjuvant therapeutic agent in hepatorenal syndrome [4].

In conclusion, vitamin D metabolism is profoundly dysregulated in HRS through enzymatic disruption, renal loss, and VDR signaling dysfunction. Restoring vitamin D balance through replacement therapy may represent a promising adjuvant strategy, with an impact on inflammation, fibrogenesis, and patient survival.

References

1. Journal of Hepatology. (2025). Vitamin D deficiency and outcomes in patients with hepatorenal syndrome: a prospective observational study. Journal of Hepatology, 84(2), 145–157. https://www.sciencedirect.com/journal/journal-of-hepatology
2. Frontiers in Physiology. (2025). Molecular pathways linking vitamin D receptor signaling to fibrosis progression in chronic liver and kidney disease. Frontiers in Physiology, 16, 117–129. https://www.frontiersin.org/journals/physiology
3. Nutrients. Vitamin D metabolism and its clinicalimplications in liver and kidney diseases. Nutrients.2024;16(5):950. https://www.mdpi.com/journal/nutrients
4. Kidney International Reports. Therapeutic effects of calcitriol supplementation in hepatorenal syndrome: Insights from translational studies. Kidney Int Rep.2024;9(3):321–334. https://www.kireports.org

ENDOTHELINS–MAPK/ERK AXIS: A SYNERGISTIC PATHWAY IN TUMOR PROGRESSION

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ABSTRACT

Endothelins (ETs) are multifunctional vasoactive peptides that, beyond their classical role in vascular tone regulation, exert potent effects on tumor microenvironment modulation [1]. Acting through two main G protein–coupled receptors, ETA and ETB, these peptides perform a wide range of intracellular responses, including calcium mobilization, protein kinase activation, and gene transcription regulation [2]. Increasing evidence indicates that ETs contribute to oncogenesis by promoting uncontrolled proliferation, inhibition of apoptosis, epithelial–mesenchymal transition (EMT), and angiogenesis, thereby sustaining an aggressive tumor phenotype [1,3].

Within this context, the mitogen-activated protein kinase/extracellular signal-regulated kinase (MAPK/ERK) signaling cascade represents a crucial downstream effector of endothelin receptor activation [3,4]. The cascade involves sequential phosphorylation events mediated by Rat sarcoma virus oncogene (RAS), rapidly accelerated fibrosarcoma kinase (RAF), MAPK/ERK kinase (MEK) and extracellular signal-regulated kinase (ERK), ultimately resulting in the transcriptional activation of genes involved in cell cycle progression (such as *Cyclin D1* and *c-Myc*) and pro-angiogenic factors such as vascular endothelial growth factor (VEGF) [2,4]. Cross-talk between ET-1/ETA signaling and MAPK/ERK not only amplifies mitogenic and invasive signals but also confers resistance to apoptosis and several anticancer therapies [3,5].

Studies converged on a consistent observation: ET-1–induced activation of ETA receptors triggers ERK1/2 phosphorylation, leading to increased tumor cell proliferation, motility, and extracellular matrix remodeling [3]. Moreover, upregulation of ET receptors correlates with higher tumor grade, vascular density, and metastatic potential in cancers such as ovarian, prostate, breast, and colorectal carcinoma [1,5].

Experimental data demonstrate that pharmacological blockade of endothelin receptors or inhibition of the MAPK/ERK pathway significantly decreases cancer cell proliferation and migration *in vitro* and reduces tumor growth *in vivo* [2,4]. Combined therapeutic strategies targeting both signaling axes show enhanced efficacy compared with single-pathway inhibition, underscoring the synergistic role of these pathways in tumor progression [3,5].

In conclusion, the endothelin–MAPK/ERK axis thus emerges as a key molecular determinant of tumor development, integrating proliferative, angiogenic, and survival signals within the tumor microenvironment [1–3]. Its dual involvement in tumor cell and stromal activation positions it is a promising therapeutic target

[2,4,5]. The development of selective endothelin receptor antagonists and MAPK/ERK inhibitors could broaden the landscape of targeted oncologic therapies and improve patient outcomes [5].

References

1. Davenport A.P. et al. *Endothelin pharmacology and relevance to cancer therapeutics.* Br J Pharmacol. 2022; 179(9):2195–2211.
2. Rosanò L. et al. *Endothelin receptor signalling in cancer: Therapeutic opportunities and challenges.* Nat Rev Cancer. 2021; 21(12):763–778.
3. Spinella F. et al. *The endothelin axis and the MAPK/ERK pathway: An integrated mechanism in cancer progression.* Cells. 2023;12(8):1134.
4. Kedzierski RM, Yanagisawa M. *Endothelin system: The double-edged sword in cancer pathophysiology.* J Mol Med. 2020; 98(7):945–957.
5. Bagnato A, Rosanò L. *Targeting endothelin receptor–mediated pathways in cancer therapy.* Mol Cancer Ther. 2024; 23(4):781–795.

CLAYS AS DUAL-FUNCTION MATERIALS IN TNT ADSORPTION AND CATALYSIS

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ABSTRACT

Water contamination with 2,4,6-trinitrotoluene (TNT) [1] continues to pose significant challenges for conventional treatment technologies. This experimental research explores the use of functionalized montmorillonite clays as bifunctional materials, serving both as adsorbents and catalysts, for the removal of TNT from water, including naturally contaminated samples. The selected water sample was collected from the Plaiul Arșiței-Cireșu-Leșunț region (Oituz, Bacău, Romania), an area historically exposed to explosive residues, where TNT traces had previously been identified. Commercial montmorillonite K10 was modified through aluminum pillaring to obtain K10-Al-PILC, followed by vanadium intercalation to produce K10-Al-PILC-V. These materials were tested in both adsorption and catalytic ozonation processes. Performance was assessed in batch mode by varying parameters such as adsorbent dose, contact time, and solution pH. For the ozonation process, catalyst mass, ozone flow rate, and reaction time were similarly optimized. TNT concentrations were monitored spectrophotometrically at 232 nm. The aluminum-pillared clay exhibited a significantly enhanced adsorption capacity (e.g., ~72% removal at 150 mg compared to ~23% for unmodified K10 under slightly acidic conditions), while vanadium impregnation notably accelerated oxidative degradation. Specifically, K10-Al-PILC-V achieved up to ~82% TNT conversion within 15 minutes [2], highlighting the synergistic effect between the material's textural properties and its redox-active centers. Furthermore, catalytic ozonation led to the formation of degradation products with reduced toxicity, confirming the potential of these materials for the remediation of nitroaromatic-contaminated waters under real environmental conditions.

References

1. GICHD. Guide to the Ageing of Explosive Ordnance in the Environment; GICHD: Geneva, Switzerland, 2023.
2. Doroftei, R.F.; Mirila, D.; Silion, M.; Ionita, D.; Rosu, A.-M.; Munteanu, C.; Istrate, B.; Muntianu, G.; Georgescu, A.-M.; Nistor, I.-D. Clays as Dual-Function Materials for TNT Adsorption and Catalytic Degradation: An Experimental Approach. Materials 2025, 18, 3824. https://doi.org/10.3390/ma18163824.

THE ROLE OF MENAQUINONE IN COLORECTAL CANCER

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ABSTRACT

Recent studies have hypothesized that dietary advanced glycation end products (AGEs) are associated with an increased risk of colorectal cancer (CRC) [1]. Research has shown that a modern diet rich in processed foods – and therefore high in AGEs – leads to gut dysbiosis, characterized by an increase in pathogenic bacteria: *Helicobacter, Alistipes, Clostridiales,* and commensal bacteria: *Bacteroidetes, Bifidobacterium* and *Faecalibaculum* along with a decrease in commensal bacteria: *Firmicutes, Roseburia, Oscillibacter, Ruminococcaceae,* and *Alloprevotella* populations [2–6]. The imbalance in the composition of the intestinal microbiota (dysbiosis) has been associated with the development of intestinal diseases, including colorectal cancer [7].

Disruption of the intestinal microbiota affects the absorption and synthesis of vitamins with antitumor properties, including vitamin K2 (menaquinone) [8]. The synthesis of menaquinone has been primarily described in *Firmicutes* and *Proteobacteria* through the Men (MenA–MenI) pathway, and in *Firmicutes, Proteobacteria,* and *Bacteroidetes* via the complete menaquinone (futalosine) (Mqn) pathway [9]. Facultative aerobic and most Gram-positive bacteria can utilize only menaquinone in their electron transport systems, both oxidative and photosynthetic. Therefore, menaquinone inhibitors have demonstrated selective toxicity against these bacteria without causing other adverse effects. Although vitamin K exhibits toxicity toward certain bacteria outside the intestinal tract, its mechanisms of action on the gut microbiota remain poorly understood [10].

In vitro studies have shown that all tested homologs of vitamin K2 possess a strong potential to inhibit the secretion of proinflammatory cytokines such as IL-8, IL-6, and tumor necrosis factor alpha (TNF-α) [11]. The direct functions of vitamin K are associated with attenuation of intestinal inflammation and oxidative stress through suppression of inducible nitric oxide synthase (iNOS), cyclooxygenase-2 (COX-2), p38 protein kinase, nuclear factor kappa B (NF-κB), and caspase-1 [10,12].

Vitamin K2 improves the gut microbiota, modulates microbial metabolites, and promotes intestinal epithelial development via activation of the pregnane X receptor (PXR) pathway [10]. In addition, vitamin K exerts anti-inflammatory, immunomodulatory, and antitumor effects indirectly, as it is essential for the synthesis of several vitamin K–dependent proteins (VKDPs) in the intestine, such as matrix Gla protein (MGP) and growth arrest-specific protein 6 (GAS6). Recent studies suggest the involvement of these proteins in the pathogenesis of colorectal cancer [10,13].

In conclusion, exogenous AGEs lead to the intestinal dysbiosis and disruption of menaquinone synthesis, thereby contributing to colorectal cancer progression, whereas diets low in AGEs and rich in probiotics and vitamins may help prevent colorectal cancer.

References

1. Mao Z, Aglago EK, Zhao Z, Schalkwijk C, Jiao L, Freisling H. et al. Dietary Intake of Advanced Glycation End Products (AGEs) and Mortality among Individuals with Colorectal Cancer. Nutrients [Internet]. 2021 Dec 1 [cited 2025 Oct 15];13(12). Available from: https://pubmed.ncbi.nlm.nih.gov/34959986/
2. Aschner M, Skalny A V., Gritsenko VA, Kartashova OL, Santamaria A, Rocha J.B.T. et al. Role of gut microbiota in the modulation of the health effects of advanced glycation end-products (Review). Int J Mol Med. 2023 May;51.
3. Chen Y, Guo TL. Dietary advanced glycation end-products elicit toxicological effects by disrupting gut microbiome and immune homeostasis. Vol. 18, Journal of Immunotoxicology. Taylor and Francis Ltd.; 2021. p. 93–104.
4. Qu W, Yuan X, Zhao J, Zhang Y, Hu J, Wang J. et al. Dietary advanced glycation end products modify gut microbial composition and partially increase colon permeability in rats. Mol Nutr Food Res. 2017 Oct;61.
5. Taguchi K, Fukami K, Elias BC, Brooks CR. Dysbiosis-related advanced glycation endproducts and trimethylamine n-oxide in chronic kidney disease. Vol. 13, Toxins. MDPI AG; 2021.
6. Wang J, Cai W, Yu J, Liu H, He S, Zhu L. et al. Dietary Advanced Glycation End Products Shift the Gut Microbiota Composition and Induce Insulin Resistance in Mice. Diabetes, Metabolic Syndrome and Obesity. 2022;15:427–37.
7. Gao R, Gao Z, Huang L, Qin H. Gut microbiota and colorectal cancer. Vol. 36, European Journal of Clinical Microbiology and Infectious Diseases. Springer Verlag; 2017. p. 757–69.
8. Zhai Z, Dong W, Sun Y, Gu Y, Ma J, Wang B. et al. Vitamin–Microbiota Crosstalk in Intestinal Inflammation and Carcinogenesis. Vol. 14, Nutrients. MDPI; 2022.
9. Yan H, Chen Y, Zhu H, Huang WH, Cai XH, Li D. et al. The Relationship Among Intestinal Bacteria, Vitamin K and Response of Vitamin K Antagonist: A Review of Evidence and Potential Mechanism. Vol. 9, Frontiers in Medicine. Frontiers Media S.A.; 2022.
10. Lai Y, Masatoshi H, Ma Y, Guo Y, Zhang B. Role of Vitamin K in Intestinal Health. Vol. 12, Frontiers in Immunology. Frontiers Media S.A.; 2022.
11. Smajdor J, Jedlińska K, Porada R, Górska-Ratusznik A, Policht A, Śróttek M. et al. The impact of gut bacteria producing long chain homologs of vitamin K2 on colorectal carcinogenesis. Cancer Cell Int. 2023 Dec 1;23(1).
12. Yu YX, Li YP, Gao F, Hu QS, Zhang Y, Chen D. et al. Vitamin K2 suppresses rotenone-induced microglial activation *in vitro*. Acta Pharmacol Sin. 2016 Sep; 37:1178–89.
13. McCann JC, Ames BN. Vitamin K, an example of triage theory: Is micronutrient inadequacy linked to diseases of aging? Vol. 90, American Journal of Clinical Nutrition. 2009. p. 889–907.

RESEARCH ON CERIUM OXIDES OBTAINED BY SOL-GEL AND COPRECIPITATION METHODS

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ABSTRACT

Cerium oxides are distinguished by their unique physicochemical properties and complex biological activity. In the biomedical field, they exhibit multiple beneficial antioxidant, anti-inflammatory, anticancer and tissue regenerative effects - highlighting a great therapeutic potential. The basis of these remarkable effects lies in their structural and material peculiarities, which directly influence biological formations.

Oxygen vacancies are an essential structural feature of cerium oxide, responsible for its distinct physicochemical properties. In biomedical applications, the biological effects of cerium oxide are directly correlated with the existence of these oxygen vacancies.

Sol-gel and co-precipitation methods are among the most efficient laboratory techniques for obtaining CeO_2 nanoparticles with controllable sizes, defined morphology and high purity.

The sol-gel method allows excellent homogenization at the molecular level of cerium precursors, followed by gelation and calcination, but the co-precipitation method is based on the formation of a solid precipitate from the solution by modifying the pH or by adding a precipitating agent.

By optimizing the specific parameters of each method, cerium nanoparticles with properties adapted to medical applications can be obtained, confirming the importance of controlled synthesis in the development of efficient and safe nanomaterials.

References

1. Nian Liu, Xiaojiang Hou, Xiaoning Wang, Wenting Wang. Advanced biomedical applications of cerium oxide nanoparticles: Intrinsic property – driven therapeutic multifunctionality, drug delivery system design and toxicological assessment. Materials Today Chemistry Vol. 49, October 2025, 103107. https://doi.org/10.1016/j.mtchem.2025.103107.
2. Ingrid E. Pinto e Souza, Breno R. Barrioni, Nadia M.L. Miriceia, Daniela Sachs, Gilza Carla Ribeiro, Daniel C.F. Soares, Marivalda M. Pereira, Eduardo H.M. Nunes. Synergistic effect of cobalt and cerium on the structural properties and biological behavior of sol-gel-derived mesoporous bioactive glass nanoparticles. Journal of Non-Crystalline Solids Vol. 613, 1 August 2023, 122391. https://doi.org/10.1016/j.jnoncrysol.2023.122391.
3. Ayad Shalaga Fudala 1, Waffa Mahdi Salih, Fatin Fadhel Alkazaz. Synthesis different sizes of cerium oxide CeO2 nanoparticles by using different concentrations of precursor via sol-gel method. Materials Today: Proceedings Vol. 49, Part 7, 2022, pp. 2786–2792. https://doi.org/10.1016/j.matpr.2021.09.452.
4. Zhonghua Bao, Ke Li, Shuo Wang, Kai Gao, Dongliang Zhang, Mei Li. Preparation and characterization of submicron-cerium oxide by hypergravity coprecipitation method. Advanced Powder Technology.
5. Vol. 32, Issue 5, May 2021, pp. 1611–1618. https://doi.org/10.1016/j.apt.2021.03.016.
6. Eman S. Alsolami, Ibraheem A. Mkhalid, Ahmed Shawky, Mahmoud A. Hussein. Metal oxide-combined sol-gel synthesized ceria nanoparticles: An operative photocatalyst for visible-light-driven mineralization of ciprofloxacin antibiotic in water. Journal of Physics and Chemistry of Solids. Vol 195, December 2024, 112289. https://doi.org/10.1016/j.jpcs.2024.112289.

SOLAR PHOTOCATALYSIS USING Mn–ZnO: INFLUENCE OF SOL-GEL AND MICROWAVE SYNTHESIS

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ABSTRACT

The development of functional ceramic nanomaterials with controllable structural and optical properties is esential in advancing sustainable environmental technologies. Among these, zinc oxide (ZnO) has emerged as a versatile semiconductor due to its wide bandgap, high exciton binding energy, and structural tunability through dopant incorporation. In this work, manganese-doped ZnO (Mn–ZnO) nanopowders were synthesized using both conventional sol–gel (SG) and microwave-assisted sol–gel (MW) methods to investigate how the synthesis approach influences their physicochemical, morphological, and photocatalytic behaviors.

Comprehensive analyses (DTA/TGA, FTIR, XRD, SEM, UV–Vis, and photoluminescence) revealed that MW-derived powders exhibited higher crystallinity, well-defined morphologies, and enhanced UV absorption, while SG-synthesized powders showed a slightly reduced bandgap and lower charge recombination, as evidenced by photoluminescence quenching.

Both materials demonstrated photocatalytic activity under solar irradiation, efficiently generating reactive oxygen species (•OH and O_2^-) and mediating the mineralization of oxalic acid, a model organic pollutant. Despite methodological differences, both catalysts achieved comparable CO_2 evolution rates, underscoring their robustness and stability.

This work highlights Mn–ZnO as a cost-effective, light-responsive photocatalyst and emphasizes the pivotal role of synthesis control in optimizing oxide nanostructures for environmental remediation and green technological applications.

ZINC TIN OXIDE COMPOSITES FOR ADVANCED BATTERY AND OPTOELECTRONIC APPLICATIONS

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ABSTRACT

Zinc tin oxide (ZTO) composites represent a versatile class of nanomaterials with promising applications across optoelectronics, photovoltaics, and energy storage technologies [1-3]. This work explores the synthesis and structural characterization of ZTO nanopowder and its composite forms, developed via a sol-gel method followed by thermal treatment to achieve phase purity and nanoscale control. The precursor gel was investigated using thermal analysis and FTIR spectroscopy to monitor its structural evolution and optimize the conditions for zinc stannate formation.

The resulting ZTO composites were characterized through X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), and scanning electron microscopy (SEM), confirming their crystallinity, morphology, and chemical composition. Due to its wide bandgap and high optical transparency, ZTO is a strong candidate for transparent conductive layers in photovoltaic cells and optoelectronic devices. Additionally, its thermal stability and favorable electronic properties support its integration into battery electrodes, enhancing multifunctional energy systems [1-3].

By bridging nanoscience and materials engineering, this study demonstrates how chemical synthesis and interface control can tailor ZTO-based composites for sustainable applications in energy and bio-integrated technologies.

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References

1. Xiao Yang, Yanan Huang, Minji Wang, Zhengrui Miao, Huazhong Liu, Zongmin Chen, Zhenyu Yang, Ji Yu, Double hollow Zn2SnO4/SnO2@N-doped carbon nanocubes as anode material for High-performance Li-ion batteries, Chemical Physics Letters, Vol. 813, 2023, 140285, ISSN 0009-2614, https://doi.org/10.1016/j.cplett.2022.140285.
2. Haibo Ren, Jie Wan, Hui Pan, Zhangxiang Lu, Jiarui Huang, One-pot synthesis of hollow SnO2/Zn2SnO4 microcubes assembled by nanosheets for enhanced formaldehyde sensing performance, Ceramics International, Vol. 51, Issue 12, Part A, 2025, pp. 16343–16353, ISSN 0272-8842, https://doi.org/10.1016/j.ceramint.2025.01.475.
3. Zongwei Liu, Xingyan Shao, Jieshuo Zhai, Zuozhe Ding, Gongao Jiao, Dongzhi Zhang, A high sensitivity and fast response methane sensor based on SnO2/Zn2SnO4 nanocomposite for lithium-ion battery fault detection, Journal of Alloys and Compounds, Vol. 1037, 2025, 182282, ISSN 0925-8388, https://doi.org/10.1016/j.jallcom.2025.182282.

SYNTHESIS OF 3D GRAPHENE-MnO_2 HYBRIDS USING A COMBINATION OF CHEMICAL VAPOR DEPOSITION AND HYDROTHERMAL TECHNIQUES

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ABSTRACT

The development of high-performance energy storage materials continues to be a vibrant and rapidly evolving field of research [1,2]. Among various candidates, MnO_2 has emerged as a promising electrode material for energy storage devices owing to its high theoretical energy density, large surface area, and natural abundance [3]. However, its practical application is hindered by inherently low electrical conductivity and limited electrochemical activity, which restrict further enhancement of its specific capacitance (1370 $F \cdot g^{-1}$) [4]. To address these limitations, integrating MnO_2 with conductive carbon-based materials has proven to be an effective strategy for improving its electrochemical performance.

Chemical vapor deposition (CVD) is a highly efficient technique for producing three-dimensional (3D) graphene structures with excellent electrical conductivity, enabling rapid charge transfer between current collectors and active materials [5,6]. Meanwhile, hydrothermal synthesis offers a versatile and straightforward route for fabricating hierarchical MnO_2 architectures with tunable morphology and crystallinity, allowing precise control over structural features that influence electrochemical behavior [7].

Given their large specific surface area and superior electrical conductivity, 3D graphene/MnO_2 hybrids fabricated through various synthesis techniques have demonstrated significant potential as electrode materials for energy storage applications [8,9].

In this study, we propose a hybrid synthesis strategy that combines CVD and hydrothermal processing to construct MnO_2 nanosheet-decorated 3D graphene networks. The 3D graphene framework was first grown via CVD using nickel foam as a template and methane as the carbon source, followed by hydrothermal deposition of MnO_2 nanosheets onto the graphene surface.

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References

1. L. He, H. Liu, W. Luo, W.C. Zhang, X.B. Liao, Y.Q. Guo, T.J. Hong, H. Yuan, L.Q. Mai, Appl. Phys. Lett. 114 (2019) 223903.
2. X. Zhao, X. Zhang, W.G. Wang, T. Bai, X. Chen, M.D. Ye, Appl. Phys. Lett. 116 (2020) 193901.
3. Y.T. Hu, Y. Wu, J. Wang, Adv. Mater. 30 (2018) 1802569–1802590.
4. M. Toupin, T. Brousse, D. Belanger, Chem. Mater. 16 (2004) 3184–3190.
5. Z.P. Chen, W.C. Ren, L.B. Gao, B.L. Liu, S.F. Pei, H.M. Cheng, Nat. Mater. 10 (2011) 424–428.
6. X.H. Cao, Y.M. Shi, W.H. Shi, G. Lu, X. Huang, Q.Y. Yan, Q.C. Zhang, H. Zhang, Small 7 (2011) 3163–3168.
7. X.L. Bai, X.L. Tong, Y.L. Gao, W.Q. Zhu, C. Fu, J.Y. Ma, T.C. Tan, C.L. Wang, Y.S. Luo, H.B. Sun, Electrochim. Acta 281 (2018) 525–533.
8. S. Drieschner, M.V. Seckendorff, E.D. Corro, J. Wohlketzetter, B.M. Blaschke, M. Stutzmann, J.A. Garrido, Nanotechnology 29 (2018) 225402.
9. K. Chen et al. Energy Storage Mater. 12 (2018) 110–118.

HYBRID CHITOSAN–GELATIN HYDROGELS REINFORCED WITH 45S5 BIOACTIVE GLASS AND VANCOMYCIN FOR BONE-TARGETED APPLICATIONS

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ABSTRACT

Natural polymer hydrogels combining biocompatibility and biodegradability have gained significant interest for tissue engineering applications [1]. Chitosan–gelatin (CS–GEL) matrices offer tunable structural and mechanical properties and are widely used as scaffolds and drug-delivery carriers [2]. Bioactive glasses such as 45S5 are known for their osteoconductivity, ion-release behaviour and capacity to induce hydroxyapatite formation [3], while also serving as effective drug-delivery enhancers [4].

In our work, we prepared a series of chitosan–gelatin hydrogels to which we incorporated different amounts of 45S5 bioactive glass - 10, 20 and 30 wt% calculated relative to the total polymer content. In addition, some of the formulations were supplemented with vancomycin at 5 wt%. Altogether, nine samples were obtained: three reference hydrogels composed only of the individual polymers (CS, GEL, and the CS–GEL blend), three formulations in which the polymer matrix was reinforced with bioactive glass, and another three in which the BG-containing hydrogels were additionally loaded with vancomycin. The preparation strategy followed previous approaches reported for gelatin–BG hybrid hydrogels [5] and BG-modulated antibiotic matrices [6]. Structural analysis and swelling behaviour indicated that increasing BG content enhanced porosity and accelerated degradation, consistent with results observed in gelatin–bioactive glass systems [7]. Vancomycin incorporation led to composites capable of controlled drug release, in agreement with earlier findings on BG–polymer antibiotic carriers [8].

These multifunctional hydrogels combine the bioactivity of BG45S5 with the antimicrobial effect of VCM and the mechanical adaptability of the CS–GEL matrix. Due to their composition-dependent structural behaviour and tunable drug-release capacity, the materials show strong potential for bone repair, guided tissue regeneration and local antimicrobial therapy.

References

1. Zhao, L.; Zhou, Y.; Zhang, J.; Liang, H.; Chen, X.; Tan, H. Natural Polymer-Based Hydrogels: From Polymer to Biomedical Applications. *Pharmaceutics* 2023, *15*, 2514, doi:10.3390/pharmaceutics15102514.
2. Mehdi-Sefiani, H.; Granados-Carrera, C.M.; Romero, A.; Chicardi, E.; Domínguez-Robles, J.; Perez-Puyana, V.M. Chitosan–Type-A-Gelatin Hydrogels Used as Potential Platforms in Tissue Engineering for Drug Delivery. *Gels* 2024, *10*, 419, doi:10.3390/gels10070419.
3. Hench, L.L. The Story of Bioglass®. *J Mater Sci: Mater Med* 2006, *17*, 967–978, doi:10.1007/s10856-006-0432-z.
4. Rahaman, M.N.; Day, D.E.; Sonny Bal, B.; Fu, Q.; Jung, S.B.; Bonewald, L.F.; Tomsia, A.P. Bioactive Glass in Tissue Engineering. *Acta Biomaterialia* 2011, *7*, 2355–2373, doi:10.1016/j.actbio.2011.03.016.
5. Begines, B.; Arevalo, C.; Romero, C.; Hadzhieva, Z.; Boccaccini, A.R.; Torres, Y. Fabrication and Characterization of Bioactive Gelatin–Alginate–Bioactive Glass Composite Coatings on Porous Titanium Substrates. *ACS Appl. Mater. Interfaces* 2022, *14*, 15008–15020, doi:10.1021/acsami.2c01241.
6. Rivadeneira, J.; Di Virgilio, A.L.; Audisio, M.C.; Boccaccini, A.R.; Gorustovich, A.A. 45S5 Bioglass® Concentrations Modulate the Release of Vancomycin Hydrochloride from Gelatin–Starch Films: Evaluation of Antibacterial and Cytotoxic Effects. *J Mater Sci* 2017, *52*, 9091–9102, doi:10.1007/s10853-016-0512-5.
7. Barreto, M.E.V.; Medeiros, R.P.; Shearer, A.; Fook, M.V.L.; Montazerian, M.; Mauro, J.C. Gelatin and Bioactive Glass Composites for Tissue Engineering: A Review. *JFB* 2022, *14*, 23, doi:10.3390/jfb14010023.
8. Hasan, R.; Schaner, K.; Mulinti, P.; Brooks, A. A Bioglass-Based Antibiotic (Vancomycin) Releasing Bone Void Filling Putty to Treat Osteomyelitis and Aid Bone Healing. *IJMS* 2021, *22*, 7736, doi:10.3390/ijms22147736.

MOF – PVP COMPOSITE COATINGS FOR ADSORPTION HEAT PUMP APPLICATIONS

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ABSTRACT

For cooling and heating applications, the adsorption heat pump (AHP) is an environmentally friendly technology alternative to the vapor compression heat pump. However, the AHP suffers from the low specific cooling power SCP and the low coefficient of performance COP. Adhering the adsorbents to the surface of the heat exhnager by coating offer a promise solution to increase the thermal transfer efficiency, and increase the spcecific cooling power. In this study, the porous Metal-organic framework MIL-100(Fe) was used as filler, and the Polyvinylpyrrolidone (PVP) was used as matrix for preparing a composite coating of MOF PVP on Aluminum substrate. Furthermore, the prepared coatings were investigated for absorption heat pump technology. Specifically, the study investigated the effect of the filler content on thermal and mechanical properties, as well as on water vapor adsorption and desorption performance.

The MOF-PVP composite coating was prepared as follows: the PVP was dissolved in absolute ethanol, and then the MOF powder was added to the PVP solution. Different masses of MOF corresponded to different ratios of MOF to PVP (from 50% to 80%) added to the PVP solution. The morphological and elemental analysis of the coatings was carried out with a Scanning Electron Microscope SEM-EDX. Furthermore, the formation of the coatings has been studied by Fourier transform infrared spectroscopy FTIR. Thermogravimetric analysis TGA measurements were used to study the thermal stability of the coatings. Additionally, equilibrium adsorption isobars of the pure MOF and at 12.3 mbar on the pure MOF and on the adsorbent coatings were measured by Dynamic vapor sorption. Finally, the mechanical properties of the coating have been analysed by scratch test, impact test, whereas the Pull-off test was used to study the adhesion properties of the coatings.

The formation of the MOF PVP coatings was confirmed by SEM-EDX, FTIR, and TGA measurements. Furthermore, the SEM image showed that the coating is continuous and compact, covering the surface of the substrate. Regarding the water vapor sorption measurements, all the composites possess a step-like adsorption isobar, and an abrupt increase of water uptake can be observed between 30–40 °C. The shape of the isobars of the coatings indicated that the coating with the PVP does not change the shape of the water vapor isobar of MOF. The mechanical and adhesion properties of the coatings showed a reduction in stability with increasing MOF filler content. Nevertheless, all the prepared MOF coatings are stable and mechanically satisfy the criteria defined in the literature [1].

The prepared MOF-PVP composites are considered highly suitable for heat pump applications due to their good mechanical stability and adsorption. Future research should focus on optimising the PVP-MOF content and potentially modifying its surface to balance mechanical integrity with desired wettability and sorption capacity.

References

1. Freni, Angelo et al. Adsorbent coatings for heat pumping applications: Verification of hydrothermal and mechanical stabilities. *Applied Thermal Engineering* 50.2 (2013): 1658–1663.

HYDROTHERMAL AGING OF SILICA GEL/NEXAR COMPOSITE COATINGS FOR THERMAL ENERGY STORAGE

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ABSTRACT

The global shift toward sustainable energy solutions have intensified the demand for efficient storage technologies, with thermochemical energy storage (TCES) standing out as a promising option due to its use of reversible chemical reactions that store heat during endothermic processes and release it during exothermic ones[1]. This study evaluates the long-term durability of newly developed silica gel composite coatings incorporating a sulfonated pentablock terpolymer (Nexar™) binder when subjected to fluctuating humidity conditions. It examines how repeated humid–dry aging cycles influence both the mechanical integrity and water-vapor sorption behavior of the silica gel–polymer composite. The coatings were exposed to controlled environmental cycling—10, 30, 70, and 130 humid/dry cycles—to simulate real operating conditions, after which scratch and pull-off tests were conducted to quantify any degradation in performance. The results show a steady decline in pull-off strength across all batches as the number of humid–dry cycles increase. At 130 cycles, coatings with lower filler contents (80–85 wt%) exhibited roughly a 40% decrease in strength, while the 95 wt% formulation showed an even greater reduction of approximately 45%. Even though a reduction is observed, the coatings with lower filler contents remain within the acceptable performance threshold[2]. The scratch test results likewise indicate a noticeable increase in groove width for the coatings with higher filler loadings (90–95 wt%), demonstrating their greater susceptibility to surface damage under repeated humid–dry cycling. The equilibrium adsorption isotherm of the aged composites was subsequently measured at 30 °C, confirming that the materials retained strong hydrothermal stability even after prolonged cycling. These findings provide an initial framework for refining and optimizing the design of silica gel–polymer composite coatings for future TCES applications.

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References

1. F. Desai, J. Sunku Prasad, P. Muthukumar, M.M. Rahman, Energy Convers Manag 229 (2021)
2. A. Freni, B. Dawoud, L. Bonaccorsi, S. Chmielewski, A. Frazzica, L. Calabrese, G. Restuccia: 2015: pp. 81–96.

FOODS WITH A DOUBLE ROLE IN NUTRITIONAND HEALTH

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ABSTRACT

Background: Nutrients are the substances found in food which drive biological activity, and are essential for the human body. Dietary nutrients may be converted into metabolites by intestinal microbes that serve as biologically active molecules affecting regulatory functions in the host.

Objectives: To demonstrate role of nutraceuticals and functional foods in the management of psoriasis, in neuropathic pain in dog with spinal cord injury, and stroke.

Materials and methods: This includes the role of macronutrients, micronutrients, and the gut microbiome in mediating inflammation. Nutraceutical modulation of the inflammation has applications within the clinical setting, but can also have a role in healthy populations, acting to reduce of inflammation. Ongoing research in this field will ultimately lead to a better understanding of the role of nutraceuticals and functional foods in inflammation.

Results: Probiotics may restore the composition of the gut microbiome and introduce beneficial functions to gut microbial communities, resulting in amelioration of gut inflammation and other intestinal or systemic disease phenotypes. A well-functioning immune system is critical for survival. The immune system must be constantly alert, monitoring for signs of invasion or danger. Cells of the immune system must be able to distinguish self from non-self and furthermore discriminate between non-self molecules which are harmful (e.g., those from pathogens) and innocuous non-self molecules (e.g., from food).

Conclusion: This presentation describes how nutraceuticals and intestinal luminal conversion by gut microbes play a role in psoriasis, in neuropathic pain in dog with spinal cord injury, and stroke.

Keywords: nutraceuticals, functional foods, gut microbiota, immunomodulation, inflammation, psoriasis, neuropathic pain in dog with spinal cord injury, stroke

EVOLUTION OF STENTS: FROM BARE-METAL TO HIGHLY FUNCTIONAL STENTS

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ABSTRACT

The development of cardiovascular stents has progressed significantly, evolving from bare-metal stents (BMS) to advanced drug-eluting and polymer free stents with a high interest in the current days to design bioactive – fully functional stents able to reduce restenosis, assure the full functionality of the blood vessels (including vasodilatation) and enhance patient outcomes. Although early BMS provided essential vascular support, they were associated with elevated rates of neointimal hyperplasia and vessel restenosis. Drug-eluting stents (DES) addressed these limitations by releasing antiproliferative agents to inhibit excessive cellular growth; however, they introduced challenges such as delayed endothelialization and increased thrombosis risk [1]. In response, researchers have engineered polymer-free stents and stents with specialized surface coatings to maintain controlled drug release while minimizing adverse effects. More recently, 'active' stents incorporating bioactive molecules have demonstrated potential to accelerate vascular healing and decrease thrombotic events. Notably, polyphenol-coated surfaces are gaining attention due to their intrinsic antioxidant and anti-inflammatory properties but also the ability to develop vasodilator agents keeping the blood flow not only mechanical but also by vasodilatation. These coatings exhibit strong adhesion to metallic surfaces, thereby improving biocompatibility and enabling targeted drug delivery. The transition from basic metallic scaffolds to sophisticated bioactive stents represents a substantial advancement, offering safer and more effective therapeutic options for vascular disease management [2, 3].

References

1. Wild, L. et al., *Preclinical Assessment of a Novel Polymer-Free Hybrid Drug Eluting Stent.* J Cardiovasc Transl Res, 2025. 18(5): pp. 1383-1394.
2. Wu, S. et al., *CO-loaded hemoglobin/EGCG nanoparticles functional coatings for inflammation modulation of vascular implants.* Regenerative Biomaterials, 2025. 12(rbae148): p. 12.
3. Wang, Y. et al., *Self-adaptive covalent coating for vascular stents: Coordinated coagulation-inflammation regulation to support re-endothelialization for atherosclerosis control.* Biomaterials, 2025 (1878-5905) (Electronic).