The Academy of Romanian Scientists

University Politehnica of Bucharest

National Center of Micro and Nanomaterials

International Scientific Conference

APPLICATIONS OF CHEMISTRY IN NANOSCIENCES AND BIOMATERIALS ENGINEERING

Virtual Conference - Teams platform

22 - 24 June 2022

Conference opening
22 June at 09:00 AM

Virtual International Scientific Conference on

"Applications of Chemistry in Nanosciences and Biomaterials Engineering"

NanoBioMat 2022 – Summer Edition

22-24 June 2022

Program

The program will be published on the official webpage of AOSR and UPB on 15.06.2022 as well as in the TEAMS Class. The link for the TEAMS Class is https://bit.ly/3O3ZzRJ.

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.

Deadlines:

1. Registration: 30.05.2022
2. Abstract submission: 05.06.2022
3. Acceptance Notification: 10.06.2022
4. Final Program announcement: 15.06.2022
5. Conference: 22-24.06.2022

Registration:

Registration should be done using the link: https://bit.ly/3ztUwpy.

Registration is free for all students and postdoctoral researchers (or equivalent).

Abstract submission:

Abstract should be submitted in MS Word document, by email, to Eng. Cristina CHIRCOV (cristina.chircov@upb.ro) on or before 05.06.2022. The abstract should be 150 – 300 words and it must be submitted using the template available in the registration link.

Scientific Committee

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Program

22 June 2022

09:00-09:15 – OPENING CEREMONY

Ecaterina ANDRONESCU – President of the Scientific Committee

Adrian-Alexandru BADEA – President of The Academy of Romanian Scientists

Mihnea Cosmin COSTOIU – Rector of the University Politehnica of Bucharest

Tudor PRISECARU – President of the University Politehnica of Bucharest Senate

09:15-11:15 – PLENARY SESSION

Chairs – Aldo BOCCACCINI, Ecaterina ANDRONESCU

09:15-09:45 – *Bioactive Glasses Doped with Biologically Active Ions for Tissue Engineering*. **Prof. Aldo R. BOCCACCINI**

09:45-10:15 – *Advanced Composite Materials for Low Temperature Thermochemical Energy Storage Applications.* **Prof. Luigi CALABRESE**

10:15-10:45 – *Lipid Bilayers in The Bio-Nano World: Assets and Dangers*. **Prof. Carlos MARQUES**

10:45-11:15 – *Cinchona Alkaloids and Their Derivatives as Multifunctional Chiral Ligands in Asymmetric Catalysis*. **Prof. Ion NEDA**

11:15-12:30 – POSTER SESSION (I)

Chairs – Herbert Ryan MARINI, Denisa FICAI

1. *Phytotoxicity of Cd(II) and Pb(II) in Single and Binary Mixture Solutions to Lavandula Angustifolia L. Seeds Germination*. **Laura Hagiu Zaleschi,** Isabela-Maria Simion, Maria Apostol, Gabriel Ciprian Teliban, Mihai Stavarache, Adrian Nazare, Raluca-Maria Hlihor
2. *Biopolymer-Based Interpenetrated Hydrogels for Wastewater Treatment*. **Iulia Elena Neblea,** Tanța-Verona Iordache, Anamaria Zaharia, Andreea Olaru, Andreea Miron, Mircea Teodorescu, Andrei Sarbu, Anita-Laura Chiriac
3. *Molecularly Imprinted Polymer Based Electrochemical Sensor for Ephedrine Hydrochloride Detection*. **Sorin-Viorel Dolana,** Elena-Bianca Stoica, Tanţa-Verona Iordache, Anamaria Zaharia, Anita-Laura Chiriac, Teodor Sandu, Andrei Sârbu, Ana-Mihaela Gavrilă
4. *Application of Heterogeneous and Homogeneous Photocatalysis in the Treatment of Wastewater Contaminated with Organo-Persistent Pesticides*. **Maria Drăgan,** Andreea Iacob, Oana Dragostin, Magdalena Bîrsan, Oana Ionescu, Ioana Vasincu, Maria Apotrosoaei, Florentina Lupascu, Alin Focșa, Alexandru Sava, Lenuţa Profire, Cătălina Stan

5. *The Potential of Alfalfa (Medicago Sativa L.) in Phytoremediation of Soil Contaminated with Copper Ions.* **Ionela Catalina Vasilachi,** Petronela Cozma, Mariana Diaconu, Maria Gavrilescu
6. *Effects of Heavy Metals Stress on the Growth and Development of Brassica Napus (Rapeseed) at Laboratory Scale.* **Maria Paiu,** Petronela Cozma, Ionela Cătălina Vasilachi, Mariana Minuț, Mariana Diaconu, Maria Gavrilescu
7. *The Synthesis of Novel Polyssacharide Based Nanocomposite Materials. Comparative Study of Cloisite Clay Type.* Raluca Ianchis, **Ioana Catalina Gifu**, Elvira Alexandrescu, Maria Minodora Marin, Sabina Burlacu, Catalin Mihaescu, Cristina Lavinia Nistor, Cristian Petcu
8. *Pulsed Laser Emission in Rhodamine B - Doped DNA Biopolymer.* Adrian Petris, Ileana Rau, **Petronela Gheorghe**
9. *Anticancer Activity of Cyanobacteria.* **Alina Trofim**, Cezara Bivol, Oleg Turcanu
10. *Advances in Green Synthesis of Metal Oxide Nanoparticles used in Tissue Engineering*. **Denisa-Maria Radulescu**, Ecaterina Andronescu, Alexandru-Mihai Grumezescu, Ionela Andreea Neacsu, Adrian-Ionut Nicoara
11. *Current Trends in the Synthesis of Natural Hydroxyapatite-Based Materials for Tissue Engineering*. **Diana-Elena Radulescu**, Ecaterina Andronescu, Alexandru-Mihai Grumezescu, Ionela Andreea Neacsu, Otilia Ruxandra Vasile
12. *Magnetite Microspheres for the Controlled Release of Rosmarinic Acid.* **Cristina Chircov**, Diana-Cristina Pîrvulescu, Alexandra Cătălina Bîrcă, Ecaterina Andronescu
13. *Collagen Wound Dressings Loaded with CuO- and ZnO-based Microspheres.* **Alexandra Cătălina Bîrcă**, Mihai Alexandru Minculescu, Alexandru Mihai Grumezescu, Cristina Chircov, Ecaterina Andronescu
14. *Comparative Study of a Glycopeptide Antibiotic Release Behavior from Mesoporous Materials Using Different Loading Methods.* **Georgiana Dolete**, Bogdan Purcăreanu, Anton Ficai, Dan Eduard Mihaiescu, Ovidiu Oprea, Roxana Trusca
15. *Application of Aerobic Granular Sludge Technology for Treating Aminoacids Compounds from Piggery Industry.* **Barbara Muñoz-Palazon**, Aurora Rosa-Masegosa, Lizandra Perez, Jesus Gonzalez Lopez, Alejandro Gonzalez Martinez
16. *Cyanobacteria – Important Sources of Bioactive Substances with Antimicrobial Activity.* **Alina Trofim**, Liliana Zosim, Valeriu Rudic, Greta Balan

12:30-13:30 – LUNCH BREAK

13:30 - 16:00 – SESSION I. ADVANCED TECHNIQUES FOR MATERIAL DESIGN AND PROCESSING

Chairs – Jörg OPITZ, Ioana DEMETRESCU

13:30-13:45 – *Graphene-Quantum-Dots-Decorated Nickel Aluminate Spinel Binary Nanostructure as Diagnostic Tool in Electrochemical Biosensing*. **Elzbieta Regulska,** Joanna Breczko, Anna Basa, Beata Szydlowska, Katarzyna Kakareko, Alicja Rydzewska-Rosołowska, Tomasz Hryszko

13:45-14:00 – *Calcium Phosphate Coatings Obtained by Radiofrequency Magnetron Sputtering For Bone Tissue Engineering Applications*. **Maria E. Zarif,** Sasa A. Yehia, Bogdan Biță, Andreea Groza, Alexandru Grumezescu, Ecaterina Andronescu

14:00-14:15 – *An Electrically and Optically Tuned Surfactant Free Non-Aqueous Self-Stabilized Nematic Emulsions for Optical Device Applications*. **Ashok Chaudhary**, Ravi K. Shukla

14:15-14:30 – *Water-Soluble Schiff Base and its Corresponding Palladium Complex: Synthesis, Characterization, Oral Toxicity and Anticancer Activities*. **Khadija Khaldoune,** Ali Hasnaoui, Ali Oubella, Karima Lafhal, Larbi Elfirdoussi, Naima Fdi, Mustapha AitAli

14:30-14:45 – *Preparation and Wetting Mechanism of Hierarchically Textured Aluminum-Based Superhydrophobic Surfaces*. **Amani Khaskhoussi**, Luigi Calabrese, Edoardo Proverbio

14:45-15:00 – *Thermodynamic Approach of Curcumin and Whey Protein Binding*. **Levete Racz,** Csaba-Pal Racz, Ossi Horovitz, Aurora Mocanu, Maria Tomoaia-Cotisel

15:00-15:15 – *3D Printing of $Ca_{10}(PO_4)_6(OH)_2$ Obtained from Natural Sources*. **Maria-Eliza Pușcașu**, Ștefania Chiriac, Miruna-Adriana Ioța, Laura-Mădălina Cursaru, Roxana Mioara Piticescu

15:15-15:30 – *Bacterial Cellulose Use for Templating Growth of MOF Nanoparticles for Oxygen Reduction Reaction Electrocatalytic Activities*. **Berna Alemdag**, Aytekin Uzunoglu, Semra Unal Yildirim, Unal Sen, Mustafa Erkartal, Cem Bulent Ustundag

15:30-15:45 – *Magnetron Sputtered Titania and Carbon Fiber Cloth Composite and its Application in Electrochemical Supercapacitors*. **Aleksei P.Kozlov**, Ekaterina A. Arkhipova, Serguei V. Savilov

15:45-16:00 – *Fabrication of MOS Gas Sensors*. **Ghazala Ansari**, Vinod Kumar

13:30 - 15:45 – SESSION II. NATURAL BIOACTIVE COMPOUNDS

Chairs – Viorel NACU, Anton FICAI

13:30-13:45 – *Determination of Total Poliphenols Content in Taraxacum Officinale Leaves.* **Ala Fulga,** Valeriana Pantea

13:45-14:00 – *Therapeutic Formulations Containing Plant Secondary Metabolites Used to Increase the Efficiency of Antibiotics*. **Cristina Teodora Dobrota,** Diana Alexandra Florea, Rahela Carpa, Gheorghe Tomoaia, Aurora Mocanu, Maria Tomoaia-Cotisel

14:00-14:15 – *Synthesis of Medicinal Plant Based Bioactive Electrospun Nanofibrous Mats and Their Effect on The Antioxidant Activity*. **Ayşe Betül Demirel**, Serap Ayaz Seyhan, Dilek Bilgiç Alkaya, Sumeyye Cesur, Oguzhan Gunduz

14:15-14:30 – *Characterization and Application of Silver Nanoparticles Decorated Electrospun Nanofiber Loaded with Naringenin*. **Ayşem Birinci**, Serap Ayaz Seyhan, Dilek Bilgiç Alkaya, Sumeyye Cesur, Oguzhan Gunduz

14:30-14:45 – *Design and Characterization of Medicinal Plant Based Nanofibers and Their Effect on The Antioxidant Activity*. **Tuğçenur Ekici,** Elif Doğrul, Dilek Bilgiç Alkaya, Serap Ayaz Seyhan, Sumeyye Cesur, Oguzhan Gunduz

14:45-15:00 – *Chitosan, Chitin from Marine Resources - Basic Bricks in The Obtaining of Multifunctional Materials*. **Oana-Maria Memecică**, Cătălina Ușurelu, Ana Maria Albu, Ileana Rău

15:00-15:15 – *Curcumin Loaded Ethyl Cellulose Microparticles on 3D Scaffolds for Diabetic Wound Healing.* **Melih Musa Ayran**, Songul Ulag, Rıdvan Yıldırım, Oguzhan Gunduz

15:15-15:30 – *Mesoporous Silica Materials Loaded with Gallic Acid with Antimicrobial Potential.* **Gabriela Petrisor**, Denisa Ficai, Ludmila Motelica, Roxana Doina Trusca, Alexandra Catalina Bîrca, Bogdan Stefan Vasile, Georgeta Voicu, Ovidiu Cristian Oprea, Augustin Semenescu, Anton Ficai, Mircea Ionut Popitiu, Irina Fierascu, Radu Claudiu Fierascu, Elena Lacramioara Radu, Lilia Matei, Laura Denisa Dragu, Ioana Madalina Pitica, Mihaela Economescu, Coralia Bleotu

15:30-15:45 – *Investigation of the Potential of Whey Protein/Vitamin E Particles Coated Whey Protein/PVA Nanofibers for the Treatment of Muscle Loss*. **Kudret Irem Deniz**, Songul Ulag, Oguzhan Gunduz

16:00 - 16:30 – BREAK

16:30 - 18:45 – SESSION III. BIOMATERIALS FOR TISSUE ENGINEERING AND REGENERATION (I)

Chairs – Oguzhan GUNDUZ, Maria TOMOAIA-COTIȘEL

16:30-16:45 – *Production of 3D Printed Dental Membrane Scaffold Reinforced with Pomegranate Extract*. **Hatice Karabulut**, Songul Ulag, Oguzhan Gunduz

16:45-17:00 – *Nanocomposites Based on Hydroxyapatite and Vitamins*. **Alexandra Avram**, Aurora Mocanu, Ossi Horovitz, Gheorghe Tomoaia, Sorin Riga, Maria Tomoaia-Cotisel

17:00-17:15 – *New Innovative Dressing with Self-Adapting and Self-Healing Properties for Chronic Wounds Treatment*. **Simona Tatarusanu**, Florentina Lupascu, Alexandru Sava, Bianca-Stefania Profire, Andreea Iacob, Anca Rusu, Paula Stamate, Andra Manaila, Lenuta Profire

17:15-17:30 – *Novel Bioactive Chitosan-PEO-Based Nanofibers for Wound Healing Applications: An In Vivo Study*. **Oana Maria Ionescu**, Andreea Teodora Iacob, Francesca Floris, Alessia Farci, Teodora Hanghicel, Ioannis Gardikiotis, Irina-Draga Căruntu, Simona Giușcă, Lenuța Profire

17:30-17:45 – *Dox Loaded PVA Tumor Dressing for Cancer Therapy*. **Gözde Çelik**, Ahsen Yilmaz, Yağmur Şimşek, Cem Bülent Üstündağ

17:45-18:00 – *Production and Characterisation of PVA/Whey Protein/Hydroxyapatite/ Gentamicin Loaded Scaffolds for Bone Tissue Engineering Applications*. **Tufan Arslan Tut**, Sumeyye Cesur, Oguzhan Gunduz

18:00-18:15 – *Design and Fabrication of Metformin-Loaded Tri-Layer PCL/PVA/PCL Scaffolds for Chronic Wound Healing*. **Sena Harmanci**, Sumeyye Cesur, Oguzhan Gunduz, Cem Bulent Ustundag

18:15-18:30 – *Biomimetic Chitosan/PEO Nanofibers as Non-Cytotoxic Wound Dressings*. **Andreea-Teodora Iacob**, Oana-Maria Ionescu, Teodora Iurașcu, Maria Apotrosoaei, Florentina Lupașcu, Ioana Vasincu, Alexandru Sava, Maria Drăgan, Dan Lupașcu, Lenuța Profire

18:30-18:45 – *Composite Coatings with Graphene Oxide for Dental and Orthopedic Implants*. **Radu Nartiță**, Daniela Ioniță, Marius Enachescu, Ioana Demetrescu

16:30 - 19:00 – SESSION IV. ENVIRONMENTAL APPLICATIONS OF MATERIALS AND NANOMATERIALS

Chairs – Serguei SAVILOV, Ovidiu OPREA

16:30-16:45 – *A Sustainable Solution: Biological Treatment of Morpholine and its Derivatives (MAID) in Environment*. **Rupak Kumar**

16:45-17:00 – *CO_2 Capture Performance of Sulfur and Oxygen Doped Carbons Derived from a Molecular Precursor*. **Ali Can Zaman**

17:00-17:15 – *Sustainability Analysis of Cr(VI) Removal from Wastewaters Using Saccharomyces Cerevisiae.* **Cătălina Filote**, Mihaela Roșca, Isabela Maria Simion, Raluca Maria Hlihor

17:15-17:30 – *Statistical and Soft Computing Approaches for the Evaluation and Optimization of Bioremediation Processes*. **Mihaela Roșca**, Raluca-Maria Hlihor, Petronela Cozma, Isabela-Maria Simion, Maria Gavrilescu

17:30-17:45 – *Sampling Devices Used to Collect Indoor Airborne Viruses*. Diana Mariana Cocârță, **Anca Cristina Gogoncea**, Mariana Prodana, Ioana Demetrescu, Constantin Streche, Adrian Alexandru Badea

17:45-18:00 – *Nanomaterials as Efficient Sorbents for the Development of Sustainable Analytical Methods*. **Bárbara Socas Rodríguez**, Ruth Rodríguez-Ramos, Adrián Conde-Díaz, Álvaro Santana-Mayor, Antonio V. Herrera-Herrera, Miguel Ángel Rodríguez-Delgado

18:00-18:15 – *Study of Nickel, Copper and Silver Co-Doped ZnO Based Nanocrystalline DMS.* **Shaveta Thakur**

18:15-18:30 – *Lipid Membrane Hydroperoxidation Favor Ion Permeability*. **Eulalie Lafarge**, Pierre Muller, André Schroder, Jan Behrends, Ekaterina Zaitseva, Carlos Marques

18:30-18:45 – Recent Advances in the Application of Nanobiotechnology for Sustainable Use of Bioresources: A Sine Qua Non for the Ever-Increasing Global Population. **Charles Oluwaseun Adetunji**

18:45-19:00 – *Air and Soil Bioremedation*. **Gori Goyal**

23 June 2022

09:00 - 11:30 – SESSION V. DRUG DELIVERY APPLICATIONS OF NANOMATERIALS AND BIOMATERIALS

Chairs – Carlos MARQUES, Victor FRUTH-OPRIȘAN

09:00-09:15 – *The Influence of Coordinative Compounds, Thiosemicarbaside Derivates on the Thiol-Disulfide Groups in Human Red Blood Cells*. **Valeriana Pantea,** Evelina Lesnic, Ala Fulga

09:15-09:30 – *Non-Pressurized Topical Spray*. **Neelam Pawar**

09:30-09:45 – *Antibacterial Ability of Poly Lactic Acid Microspheres Loaded with Hydroxyapatite and Vancomycin.* **Gertrud-Alexandra Paltinean,** Sorin Rapuntean, Gheorghe Tomoaia, Sorin Riga, Aurora Mocanu, Maria Tomoaia-Cotisel

09:45-10:00 – *Pharmaceutical Approaches of Nanobodies*. **Marina Ionela Ilie**, Adrian Siluan Ivan, Doina Drăgănescu, Bruno Ștefan Velescu, Denisa Ioana Udeanu, Andreea Letiția Arsene

10:00-10:15 – *Exosomes in Neuroscience as Biomaterials*. **Jale Odabaşı Bağcı,** Şule Aydın Türkoğlu, Esra Cansever Mutlu

10:15-10:30 – *Novel Highly Efficient Multi-Target Nanoparticles in Type 2 Diabetes Mellitus.* **Florentina Geanina Lupașcu**, Andreea Teodora Iacob, Ioana Vasincu, Maria Apotrosoaei, Georgiana Taușer, Maria Drăgan, Magdalena Bârsan, Alin Focșa, Alexandru Sava, Andra Ababei, Simona Tătărușanu, Profire Lenuța

10:30-10:45 – *Preparation of Tretinoin Nanocrystals Loaded Gel for Improvement of Dermal Permeation and Anti-Cancer Activity*. Akash Sharma, **Manish Kumar**

10:45-11:00 – *Drug Designing for More Potent Drug Towards H1N1 Influenza Virus*. **Aakanksha Yadav**

11:00-11:15 – *Phytochemical and Pharmacological Evaluation of Myricaria Germanica from Northern Himalayan Region of India.* **Nissar Ahmad,** Saima Shafi, W.Y. Raja, D. Tewari, Z.A. Bhat

11:15-11:30 – *Formulation of Capsaicin Nanoparticles: Potential Uses in Food, Pharmacy and Medicine Applications.* **Moncef Chouaibi**

11:30-12:30 – POSTER SESSION (II)

Chairs – Esra Cansever MUTLU, Andreea-Teodora IACOB

1. *The Synthesis of Novel Polyssacharide Based Nanocomposite Materials. the Study of Inorganic Filler Concentration.* **Raluca Ianchis**, Ioana Catalina Gifu, Elvira Alexandrescu, Maria Minodora Marin, Sabina Burlacu, Catalin Mihaescu, Cristina Lavinia Nistor, Cristian Petcu
2. *Novel Nanocomposites Based on Mesoporous Titania/Acrylonitrile Obtained by Host-Guest Method.* **Andreea Miron**, Tanta-Verona Iordache, Sorin-Viorel Dolana, Marinela Dumitru, Ana-Mihaela Gavrila, Anamaria Zaharia, Horia Iovu, Anita-Laura (Radu) Chiriac
3. *Influence of $CaCO_3$ Addition on Alkali Activated Materials.* **Adrian-Ionuț Nicoară**, Adelina Carmen Ianculescu
4. *Molecularly Imprinted Supermacroporous Cryogels for Penicillin G Adsorption*. **Marinela Victoria Dumitru**, Tanta-Verona Iordache, Miron Andreea, Teodor Sandu, Sorin Viorel Dolana, Horia Iovu, Andrei Sarbu, Anita-Laura (Radu) Chiriac
5. *MAPLE-Coatings from Bioglasses and Antibiotics for Improved Implant Surfaces.* **Irina Negut,** Carmen Ristoscu, Tatiana Tozar, Valentina Grumezescu, Mihaela Dinu, Anca Constantina Parau, Marcela Popa, Miruna S. Stan
6. *Phosphatic Nanomaterials with High Performances for Organic Pollutants Adsorption*. **Roxana Ioana Brazdis**, Sorin-Marius Avramescu, Irina Fierascu, Anda Maria Baroi, Toma Fistos, Radu Claudiu Fierascu
7. *Potential Antimicrobial Apatitic Materials Improved with Different Metals for Heritage Science*. **Toma Fistos**, Roxana Ioana Brazdis, Anda Maria Baroi, Irina Fierascu, Lia-Mara Ditu, Valentin Raditoiu, Radu Claudiu Fierascu
8. *Innovative Drug-Delivery Scaffolds Used for Post Operatory Infections Treatment*. **Adrian Moraru**, Ana-Maria Pușcașu, Cristina Chircov, Alexandra Cătălina Bîrcă, Adrian Surdu, Vladimir Lucian Ene, Ionela Neacșu
9. *Prevention and Treatment of Nosocomial Infections: Review*. **Marian Rașcov**, Ecaterina Andronescu, Anton Ficai, Ovidiu Cristian Oprea
10. *Development of New Zinc Oxide Antiseptics for the Clinical Treatment of Wounds*. **Irina Elena Doicin**, Ionela Andreea Neacsu, Vladimir Lucian Ene, Bogdan Stefan Vasile, Ecaterina Andronescu
11. *Thiol-Disulfide Groups in Patients with Pulmonary Tuberculosis.* **Evelina Lesnic**, Valeriana Pantea
12. *Barrier Performance of Spray Coated Nanocellulose Film*. **Kirubanandan Shanmugam**

13. *Magnetic Core-Shell Nanoparticles Obtained Through Different Synthesis Methods.* **Dan Adrian Vasile**, Bogdan Stefan Vasile, Anton Ficai
14. *Antimicrobial Activity of Cinnamaldehyde Schiff Bases*. **Neetu Singh**
15. *Application of Nanomaterials in Food: Processing and Characteristics*. **Mohammad Zarein**

12:30 - 13:30 – LUNCH BREAK

13:30 - 15:30 – SESSION VI. CONTROLLED RELEASE OF ACTIVE SUBSTANCES FOR BIOMEDICAL APPLICATIONS

Chairs – Domenico LOMBARDO, Lenuța PROFIRE

13:30-13:45 – *Controlled Release of Drugs from Three-Dimensional Scaffolds Containing Drug-Loaded Photocatalytic Bismuth Ferrite Nanoparticles*. **Sule Ilgar**, Songul Ulag, Oguzhan Gunduz, Cem Bulent Ustundag, Musa Turker

13:45-14:00 – *The Effect of Crosslinking Time on the Release of Gentamicin from Nanofibers*. **Esra Pilavci**, Sumeyye Cesur, Elif Ilhan, Mustafa Sengor, Ewa Kijeńska-Gawrońska, Oguzhan Gunduz

14:00-14:15 – *Release Profile of Some Cyclodextrin-Ibuprofen Derivatives Complexes - In Vivo Study*. **Ioana-Mirela Vasincu**, Maria Apotrosoaei, Florentina Lupașcu, Andreea Iacob, Maria Drăgan, Alexandru Sava, Gabriela Dumitrița Stanciu, Anca-Roxana Petrovici, Narcisa Marangoci, Mariana Pinteală, Lenuța Profire

14:15-14:30 – *New Nitric Oxide-Releasing Indomethacin Derivatives: Synthesis and Biological Evaluation*. **Alexandru Sava**, Andreea Iacob, Ioana Vasincu, Florentina Lupascu, Maria Apotrosoaei, Alin Focsa, Maria Dragan, Alina Panainte, Nela Bibire, Frederic Buron, Sylvain Routier, Lenuţa Profire

14:30-14:45 – *Nanostructured Drug Delivery Systems in Oncotherapy*. **Paul Adrian Tărăbuță**, Anton Ficai

14:45-15:00 – *Fluconazole and Cinnamaldehyde Loaded-Multilayer Elektrospun Nanofibers for the Treatment of Fungal Keratitis*. **Elif Ilhan**, Sumeyye Cesur, Faik Nuzhet Oktar, Oguzhan Gunduz

15:00-15:15 – *Graphene-Based Drug Loaded Drug Delivery System for Cancer Treatment*. **Reyhan Yanıkoğlu**, Fatih Çiftçi, Zeynep Karavelioğlu, Rabia Çakır Koç, Cem Bülent Üstündağ

15:15-15:30 – *Bioactive Organometallics*. **Irina-Gabriela Voinea**

13:30-16:00 – SESSION VII. ADVANCED BIOMEDICAL APPLICATIONS

Chairs – Luigi CALABRESE, Maria GAVRILESCU

13:30-13:45 – *Structural Analysis of Dibenzepine and Butyrophenone Derivatives in the Context of Ventral Striatum Abnormalities in Schizophrenia*. **Łukasz Grabowski**

13:45-14:00 – *Advanced Oxidation Protein Products Variation in Experimental Ovarian Torsion*. **Cornelia Lazăr**, Olga Tagadiuc, Silvia Stratulat

14:00-14:15 – *Bismuth Nitrate Added Polymer-Based Strain Sensors for Biomedical Applications*. **Merve Sırtıkara**, Mustafa Şengör

14:15-14:30 – *Application of Gold Nanoparticles*. **Rahul Kanaoujiya**, Shekhar Srivastava

14:30-14:45 – *Physicochemical Properties of Shea Butter Oil and Its Application*. **Maurice Jemkur,** Shoge Monsurat

14:45-15:00 – *Polymorphism Genetics Aspect; The Challenging of Personalized Medicine in Indonesia*. **Syahrul Tuba**, Rifly Aprianto, Gilang Bhakti Nusantara, Raja Rajendra, Fatkhu Rahman

15:00-15:15 – *Synthesis and Biomedical Application of Metal Nanoparticles*. **Mittal Thakkar**

15:15-15:30 – *Synthesis of Copper Nanoparticles from Origanum Species*. **Dhivya A. Sasikala**

15:30-15:45 – *Applications of Ceria Nanoparticles*. **Aasma Bibi**, Humaira Razzaq

15:45-16:00 – *Graphene as Smart Material.* **Abullais Nehal Ahmed**

15:30 - 16:00 – BREAK

16:00 - 18:50 – SESSION VIII. MATERIALS AND NANOMATERIALS FOR ADVANCED APPLICATIONS

Chairs – Cem Bulent USTUNDAG, Radu FIERASCU

16:00-16:20 – *The Role of Micro- and Nanoparticles in Stratospheric Ozone Depletion.* **Serguei V. Savilov**, Natalia E. Strokova, Natalia N. Kuznetsova

16:20-16:35 – *Barrier Performance of Spray Coated Nanocellulose Film.* **Kirubanandan Shanmugam**

16:35-16:50 – *Glass Fabrics Functionalisation for the Development of High Performance Sandwich Structures.* **George-Valentin Săftoiu**, Carolina Constantin, Adrian-Ionuț Nicoară, George Pelin, Anton Ficai

16:50-17:05 – *DLP 3D Printing of GelMA Microneedles.* **Dilruba Baykara**, Tuba Bedir, Elif Ilhan, Cem Bulent Ustundag, Oguzhan Gunduz

17:05-17:20 – *Indazole as an Inhibitor of Brass Corrosion in Chloride Solution 1 M HCl: Electrochemical/Surface Studies*. **Zakia Aribou**, Nidal Khemmou, Moussa Ouakki, Sara Sibous, Rida Alah Belakhmima, Abdelaziz Souizi, Mohamed Ebn Touhami

17:20-17:35 – *Bioinformatics Investigation of Mercury Methylating in Mycobacterium*. **Henry Njoku**

17:35-17:50 – *Conversion of Zeolite- X into Various Ion Exchanged Forms and Investigation of Their Catalytic Efficiency as Green Heterogeneous Catalyst for the Synthesis of 5-Substituted 1H-Tetrazole Derivatives*. **Sami Ullah bhat**

17:50-18:05 – *Mechanically Robust Smart Hydrogel for Dye Removal of Pesticides.* **Aabid Hussian Shalla**, Riyaz Ahmad Bhat

18:05-18:20 – *The Enhancement of The Performance of Photovoltaic Parameters of NiOx Thin Films Assisted Silicon Solar Cell through Down Shifting.* **Chandra Kumar**, Antonio Zarate, Arturo Martinez

18:20-18:35 – *Study of Nanocrystalin Superconductors*. **Sumit Kumar Gupta**

18:35-18:50 – *Air and Soil Bioremediation*. **Anamika Gautam**

24 June 2022

09:00 - 11:00 – SESSION IX. BIOMATERIALS FOR TISSUE ENGINEERING AND REGENERATION (II)

Chairs – Heiko FRANZ, Radu PITICESCU

09:00-09:15 – *Fabrication of PLA/PVA/Graphene Oxide Nanofibers for Biomedical Applications*. **Fatih Altun**, Mustafa Şengör, Songul Ulag, Oguzhan Gunduz

09:15-09:30 – *Biocompatible Coatings with Antimirobial Properties on Stainless Steel Supports*. **Maxim Maximov**, Roxana Trusca, Anton Ficai

09:30-09:45 – *Production of Antimicrobial Manganese Loaded Hydroxyapatite/Sodium Alginate Bone Scaffolds with Additive Manufacturing*. **Muge Koyun**, Selin Yasar, Elif Ilhan, Nazmi Ekren, Bilal Cinici, Oguzhan Gunduz

09:45-10:00 – *Production of 3D-printed PVA-Sodium Alginate-GelMA based Wound Dressing Scaffolds for the Treatment of Burns*. **Muhammet Sefa Izgordu**, Songul Ulag, Oguzhan Gunduz

10:00-10:15 – *Cerium-substituted Hydroxyapatite for Bone Regeneration.* **Alexandra-Cristina Burdusel**, Ecaterina Andronescu, Alexandru-Mihai Grumezescu, Anton Ficai, Alina Maria Holban

10:15-10:30 – *Morphology, Structural and Thermal Degradable Properties of Carboxylmethyl Cellulose/CuO Nanoparticles*. **Win Pa Pa Phyo**, Yamin Thet, May Thazin Kyaw, Ngwe Sin, Aung Than Htwe

10:30-10:45 – *Three-Dimensional Polycaprolactone Scaffold Combined with Tetracycline-Loaded Electrospray Particles*. **Rabia Betul Sulutas**, Sumeyye Cesur, Oguzhan Gunduz

10:45-11:00 – *Retinoids for Dermatological Applications – Cosmetic Formula with Retinol Impregnated in Bioglass – Overview of Skin Aspect Improvement on Patient with Acne*. **Ioana Lixandru Matei**

11:00-12:00 – POSTER SESSION (III)

Chairs – Vladimir BAULIN, Bogdan Stefan VASILE

1. *Molecularly Imprinted Surfaces Doped with Conductive Polymers for Lipopolysaccharide Recognition.* **Ana-Lorena Neagu,** Bianca-Elena Stoica, Ana-Mihaela Gavrila, Andreea Miron, Sorin Dolana, Andrei Sarbu, Horia Iovu, Tanta-Verona Iordache
2. *Design and In Vitro Evaluation of New Electrospun Nanofibers Based on Chitosan/Polyvinyl Alcohol for Wound Healing.* **Teodora Iurașcu**, Teodora A. Iacob, Alexandru Sava, Oana M. Ionescu, Lenuța Profire
3. *The Influence of Nanomaterials on the Grapevine Stomata.* **Daniela-I. Sărdărescu**, Diana E. Vizitiu, Radu C. Fierăscu, Irina Fierăscu, Liliana C. Soare, Camelia Ungureanu, Elena C. Buciumeanu, Anda M. Baroi
4. *Chitosan/Hydroxyapatite Based Composite Structures for Bone Cancer Treatment*. **Alina Florentina Vladu**, Ludmila Motelica, Alexandra Ene, Ecaterina Andronescu, Ionela Neacsu, Anton Ficai
5. *Bee Derived Products and Their Applications in Skin Tissue Engineering*. **Corina Dana Dumitru**, Ionela Andreea Neacsu, Alexandru Mihai Grumezescu, Ecaterina Andronescu, Denisa Ficai
6. *Coordination Compounds of Cu(II) and Bi(III) with Ethylenediaminetetraacetate Ions and 2-Acetylpyridine Thiosemicarbazones*. **Elena Neguta,** Greta Balan, Aurelian Gulea, Ion Bulimestru
7. *Black Phosphorus: Properties, Synthesis, and Applications*. **Andra-Maria Sîrmon**, Ecaterina Andronescu, Ionela-Andreea Neacșu, Vasile-Adrian Surdu, Alexandru Mihai Grumezescu
8. *Optimization of Alginate Micro/Nanoparticles Preparation by Emulsification/Internal Gelation Method Using Box-Behnken Design*. **Naima Faghmous**, Djallel Bouzid

9. *Formulation and Characterization of Topical Niosomal Gel containing Aceclofenac and Serratiopeptiase*. **Rama Shukla**
10. *Analysis of Upconversion Luminescence in Y_2O_3:Er, Yb Phosphors*. **Liviu Dudaș**, Angela Enachi, Daniela Berger, Cristian Matei
11. *Gelatin Cryogels in Wound Healing: Properties and Synthesis*. **Daniela Alina Ionita**, Ecaterina Andronescu, Ionela Andreea Neacsu, Vasile Adrian Surdu, Alexandru Mihai Grumezescu
12. *Structural, Impedance and Dielectric Behavior of Stronium Hexa Ferrites for Energy Applications*. **Muhammad Salman Habib**, Muhammad Asif Rafiq
13. *Exprimental Study of ZnO /Porous Silicon Nanocomposites Prepared by Électro Déposition Technique*. **Naceur Selmane**, Ali Cheknane
14. *Climate Variability Over Northwest Himalayan Region*. **Neha**, R. K. Dogra, N. Kumar
15. *Graphene*. **Rahul Kanaoujiya**

12:00 - 13:00 – LUNCH BREAK

13:00 - 16:00 – Fate of ESKAPE Bacteria from Hospital to Water Bodies – Lessons from RADAR Project

Chairs – Carmen CHIFIRIUC

1. *Fate of the Bacterial Load from Hospitals to WWTP and Natural Aquatic Bodies*. **Vaideanu M.**, Banciu A., Stoica C., Gheorghe S., Lucaciu I., Nita-Lazar M.
2. *Emerging Antimicrobial Nanotechnologies*. Denisa Ficai, Georgiana Dolete, Alexa Croitoru, Marcela Popa, Laura Boanţă, Dan Eduard Mihaescu, **Anton Ficai**, Ecaterina Andronescu, Mariana-Carmen Chifiriuc
3. *Evaluation of Antioxidative Status in Carassius Gibelio Collected from Bucharest Lakes*. **Alistar Cristina F.**, Ionela C. Nica, Sorina N. Voicu, Nicolai Craciun, Miruna S. Stan, Anca Dinischiotu
4. *Abundance of ESKAPE Bacteria in Municipal Waste Waters and Receiving Water Bodies*. **Popa Marcela**, Nita-Lazar M., Marutescu Luminita, Gheorghe Irina, Czobor Ilda, Popa Laura, Mariana Carmen Chifiriuc
5. *Phenotypic Evaluation of the Enterobacterales Antibiogram - Lessons for Practice through the RADAR Project*. Codiță Irina, Cristea Daniela, Dinu Sorin, Dragomirescu Cerasella Cristina, Drăgulescu Carmina, Lixandru Brânduşa, Militaru Cornelia, **Muntean Andrei-Alexandru**, Muntean Mădălina-Maria, Oprea Mihaela, Preda Mădălina, Usein Codruța, Prof. Dr. Mircea Ioan POPA

6. *Extended Genotypic Analysis of ESKAPE Resistome in Clinical and Environmental Samples*. Marius Surleac, **Ilda Czobor Barbu**, Irina Gheorghe, Simona Paraschiv, Mariana Carmen Chifiriuc, Dan Oțelea

16:00-16:30 – CLOSING CEREMONY

Book of Abstracts

Plenary Lectures

Bioactive Glasses Doped with Biologically Active Ions for Tissue Engineering

Aldo R. Boccaccini

Institute of Biomaterials, University of Erlangen-Nuremberg, 91058 Erlangen, Germany

ABSTRACT

Bioactive glasses (BGs) are being increasingly investigated for tissue engineering (TE), including both hard (bone) TE and soft tissue repair and wound healing. Such applications are based on the biochemical reactions occurring on the BG surface in contact with the biological environment, which involve the release of biologically active ions as ionic dissolution products. Such ions are capable of stimulating specific cellular responses involved in tissue growth [1]. In addition, BGs can induce immunomodulatory effects to trigger bone regeneration and wound healing [2].

In this presentation ion doped BGs will be discussed in the context of their use in bone tissue engineering and wound healing. In particular, it will be shown that certain ions released from BGs can induce angiogenesis, e.g. in specific concentrations such ions enhance the secretion of vascular endothelial growth factor. Moreover, the results of cell culture studies that investigate the effect of ion concentration (following BG dissolution) on stem cell behavior will be presented.

In the second part of this talk, applications of ion releasing BGs (e.g. as mesoporous BG nanoparticles) in the field of 3D bioprinting (biofabrication) for both hard and soft tissue engineering will be discussed. Examples of such applications, including the addition of silica-calcia mesoporous nanoparticles in alginate based hydrogels to develop novel bioinks, will be presented, highlighting the applications of such composite bioinks in cell encapsulation and biofabrication of cell laden scaffolds [3]. Challenges and opportunities in the field focusing on the local effects of ionic dissolution products on encapsulated cells will be presented.

References

1. A. Hoppe, et al., A review of the biological response to ionic dissolution products from bioactive glasses and glass-ceramics, *Biomaterials* 32 (2011) 2757-2774.
2. K. Zheng, et al., Immunomodulatory bioactive glasses for tissue regeneration, *Acta Biomater.*133 (2021) 168-186.
3. H. Zhu, et al., 3D Bioprinting of Multifunctional Dynamic Nanocomposite Bioinks Incorporating Cu-Doped Mesoporous Bioactive Glass Nanoparticles for Bone Tissue Engineering, *Small* (2022) 2104996.

Advanced Composite Materials for low Temperature Thermochemical Energy Storage Applications

Luigi Calabrese

Department of Engineering of the University of Messina

ABSTRACT

The growing energy demand coupled to the stringent requirement to discard the fossil fuels, oriented the energy consumption towards the renewable sources in several real contexts, from building to industrial applications. This addressed new research activities focused to the development of innovative materials for thermal energy storage (TES).

TES technologies are classified into three categories: sensible, latent and thermochemical. Thermochemical ones are a promising solution, able to reach high energy density and to store it indefinitely as long as the components that take part in the reaction remain separate. Among the low temperature thermochemical energy storage (TCS) technologies, the inorganic salt hydrates are widely investigated to overcome the mismatch between energy supply and demand caused by the diurnal nature of solar energy. However, some drawbacks of this class of materials, such as deliquescence, chemical instability, limited mass transfer and corrosion issues, have significantly hindered his extension in application fields. In such a context, new research frontiers oriented toward the development of innovative micro- and nano- structured composite sorbents for TCS applications are growing the interest in this research topic breaking new grounds for this field of research. The purpose of this paper is to give a short overview on the recent improvement on composite materials for low temperature TCS applications.

Lipid Bilayers in the Bio-Nano World: Assets and Dangers

Carlos M. Marques

Institut Charles Sadron, University of Strasbourg, CNRS, Strasbourg, France
e-mail: marques@unistra.fr

ABSTRACT

Membranes in the biological realm self-assemble from phospholipids and other lipid-bilayer forming molecules. The resulting five nanometers thin (or thick?) structures are so resilient that they play a major role in the organization of life as compartmentalizing cell elements, as substrates for metabolic bio-chemistry and suspectedly for even more elaborate functions yet to be discovered. Self-assembled membranes make up also for a large tonnage of the detergent and cosmetic commodities, and play an increasing role in pharmaceutics.

Wherever lipid membranes are assembled, formulated and transported, they are exposed to interactions with an increasingly larger variety of nano-constituents of their bio or material environment. Understanding what opportunities and difficulties arise by the presence of biomembranes in a nanostructured world is therefore essential for unfolding therapeutical pathways, for increasing performance or simply to prevent health concerns.

In this talk I will illustrate efforts and strategies developed over the past years for valuing the assets of lipid self-assemblies in the bio-nano world and evaluating some of the dangers that membranes face when exposed to interactions with nanoobjects.

Cinchona Alkaloids and their Derivatives as Multifunctional Chiral Ligands in Asymmetric Catalysis

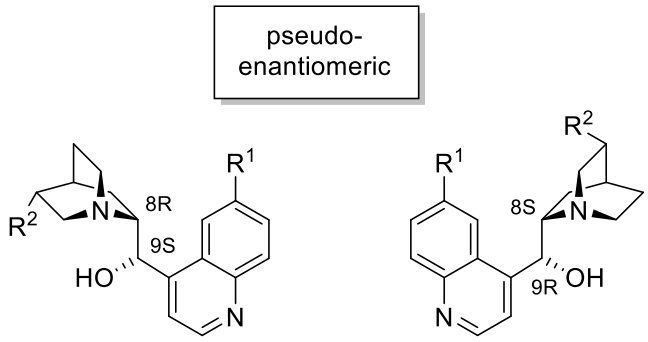
Heiko Franz[1], Catalin Maftei[1], **Ion Neda[2]**

[1]InnoChemTech GmbH, Hagenring 30, D-38106 Braunschweig, Germany
[2]Technische Universität "Carola-Wilhelmina", Hagenring 30, D-38106 Braunschweig, Germany

ABSTRACT

Cinchona alkaloids and their derivatives are widely used as chiral ligands, catalysts or racemic resolution agents in various industrial applications. There are two series of pseudoenantiomers, the 8S, 9R series and the 8R, 9S series (see graphic below), containing the same core structure with slightly different functionalities. These substances we combined in a tool kit which contains beside the well-known Cinchona alkaloids the 6´amino- derivatives ($R^2 = NH_2$). This tool kit offers the possibility to perform rapidly and efficiently a fine tuning in Asymmetric Synthesis in order to obtain your required enantiopure R or S configured compound.

We have synthesized new Chiral Tools from Nature:



8R,9S-series
Quinidine-type

8S,9R-series
Quinine-type

8*S*, 9*R* series

Quinine R^1= OMe R^2 = CH=CH_2; Dihydroquinine R^1= OMe R^2 = CH_2 -CH_3; Cupreine R^1= OH R^2 = CH=CH_2; Dihydrocupreine R^1= OH R^2 = CH_2 -CH_3; *6`-Aminocinchonidine $R^1$= $NH_2$ $R^2$ = $CH=CH_2$; 6`-Aminodihydro-cinchonidine R^1= NH_2 R^2 = CH_2 -CH_3*; Cinchonidine R^1= H R^2 = CH=CH_2, Dihydrocinchonidine R^1= H R^2 = CH_2 -CH_3

8*R*, 9*S* series

Quinidine R^1= OMe R^2 = CH=CH_2; Dihydroquinidine R^1= OMe R^2 = CH_2 -CH_3; Cupreidine R^1= OH R^2 = CH=CH_2; Dihydrocupreidine R^1= OH R^2 = CH_2 -CH_3*; 6`-Aminocinchonine $R^1$= $NH_2$ $R^2$ = $CH=CH_2$; 6`-Aminodihydro-cinchonine R^1= NH_2 R^2 = CH_2 -CH_3*; Cinchonine R^1= H R^2= CH=CH_2; Dihydrocinchonine R^1= H R^2 = -CH_2-CH_3

Furthermore, four new members of the family of 1,2-diamines of quincorine and quincoridine have been synthesized, being hydrogenated and didehydrogenated at the C10–C11 fragment. The alkynes, containing an additional amino group at C9, are potentially useful building blocks for cross-coupling reactions. Additional investigations concerning the chemical properties of the molecules point to a significant impact of the remote C5 substituent on the basicity of the bridgehead nitrogen.

This unique class of multifunctional chiral ligands, catalysts and resolving agents offer a genuine alternative to current systems and a broad range of new easily accessible derivatives for Asymmetric Synthesis.

- Serve as highly versatile catalysts for a broad spectrum of enantioselective transformations;

- Are highly enantioselective catalysts for more than 50 types of asymmetric reactions;
- Enables a target-oriented production of the required (R) or (S) stereoisomer;
- Are usually robust and tolerate different reaction conditions;
- Soluble in a wide range of organic solvents and aqueous solutions;
- Recyclable and therefore cost-efficient.

For example:

Strecker, Mannich and Michael addition; Cycloaddition; Epoxidation; α-Alkylation; Trifluoromethylation; α-Halogenation, Cyclopropanation; Dihydroxylation

Poster Section (I)

Phytotoxicity of Cd(II) And Pb(II) in Single and Binary Mixture Solutions to *Lavandula Angustifolia* L. Seeds Germination

Laura Hagiu Zaleschi*, Isabela-Maria Simion, Maria Apostol, Gabriel Ciprian Teliban, Mihai Stavarache, Adrian Nazare, Raluca-Maria Hlihor*

"Ion Ionescu de la Brad" Iasi University of Life Sciences, Faculty of Horticulture, Department of Horticultural Technologies, 3 Mihail Sadoveanu Alley, 700490 Iasi, Romania
*Correspondence: laurazaleschi@uaiasi.ro; raluca.hlihor@uaiasi.ro

ABSTRACT

Heavy metals such as Cd and Pb do not bring any benefit to organisms or plants and are considered to show some of the highest threats in the environment. Cadmium leads to chlorosis, inhibition of growth, darkening of the root and finally death of the plants, while lead accumulates mostly at the root level, but still affects the growth, morphology and photosynthetic process of the plants. In this context, the main scope of this study is to identify (i) the phytoxicity of Cd(II) and Pb(II) treatments in single and binary mixture to the germination process and early growth stage of lavender (*Lavandula angustifolia* L.) and (ii) the upper concentration limits of the pollutants causing seedlings death. Lavender seeds were selected and sterilized to avoid fungal contamination, and further on, placed in Petri dishes containing filter paper to maintain a moisted environment. The pollutant solutions used were made from a stock solution of 1000 mg/L metal concentration ($CdCl_2$ and $PbCl_2$). Several treatments were employed for each pollutant, for Cd(II), 8 variants from 2.5 to 100 mg/L were used, while for Pb(II), 11 variants from 5 to 500 mg/L were used. To assess the phytotoxicity caused by the mixture of heavy metals, one variant was used, Pb 50 mg/L + Cd 2.5 mg/L. Simultaneously with these variants, control samples were installed with lavender seeds in distilled water. Each variant was made in triplicate, watered with 3 mL of pollutant solution, sealed with parafilm and placed in a plant growth chamber at a temperature of 22±2°C, light 16 h and 8 h darkness and humidity 70% ± 25%. To highlight the toxic effects of Cd(II) and Pb(II) we observed the germination process for 21 days and measured the length of the lavender seedlings. Further within this assessment we calculated the germination percentage and rate, toxicity, tolarance and vigor indexes. The results showed that Cd(II) was the most toxic pollutant for lavender seeds, while the binary mixture of Pb(II) and Cd(II) had a low toxicity for the germination process. Considering the length measurements, it was observed that in case of Cd(II) presence at a concentration of 5 mg/L, the seedlings length decreased by 42%, while for Pb(II) it decreased by 3%. At the highest metal concentration considered within the experiment, for Cd(II) (100 mg/L) the length decreased by 86% and for Pb(II) (500 mg/L), it decreased by 75%. For the heavy metal binary mixture solution, the lavender seedlings length decreased by 24%. In terms of germination, for 100 mg/L Cd(II) treatment, we recorded the lowest germination percentage (53%), while for the Pb(II)/Cd(II) mixture, the highest germination percentage (87%). The toxicity index showed also that the lavender seedlings were most affected in the presence of cadmium, with a toxicity index of 86% at 100 mg/L Cd(II), 46% at 100 mg/L Pb(II) and 24% in the case of Pb 50 mg/L/Cd 2.5 mg/L mixture. In conclusion, we can say that lavender seeds tolerate better Pb(II) than Cd(II) presence. In case of the Pb(II)/Cd(II) binary mixture it looks like both metals act against each other and diminish the negative effect for lavender seedlings. This study improved our experimental plans considering lavender germination in soil under greenhouse conditions.

Acknowledgments: This work was supported by the Romanian Ministry of Education and Research, CNCS - UEFISCDI, project number PN-III-P1-1.1-TE-2019-1200, contract no. 120/2020.

Biopolymer-Based Interpenetrated Hydrogels for Wastewater Treatment

Iulia Elena Neblea[1], Tanța-Verona Iordache[1], Anamaria Zaharia[1], Andreea Olaru[2] Andreea Miron[1], Mircea Teodorescu[3], Andrei Sarbu[1], Anita-Laura Chiriac[1*]

[1] National Institute for Research & Development in Chemistry and Petrochemistry ICECHIM, 202 Spl. Independentei, 060021, Bucharest, Romania
[2] SC EDAS-EXIM SRL, Str. Banat 23, Bucharest, 1st district, Romania
[3] University Politehnica of Bucharest, 011061 Bucharest, Romania
*Correspondence: anita-laura.radu@icechim.ro

ABSTRACT

The authors did not agree with the publishing of the abstract.

Molecularly Imprinted Polymer Based Electrochemical Sensor for Ephedrine Hydrochloride Detection

Sorin-Viorel Dolana[1], Elena-Bianca Stoica[1]Tanţa-Verona Iordache[1], Anamaria Zaharia[1], Anita-Laura Chiriac[1], Teodor Sandu[1], Andrei Sârbu[1], Ana-Mihaela Gavrilă[1*]

[1]National Research and Development Institute for Chemistry and Petrochemistry ICECHIM, Bucharest, RO
*Correspondence: ana.gavrila@icechim.ro

ABSTRACT

The authors did not agree with the publishing of the abstract.

Application of Heterogeneous and Homogeneous Photocatalysis in the Treatment of Wastewater Contaminated with Organo-Persistent Pesticides

Maria Drăgan[1*], Andreea Iacob[1], Oana Dragostin[2], Magdalena Bîrsan[1], Oana Ionescu[1], Ioana Vasincu[1], Maria Apotrosoaei[1], Florentina Lupascu[1], Alin Focşa[1], Alexandru Sava[1], Lenuţa Profire[1], Cătălina Stan[1]

[1]University of Medicine and Pharmacy "Grigore T. Popa", Faculty of Pharmacy, Iasi, University Street no 16, 700115;
[2]University of Medicine and Pharmacy "Dunărea de Jos", Faculty of Pharmacy, Galaţi, 800008, Romania
*E-mail: maria.wolszleger@umfiasi.ro

ABSTRACT

Heterogeneous photocatalysis leads to the mineralization of organic carbon through a slurry or thin film semiconductor catalyst in the presence of solar or artificial radiation and oxygen or a free radical acting as an oxidizing agent. Currently, it has many applications, from medicine, where it is used for disinfection and destruction of cancer cells, to water treatment for potable water and wastewater treatment. This study follows the behavior of an organo-persistent pesticide in various photochemical irradiation conditions. The obtained results have shown that the best behavior in the degradation of the pesticide was found for the TiO2 P-25 catalyst, which was considered a reference catalyst. Also, the most advanced pesticide degradation occurs when heterogeneous photocatalysis is performed with the aid of a higher concentration of catalyst (TiO2 P-25) and it has been observed the beneficial effect of acid pH on pesticide degradation. In conclusion, we can say that the almost complete degradation of pesticide is achieved after approx. 180 minutes in the presence of an acidic medium (pH = 3), using UV-A radiation and a TiO2-P25 type catalyst of 0.5 g/L for an initial pesticide concentration of 10 ppm.

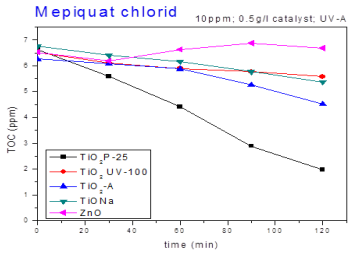


Fig.1. Pesticide degradation by heterogeneous photocatalysisusing different catalysts

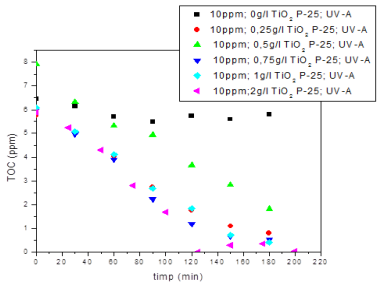


Fig.2. The TiO_2 P-25 concentration influence on the degradation of mepiquat chloride

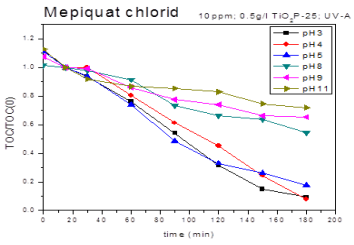


Fig. 3. Pesticide degradation in time at different pH values of the initial solution

References

1. D. Lutic, C. Coromelci-Pastravanu, I. Cretescu, I. Poulios, C.D. Stan, Photocatalytic Treatment of Rhodamine 6G in Wastewater Using Photoactive ZnO, *International Journal of Photoenergy*, 2012, DOI: 10.1155/2012/475131.
2. C.D.Stan, I.Creţescu, C.Păstrăvanu, I.Poulios, M. Dragan, Treatment of Pesticides in Wastewater by Heterogeneous and Homogeneous Photocatalysis, *International Journal of Photoenergy*, vol. 2012, Article ID 194823, 6 pages, doi: 10.1155/194823.
3. C. Pastravanu, I. Poulios, E. Popovici, and I. Cretescu, "A case study of textile wastewater treatment by heterogeneous photocatalytic degradation," The Annals of the "Dunarea de Jos" University of Galati Fascicle II—Mathematics, Physics, Chemistry, Informatics, vol. 32, pp. 31–38, 2009.

The Potential of Alfalfa (Medicago Sativa L.) in Phytoremediation of Soil Contaminated with Copper Ions

Ionela Catalina Vasilachi[1*], Petronela Cozma[1], Mariana Diaconu[1], Maria Gavrilescu[1,2*]

[1]"Gheorghe Asachi" Technical University of Iasi, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management, 73 Prof. D. Mangeron Blvd., 700050 Iasi, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania
*Correspondence: ionela.vasilachi@yahoo.com; ionela-catalina.vasilachi@student.tuiasi.ro; mgav@tuiasi.ro

ABSTRACT

Heavy metal pollution has become almost chronic worldwide with increasing human activity and continues to affect both soil quality and crop yields. Among the remedial solutions, bioremediation - including phytoremediation, is a widely accepted method that offers environmentally safe solutions. The use of green plants as hyperaccumulating agents for heavy metal ions has been proven to be advantageous in terms of cost, feasibility, efficiency being also considered an environmentally friendly method. An efficient applicability of phytoremediation involve the selection of plants with high tolerance and bioaccumulation capability, with fast growth and high biomass yield. Taking into account the widespread distribution of alfalfa (*Medicago sativa* L.) in agriculture, on different geographical and climatic areas, but also considering its biological characteristics, this plant was widely tested for its hyperaccumulative potential. Consequently, our paper aims to investigate the tolerance of the alfalfa plant and assess its effectiveness for the remediation of soils polluted at various copper thresholds. In this regard, a pot experiment was performed at the greenhouse level, using a concentration range of 10-500 mgCu(II)/kg, to investigate the phytotoxic effects of Cu(II) ions in the soil on the germination of alfalfa seeds, the growth and development rate of the plant components, as well as their color changes and deformation, but also the biomass yield, over an experimental period of two months. The results showed a seed germination degree of over 87%, alfalfa being slightly affected by the presence of Cu(II) ions. The relative increase (% increase over control) of plant components indicates a relatively weak negative effect on stem growth as metal concentration in soil increases. In case of roots, a slightly higher growth was found in the selected interval, compared to the control sample, although the root system is the first organ that comes into contact with metal ions. The values obtained in the case of relative biomass showed that, at a concentration of 500 mg/kg soil, the biomass (dry matter) decreased by 3% for the root system and around 15% for the aerial part of the plant. Therefore, following the results obtained, we can consider that alfalfa (*Medicago sativa* L.) can be a suitable plant for phytoremediation of soils polluted with Cu(II) ions, while the biomass obtained from the process can be used as a secondary source for Cu(II).

Keywords: copper, *Medicago sativa* L., phytoremediation, soil

Acknowledgements:

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Effects of Heavy Metals Stress on the Growth and Development of *Brassica Napus* (Rapeseed) at Laboratory Scale

Maria Paiu[1*], Petronela Cozma[1], Ionela Cătălina Vasilachi[1] , Mariana Minuț[1], Mariana Diaconu[1], Maria Gavrilescu[1,2*]

[1]Gheorghe Asachi" Technical University, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management, Iasi, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania

*Correspondence: maria.paiu@student.tuiasi.ro; mgav@tuiasi.ro

ABSTRACT

Remediation of soils contaminated with heavy metals as a result of anthropogenic activities that can generate pollution is an increasingly acute need of mankind. The release of toxic heavy metals, such as cobalt (Co) and nickel (Ni) in high concentrations into the environment became a major pollution problem affecting soil quality, thus posing a direct hazard to the ecosystem and human health. Removing toxic heavy metals from contaminated media by conventional methods is quite challenging because some disadvantages. Phytoremediation is an environmentally friendly and cost-effective technology for the remediation of soils contaminated with toxic metals. This technique has been proposed and recommended as a new cleaning-up technology. Thus, certain categories of plants showed an extraordinary capacity to tolerate and remove heavy metal pollutants from the affected environmental components. In this context, our work aims to assess the growth and behaviour of *Brassica napus L.* (rapeseed) plant in the presence of cobalt and nickel ions in soil. In the experimental program, rapeseed was exposed to synthetic contamination with Co(II) and Ni(II) solutions using polypropylene pots containing 15 g of soil and 10 mL of metal solution in the range of concentration between 50-1000 mg/kg soil. The experiments were carried out under laboratory conditions for 20 days. The toxicity of cobalt and nickel ions on the growth and development of rapeseed was assessed by considering phenological observations and determinations based on different growth indicators: seed germination rate, elongation rate (tolerance index) of the root system and aerial part of the plant. The results showed a higher growth rate in root length when Ni(II) contaminated solutions were applied compared to Co(II) solutions. It was observed that, at concentrations of 1000 mg/kg for both metals, the tolerance index (Er%) for oilseed rape plant components showed relatively similar values, with no significant effect on the plant. It was found that the roots of the rapeseed plant showed a higher tolerance to the pollutant nickel compared to cobalt, while the stems were more tolerant to cobalt ions. In conclusion, we can consider *Brassica napus* L. a plant with potential for phytoremediation of soils polluted with cobalt and nickel ions at moderate concentrations in soils.

Keywords: *Brassica napus*, metal toxicity, phytoremediation, soil pollution

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The Synthesis of Novel Polyssacharide Based Nanocomposite Materials. Comparative Study of Cloisite Clay Type

Raluca Ianchis[1], **Ioana Catalina Gifu[1]*,** Elvira Alexandrescu[1], Maria Minodora Marin[2,3], Sabina Burlacu[1], Catalin Mihaescu[1], Cristina Lavinia Nistor[1], Cristian Petcu[1]

[1]National R&D Institute for Chemistry and Petrochemistry ICECHIM – Bucharest, Spl. Independentei 202, 6th district, 0600021, Romania
[2]Politehnica University of Bucharest, Faculty of Applied Chemistry and Materials Science, Polizu Street 1–7, s1, 01106, Romania
[3]National Research and Development Institute for Textile and Leather, Division Leather and Footwear Research Institute, Department of Collagen, Ion Minulescu 93, 031215 Bucharest, Romania
*Correspondence: gifu_ioanacatalina@yahoo.com

ABSTRACT

Nanocomposites are mixtures of two or more materials in which at least one is nanoscale in size. These compounds may reunite different physical and chemical properties and are expected to overcome the features of the constituents in a synergistic manner. In this respect, the poor mechanical properties of hydrogels can be greatly improved by their mixing with inorganic nanofillers (clays to oxides). Hydrogels are three-dimensional polymer networks that have a high water or biological fluids absorption capacity without dissolving. Depending on their origin, hydrogels can be classified as synthetic and natural hydrogels. Natural hydrogels have important properties such as flexibility, biocompatibility and long life. In addition, hydrogels have a very similar structure to the extracellular matrix, therefore, these can be used for various applications. Most common natural hydrogels are based on chitosan, alginate, collagen, dextran, cellulose, hyaluronic acid, DNA, chitin, gelatin and fibrin [1]. The size, architecture and functions of hydrogels can vary and depending on these characteristics can be established their final application.

As mentioned, the incorporation of nanoparticles into a hydrogel material is a promising solution for overcoming the limitations of mechanical properties. The resulting physical and/or chemical interactions between nanofills and polymeric networks can generate nanocomposites with unique physically or covalently crosslinked structures with the addition of nanoparticles. Nanoparticles can vary in shape and structure, so carbon nanotubes, ceramic, polymeric, metallic nanoparticles can be used, which can provide superior properties and customized functionality.

This paper presents some preliminary studies on the synthesis and characterization of nanocomposite hydrogels based on natural polysaccharide with emphasis on the influence of Cloisites clay type on the morphostructural properties.

Promising results have been obtained recommending the obtained hydrogel nanocomposites as nanomaterials with improved mechanical capabilities, suitable for future biomedical applications.

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References

1. Ianchis R, Ninciuleanu CM, Gifu IC, Alexandrescu E, Nistor CL, Nitu S, Petcu C. Hydrogel-clay Nanocomposites as Carriers for Controlled Release. Curr Med Chem. 2020; 27(6):919-954.

Pulsed Laser Emission in Rhodamine B - Doped DNA Biopolymer

Adrian Petris[1]*, Ileana Rau[2], **Petronela Gheorghe[1]**

[1]National Institute for Laser, Plasma and Radiation Physics, 409 Atomistilor Street, 077125 Magurele, ROMANIA

[2]University POLITEHNICA Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Polizu Str., 011061 Bucharest, ROMANIA

*Correspondence: adrian.petris@yahoo.com

ABSTRACT

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Anticancer Activity of Cyanobacteria

Alina Trofim, Cezara Bivol*, Oleg Turcanu

Moldova State University, Alexei Mateevici St 60, Chisinau, Republic of Moldova
*Correspondence: bivolcezara@yahoo.com

ABSTRACT

A high number of peptides produced by the cyanobacteria of different genera, their unique structure and a wide spectrum of biological activities, including anticancer effect, indicates a significant biotechnological potential of these organisms.

Several different types of active peptides extracted from Lyngbya spp. and Nostoc ssp., were reported to possess promising anticancer effect by the disruption of microfilaments, inhibition of secretory pathways, and influencing other intracellular pathways. Extracts of marine cyanobacteria like Nostoc spongiaeforme and N. linckia, contained a polyketide called borophycin that showed the strong anticancerous effect against human colon carcinoma cell lines (LoVo). [1, 2].

Batsalova presented for the first-time evidence for saxitoxins and microcystins production by Nostoc microscopicum and highlights the toxicological importance of this cyanobacterial species. The cytotoxic activity against human cell lines HeLa established from cervical adenocarcinoma cells and A549 derived from lung carcinoma, of Nostoc microscopicum extracts, was reported [3].

Li comprehensively discuss the studies on the antioxidative, anti-inflammatory anti-carcinogenic and immune regulation properties of Nostoc commune Vaucher and Nostoc commune Vaucher-derived extracts. The available results demonstrate the potential of it to act as a functional food for the amelioration of human associated diseases [4].

Hamida was systematically investigating the anticancer activity and possible mechanism of novel silver nanoparticles (N-SNPs) synthesized by Nostoc Bahar M against the MCF-7 breast cancer cells, HCT-116 colorectal adenocarcinoma cells, and HepG2 liver cancer cells. N-SNPs decreased the viability of MCF-7, HCT-116, and HepG2 cells. Ultrastructural analysis, together with biochemical and molecular analyses, revealed that N-SNPs enhanced apoptosis via the induction of oxidative stress and/or through direct interactions with cellular structures in all tested cells. The cytotoxicity of Nostoc-mediated SNPs represents a new strategy for cancer treatment via targeting various cell death pathways [5].

Thus, the studies of revealing of new species or strains of cyanobacteria with anticancer effect, development of the methods of extraction and stabilization of valuable active substances is actual and need to be continued.

References

1. Arijit Mondal et al. Marine Cyanobacteria and Microalgae Metabolites-A Rich Source of Potential Anticancer Drugs. Mar. Drugs 2020, 18, 476.
2. Shaden A. M. Khalifa et al. Marine Natural Products: A Source of Novel Anticancer Drugs. Mar. Drugs 2019, 17, 491.
3. Batsalova T. et al. In vitro cytotoxicity and antioxidative potential of Nostoc microscopicum (*Nostocales, Cyanobacteria*). Toxicol Forensic Med Open J. 2016; 1(1): 9-17.
4. Zhuoyu Li, Min Guo. Healthy efficacy of *Nostoc commune* Vaucher. Oncotarget, 2018, Vol. 9, (No. 18), pp: 14669-14679.
5. Reham Samir Hamida et al. Oxidative Stress and Apoptotic Responses Elicited by *Nostoc*-Synthesized Silver Nanoparticles against Different Cancer Cell Lines. Cancers 2020, 12, 2099.

Advances in Green Synthesis of Metal Oxide Nanoparticles used in Tissue Engineering

Denisa-Maria Radulescu [1,*], Ecaterina Andronescu[1,2,3], Alexandru-Mihai Grumezescu[1,2,4], Ionela Andreea Neacsu[1,2,3], Adrian-Ionut Nicoara[1,2]

[1]Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, 011061 Bucharest, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania
[3]National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
[4]Research Institute of the University of Bucharest (ICUB), University of Bucharest, 050657 Bucharest, Romania
*Correspondence: denisa.m.radulescu@gmail.com

ABSTRACT

In the last years, nanotechnology has been highly studied in the materials science field as a result of its broad application in catalysis, textile industry, environment (detection of pollutants and toxins, photodegradation, remediation, water treatment), electronic (batteries, gas sensors) and pharmaceutical sector (tissue repair, cancer therapy, drug delivery). In this perspective, nanoparticles (NPs) are the most researched materials as they exhibit unique properties due to their nanometric morphology, ranging from 1 to 100 nm. Furthermore, metal and metal oxide NPs have gained significant importance for researchers and have been actively incorporated in scaffold fabrication, especially in the biomedical field, due to their ability to enhance the antibacterial, antioxidant, antifungal, or anticarcinogenic effects of the developed material. The most well-known metal NPs that have a wide range of applicability in tissue engineering are silver (Ag), platinum (Pt), gold (Au), palladium (Pd), nickel (Ni), zinc (Zn), and copper (Cu) NPs. These NPs can be synthesized by using many routes of fabrication such as conventional methods (chemical of physical synthesis) or green synthesis methods.

However, the main concern about the synthesis method of metal oxide NPs is represented by the environmental impact. In this regard, chemical and physical synthesis are the most highly used routes. Their main drawback is the use of toxic agents that could exert environmental toxicity or even carcinogenicity. Therefore, green synthesis methods could represent a solution to counter these limitations, making use of non-toxic precursors and reagents such as yeasts, bacteria, fungi, algae, and plants. The extracted phytochemicals and biomolecules from plants are the main active compounds that act as stabilizing and reducing agents for NPs formation. These active molecules could prevent nanoparticle agglomeration, reduce toxicity and improve the antimicrobial activity of NPs, leading to a possible synergistic effect.

This study aims to discuss the successful synthesis of zinc oxide and copper oxide NPs by using the green synthesis method. In this regard, orange peel has been used as a reducing and capping agent for both types of nanoparticles.

Current Trends in the Synthesis of Natural Hydroxyapatite-Based Materials for Tissue Engineering

Diana-Elena Radulescu [1,*], Ecaterina Andronescu[1,2,3], Alexandru-Mihai Grumezescu[1,2,4], Ionela Andreea Neacsu[1,2,3], Otilia Ruxandra Vasile [3]

[1]Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, 011061 Bucharest, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania
[3]National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
[4]Research Institute of the University of Bucharest (ICUB), University of Bucharest, 050657 Bucharest, Romania
*Correspondence: radulescu.diana95@gmail.com

ABSTRACT

Bone tissue engineering has attracted great interest in the treatment of bone defects, which are caused by traumatic accidents or degenerative diseases. At this moment, the most ideal solution to solve these issues is represented by the application of biomaterials. Thus, the development of tailorable materials that can mimic the properties of natural bone and enhance its regenerative abilities remains essential. In this direction, hydroxyapatite-based materials, derived from natural sources, have been the optimum solution in increasing their biocompatibility, biodegradability, antimicrobial effect, osseoregeneration, and osseointegration.

Nowadays, already chemically synthesized hydroxyapatite has been applied in tissue engineering, but the inferior durability and stability have reduced the feasibility of the material in biomedical applications. These drawbacks of chemically and physically synthesized hydroxyapatite led to the use of natural biowastes to synthesize hydroxyapatite. Recently, a unique and efficient strategy for preparing functionalized biomaterials with complex structures from natural origins has been demonstrated. Hence, bovine/fish bones, seashells, and eggshells have shown a perfect potential in obtaining hydroxyapatite with very high availability to enhance orthopedic applications. The obtained materials were proved to retain various properties from the precursor materials, such as chemical composition and pore structure. Furthermore, a rich calcium concentration and beneficial trace elements, such as Mg and Na, for bone growth can be also highlighted.

Moreover, hydroxyapatite-based materials could be further improved by the addition of various dopants, such as silver (Ag^{+}), copper (Cu^{2+}), magnesium (Mg^{2+}), zinc (Zn^{2+}), or strontium (Sr^{2+}) ions. This ability is reflected by the flexible crystal chemistry of hydroxyapatite, allowing the substitution with different cations and anions in the Ca^{2+} and OH^{-} sites. All these dopants could increase *in vitro* and *in vivo* bioactivity and biocompatibility, enhancing bone regeneration, and at the same time improving the mechanical properties of the synthesized material.

This study aims to present the applicability of food wastes, mainly eggshells and mussel shells, and the use of dopants to improve the biological and mechanical properties of hydroxyapatite, which could be further used for bone tissue engineering.

Magnetite Microspheres for the Controlled Release of Rosmarinic Acid

Cristina Chircov[1,2], Diana-Cristina Pîrvulescu[3], Alexandra Cătălina Bîrcă[1,2], Ecaterina Andronescu[1,2,4*]

[1]Department of Science and Engineering of Oxide Materials and Nanomaterials, University Politehnica of Bucharest, 011061 Bucharest, Romania
[2]National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
[3]Faculty of Medical Engineering, University Politehnica of Bucharest, 060042 Bucharest, Romania
[4]Academy of Romanian Scientists, 050045 Bucharest, Romania

ABSTRACT

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Collagen Wound Dressings Loaded with CuO- and ZnO-based Microspheres

Alexandra Cătălina Bîrcă[1,2], Mihai Alexandru Minculescu[3], Alexandru Mihai Grumezescu[1,2,4], Cristina Chircov[1,2], Ecaterina Andronescu[1,2,4]

[1]Department of Science and Engineering of Oxide Materials and Nanomaterials, University Politehnica of Bucharest, 011061 Bucharest, Romania
[2]National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
[3]Faculty of Medical Engineering, University Politehnica of Bucharest, 060042 Bucharest, Romania
[4]Academy of Romanian Scientists, 050045 Bucharest, Romania

ABSTRACT

The authors did not agree with the publishing of the abstract.

Cyanobacteria- Important Sources of Bioactive Substances with Antimicrobial Activity

Alina Trofim[1], Liliana Zosim[1,*], Valeriu Rudic[2], Greta Balan[2]

[1]Moldova State University, Alexei Mateevici St 60, Chisinau, Republic of Moldova
[2]"*Nicolae Testemitanu*"*State University of Medicine and Pharmacy, Republic of Moldova*
*Correspondence: zosim_liliana@yahoo.fr

ABSTRACT

In recent years, interest in biologically active substances from cyanobacteria has increased. The ability to improve immunity as well as the property of suppressing the activity of various fungal**,** bacteria and viruses in humans and animals has shown that the cyanobacterium *Spirulina (Arthrospira) platensis* and various extracts from its biomass (especially phycobiliproteins, carotenoids, phenolic compounds, flavonoids, acid polysaccharides etc.) can be successfully recommended in the development of new preventive remedies and alternative sources of antiviral, antimicrobial, antifungal agents [1-4].

The emergence of new strains of viruses, bacteria, fungi, as well as the increase in their resistance to drugs, raises the interest of researchers for finding of new natural antibacterial, antiviral, antifungal sources as an alternative to synthetic drugs. In our research it was established that the extract with polysaccharide content obtained from the biomass of *Spirulina platensis* grown in the presence of zinc acetate showed microbiostatic and microbicidal action on both gram-positive and gram-negative bacteria and yeast fungi of the genus *Candida*. Higher activity this extract demonstrated on the strains of *Bacillus cereus ATCC 11778* and *Acinetobacter baumannii ATCC BAA-747*, demonstrating bacteriostatic effect in 1: 1 dilution and bactericidal efect in 1: 2 dilution. On the bacteria *Escherichia coli ATCC 25922* this compound did not show bactericidal effect, only bacteriostatic effect in 1: 1 dilution. This compound also demonstrated a fungicidal and fungistatic effect on yeast fungi *Candida albicans ATCC 10231* in a 1: 1 dilution.

Thanks to its valuable biochemical composition, *Spirulina platensis* may be exploited as potent natural sources of nutraceutical and functional ingredients and can be widely used in animal feed and food supplement, pharmaceutical and health protection industry including as a preventive and alternative remedy, as well as a source of antiviral, antibacterial, antifungal agents.

References

1. El-Bay F, El-Senousy W, El-Sayed A, Kamel M. In vitro antiviral and antimicrobial activities of *Spirulina platensis* extract. Journal of Applied Pharmaceutical Science, 2013, 3(12):52-56.
2. Hetta M, Mahmoud R, El-Senousy W, Ibrahim M, El-Taweel G, Ali G Antiviral and antimicrobial activities of *Spirulina platensis*. World J Pharm Sci. 2014, 3:31-39.
3. Sarada D.V.L., Kumar C.S., Rengasamy, R. Purified C-phycocyanin from *Spirulina platensis (Nordstedt) Geitler*: a novel and potent agent against drug resistant bacteria. World J. Microbiol. Biotechnol., 2011, 27(4):779-783.
4. Usharani G.,. Srinivasan G, Sivasakthi S. Saranraj P. Antimicrobial activity of spirulina platensis solvent extracts against pathogenic bacteria and fungi. Advances in Biological Research. 2015, 9 (5): 292-298.

Section I. Advanced Techniques for Material Design and Processing

Graphene-Quantum-Dots-Decorated Nickel Aluminate Spinel Binary Nanostructure as Diagnostic Tool in Electrochemical Biosensing

Elzbieta Regulska[1,*], Joanna Breczko[1], Anna Basa[1], Beata Szydlowska[2,3], Katarzyna Kakareko[4], Alicja Rydzewska-Rosołowska[4], Tomasz Hryszko[4]

[1]Faculty of Chemistry, University of Bialystok, Ciolkowskiego 1K, 15-245 Bialystok, Poland
[2]Institute of Physics, EIT 2, Faculty of Electrical Engineering and Information Technology, Universität der Bundeswehr München, Werner-Heisenberg-Weg 39, 85577 Neubiberg, Germany
[3]Department of Materials Science & Engineering, Northwestern University, Evanston, Illinois 60208, United States
[4]Medical University of Bialystok, 2nd Department of Nephrology and Hypertension with Dialysis Unit, Bialystok, Poland
*Correspondence: e.regulska@uwb.edu.pl

ABSTRACT

Diabetes is a worldwide spread disease whose prevalence is ever increasing [1]. Blood glucose concentration is directly related to diabetes. Yet the advanced techniques are commonly employed in glucose sensing.

Herein, we propose a novel nanostructured multifunctional composite based on graphene quantum dots and nickel aluminate (NiAl2O4/GQDs) to develop ultrasensitive biosensing platform and energy storage material.

Merging nanocarbon forms with inorganic semiconductor provided the attractive synergistic behavior. Decoration of NiAl2O4 with GQDs significantly improves physicochemical features of the NiAl2O4/GQDs and thus makes it an alluring electrocatalyst and supercapacitor material. The introduced composite has a high surface area, a decreased charge-transfer resistance and an improved specific capacitance.

The NiAl2O4/GQDs-modified electrode facilitates the enhanced sensitivity towards glucose enabling its electrochemical sensing directly in human serum. Finally, we demonstrated the potential use of biosensor in diagnosis of diabetes. Our work opens new avenues towards attractive graphene-quantum-dots-decorated inorganic materials in energy storage and electrocatalysis.

References

1. X. Lin, Y. Xu, X. Pan, J. Xu, Y. Ding, X. Sun, X. Song, Y. Ren, P.-F. Shan, Sci. Rep. 10 (2020) 14790

Calcium Phosphate Coatings Obtained by Radiofrequency Magnetron Sputtering for Bone Tissue Engineering Applications

Maria E. Zarif [1,2], Sasa A. Yehia[1,3], Bogdan Biță[1,3], Andreea Groza[1], Alexandru Grumezescu[2,5,6], Ecaterina Andronescu[2,6]

[1] National Institute for Lasers, Plasma and Radiation Physics, Măgurele, Romania
[2] University Politehnica of Bucharest, Faculty of Chemical Engineering and Biotechnologies, Bucharest, Romania
[3] University of Bucharest, Faculty of Physics, Măgurele, Romania
[5] University of Bucharest, Research Institute of the University of Bucharest—ICUB, Bucharest, Romania
[6] Academy of Romanian Scientists, Bucharest, Romania
*Correspondence: maria.zarif@inflpr.ro

ABSTRACT

Bone tissue engineering (BTE) research gained a lot of interest in the last years. Different approaches were considered in order to improve the bone-implant interface and avoid implant failure. Due to their osteoconductive and bioactive properties, calcium phosphates (CaPs) were intensively studied for BTE applications. Despite the low deposition rate, radiofrequency (RF) magnetron sputtering is a promising technique due to the high coating-substrate adhesiveness and the coatings purity [1–3].

The aim of this study was to obtain calcium phosphate coatings on Ti and Si substrates, for bone tissue engineering applications, using the radiofrequency magnetron sputtering technique. The substrate temperature was changed (100, 200, and 300 °C), while the other deposition parameters (pressure, source-sample distance, and working power) were maintained constant. The gas (Ar) flow was adjusted during the experiments in order to maintain a constant pressure inside the deposition chamber.

Scanning Electron Microscopy (SEM) was required in order to evaluate the morphology and the thickness of the CaPs coatings, while Energy Dispersive X-Ray Spectroscopy (EDX) was performed to evaluate the elemental composition. The functional groups were identified by Fourier-transform Infrared Spectroscopy (FTIR).

The results showed that the deposition temperature influences the morphology of CaP films. Ca/P ratios were calculated according to the EDX data, and the functional groups, characteristic for CaPs, were identified from FTIR spectra.

Keywords: radiofrequency magnetron sputtering, calcium phosphate, bone tissue engineering

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References

1. Fedotkin AY, Bolbasov EN, Kozelskaya AI, Dubinenko G, Shesterikov E V., Ashrafov A, Tverdokhlebov SI. Calcium phosphate coating deposition by radio frequency magnetron sputtering in the various inert gases: The pilot study. Mater Chem Phys. 2019;235:121735.;
2. Prosolov KA, Popova KS, Belyavskaya OA, Rau J V., Gross KA, Ubelis A, Sharkeev YP. RF magnetron-sputtered coatings deposited from biphasic calcium phosphate targets for biomedical implant applications. Bioact Mater. 2017;2(3):170;

3. Surmenev R, Vladescu A, Surmeneva M, Ivanova A, Braic M, Grubova I, Cotrut CM. Radio Frequency Magnetron Sputter Deposition as a Tool for Surface Modification of Medical Implants. Mod Technol Creat Thin-film Syst Coatings. 2017;

An Electrically and Optically Tuned Surfactant Free Non-Aqueous Self-Stabilized Nematic Emulsions for Optical Device Applications

Ashok Chaudhary[1], Ravi K. Shukla[2]

[1]Department of Physics, Swami Premanand Mahavidyalaya Mukerian (Affiliated to Panjab University Chandigarh), Punjab, 144211, India
[2]Advanced Functional Smart Materials Laboratory, School of Physical Sciences, Department of Physics, DIT University, Dehradun, Uttarakhand 248009, India
*Correspondence: ashok86nitj@gmail.com

ABSTRACT

Surfactant free aqueous (water) and non-aqueous (ethanol, silicon oil) emulsions of nematic liquid crystal (LC) have been prepared and characterized for chemical, optical and electro-optical behaviour. Aggregation behaviour of LC in solvents have been established via chemical affinity, hydrophobic effect and hydrophobic-hydrophobic interactions. Distinct mesomorphic phases have been seen for aqueous and non-aqueous emulsions through polarizing optical microscopy (POM). Silicon oil/LC emulsions are only found stable and show reversible characteristics as function of time and temperature. Though, radial to bipolar and bipolar to broken bipolar transition have been seen as a function of silicon oil concentration. Self-stabilization, stability and distinct defect generation in such emulsions have been explained considering hydrophobic interactions, decrease in internal surface tension and anchoring energy etc. 25wt% silicon oil/LC emulsion shows the best switching characteristics, as the whole matrix switched on the application of applied voltage (5V). Silicon oil/LC emulsion devices show alerted optical transmission and better contrast ratio comparing to pristine 8CB. About 87% enhancement in transmission, 8.3dB contrast and lower Fredrick's threshold ~65% has been achieved for silicon oil/LC (25wt%) emulsion system device. These switchable and optically tuneable self-stabilized surfactant free emulsions with controlled morphological dynamics can provide a new door to design novel functional soft material platform for better optical, electro-optical, photonics, sensing and liquid crystals elastomer applications.

Keywords: Self-stabilized nematic emulsion, hydrophobic effect, switchable emulsion, optical and electro-optic response, boundary conditions

References

1. Nagelberg S, Zarzar LD, Nicolas N, Subramanian K, Kalow JA, Sresht V, Blankschtein D, Barbastathis G, Kreysing M, Swager TM, Kolle M. Reconfigurable and responsive droplet-based compound micro-lenses. Nature Communications, 8, 14673, (2017).
2. Loudet J-C, Barois P, Poulin P. Colloidal ordering from phase separation in a liquid- crystalline continuous phase. Nature, 407, 611-613, (2000)
3. Concellón A, Zentner CA, Swager TM. Dynamic Complex Liquid Crystal Emulsions. Journal of the American Chemical Society, 141, 18246-55, (2019).

Water-Soluble Schiff Base and its Corresponding Palladium Complex: Synthesis, Characterization, Oral Toxicity and Anticancer Activities

Khadija Khaldoune[1,2], Ali Hasnaoui[1], Ali Oubella[1], Karima Lafhal[2], Larbi Elfirdoussi[1], Naima Fdil[2], Mustapha AitAli[1]

[1]Molecular Chemistry Laboratory, Cadi Ayyad University, Faculty of sciences Semlalia (UCA-FSSM), Marrakech, Morocco
[2] Biochemical laboratory, Cadi Ayyad University, Faculty of medicine (UCA-FSSM), Marrakech, Morocco
*Correspondance: Khadija.khaldoune@ced.uca.ma

ABSTRACT

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Preparation and Wetting Mechanism of Hierarchically Textured Aluminum-Based Superhydrophobic Surfaces

Amani Khaskhoussi , Luigi Calabrese , Edoardo Proverbio

Department of Engineering, University of Messina, 98166 Messina, Italy
*Correspondence: akhaskhoussi@unime.it

ABSTRACT

Superhydrophobic surfaces are dynamically studied across a wide range of applications: self-cleaning, anti-icing, anti-corrosion, oil-water separation, microfluidic transmission and anti-bioadhesion [1]. Recently, several methods have been developed to elaborate superhydrophobic surface such as chemical vapor deposition, laser etching, electrospinning and electrochemical deposition. Nevertheless, these methods require a complicated process and expensive equipments As an exception, boiling and chemical etching are facile and low-cost techniques[2].

In this work, two-stage methodology to design super-hydrophobic surfaces on 6082 aluminum alloy was proposed. The first step consists of creating a rough nano/micro-structure using boiling or chemical etching and the second step consists of reducing the surface energy using a self-assembled monolayer.

Scanning electron microscopy (SEM), contact angle measuring system and atomic force microscope (AFM) were used to characterize the surfaces. The surface morphology analysis showed that each method offers a specific binary nano/micro-structure. The corresponding water contact angles are ranged from 160° to 180°. The adhesion force between the water droplets and superhydrophobic surface were discussed. The specimen etched with HF/HCl acid mixture solution shows the lowest adhesion. However, the boiled sample is characterized by the highest adhesion.

The applications of fabricated samples are mainly focus on its corresponding performances. Indeed, the superhydrophobic with high adhesion can be utilized in drug delivery. The drug delivery process can be achieved without loss because of the surface superhydrophobicity, which can save an important fund when the drug is expensive or rare. Superhydrophobic materials with high adhesion are also required for medical application to elaborate local drug delivery devices against cancer cells. On the other hand, the low adhesion superhydrophobic surfaces are useful for anticorrosion application [3] (containers, constructions, ship …). The present methodology can also be used to elaborate large scaled surfaces and expand the applications of these superhydrophobic materials.

References

1. Nyankson, E., Agbe, H., Takyi, G. K. S., Bensah, Y. D. & Sarkar, D. K. Recent advances in nanostructured superhydrophobic surfaces: fabrication and long-term durability challenges. *Curr. Opin. Chem. Eng.* **36**, 100790 (2022).
2. Nguyen-Tri, P. *et al.* Recent progress in the preparation, properties and applications of superhydrophobic nano-based coatings and surfaces: A review. *Prog. Org. Coatings* **132**, 235–256 (2019).
3. George, J. S. *et al.* Recent advances in bio-inspired multifunctional coatings for corrosion protection. *Prog. Org. Coatings* **168**, 106858 (2022).

Thermodynamic Approach of Curcumin and Whey Protein Binding

Levete Racz[1], Csaba-Pal Racz[1], Ossi Horovitz[1,] Aurora Mocanu[1], Maria Tomoaia-Cotisel[1,2,*]

[1] Babeș-Bolyai University of Cluj-Napoca, Faculty of Chemistry and Chemical Engineering, Research Centre of Physical Chemistry, 11 Arany Janos Str., RO-400028, Cluj-Napoca, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania
*Correspondence: maria.tomoaia@ubbcluj.ro mcotisel@gmail.com

ABSTRACT

Curcumin, CCM, is a pharmacologically active component of turmeric but, its stability and aqueous solubility is a limiting factor in fulfilling its therapeutic potential. Protein-based drug delivery is a known method for improving the curcumin properties. In this study whey protein concentrate, WPC, was used due to its high potential binding with small hydrophobic molecules, like CCM molecules. The interaction between curcumin and whey protein concentrate was studied by using fluorescence measurements.

Binding number (n), binding constant (KS) and thermodynamic parameters (ΔG_0, ΔH_0 and ΔS_0) at different temperatures and at different pH medium were determined. Thermodynamic approach revealed the highest stability of this CCM-WPC complex in acidic pH medium (e.g., stomach fluid of pH 1.5), decreasing at alkaline pH value (e.g., small intestine fluid of pH 7.5 to 8), and thus, indicating a rather good stability of this complex in the gastric medium. Then, in alkaline pH, which is characteristic to small intestine medium, this complex may release CCM to penetrate into blood circulation and be targeted to its place of action. AFM images showed nearly rounded CCM nanoparticles, spherical WPC nanoparticles and globular CCM-WPC nanoparticles with an average particle size of 30 ± 5 nm, 45± 5 nm, and 50± 5 nm, respectively. The FT-IR analysis revealed successfully preserved curcumin characteristic entities, in CCM-WPC complexes, with the peaks denoting aromatic C=C stretching at 1602 cm^{-1}, C=O at 1629 cm^{-1}, and peaks at 3410 cm^{-1} and 3502 cm^{-1} denoting OH of curcumin. Moreover, enol C-O and C-O-C peaks at approximately 1317 cm^{-1}, 1280 cm^{-1} and 1202 cm^{-1} were also discovered.

This study suggests that CCM can form a rather stable nanocomplex with WPC, which may serve as a promising carrier for CCM, leading to important biological effects as anti-inflammatory formulated curcumin.

3D Printing of $Ca_{10}(PO_4)_6(OH)_2$ Obtained from Natural Sources

Maria-Eliza Pușcașu[1], Ștefania Chiriac[1], Miruna-Adriana Ioța[1], Laura-Mădălina Cursaru[1, *], Roxana Mioara Piticescu[1]

[1]INCDMNR-IMNR, Blvd. Biruintei no.102, Pantelimon, Ilfov, Romania
*Correspondence: mpopescu@imnr.ro

ABSTRACT

The bone has in its composition, apart from the cells, an organic phase (preponderantly collagen) and a mineral phase which is represented by hydroxyapatite. The bone is a tissue able to self-regenerate trough the modelling and remodelling processes. Even so, in case of large defects the healing is delayed and a bone graft is needed. Hydroxyapatite is a bioactive ceramic that belongs to the calcium phosphates family. This material is well known for its similarity, in chemical and mechanical properties, to the mineral component of the bone tissue [1].

Hydroxyapatite can be synthesized from both synthetic and natural sources. Some of the natural sources of hydroxyapatite are originating either from bones or shells. In our study the shell of *Rapana venosa* was considered as calcium source. This type of shell is found in Romania coast of Black Sea, and it usually remains in a large quantity as biowaste after its visceral part is consumed [2]. In this work, hydroxyapatite was synthesized from the above mentioned natural source by hydrothermal method. The obtained powder was processed via additive manufacturing to obtain a scaffold that can further play the role of a bone graft.

The *Rapana venosa* shells were crushed, ball milled and treated with acid in order to remove any organic part. Further on a solution with well-known calcium concentration was obtained and used as a precursor in the hydrothermal synthesis of hydroxyapatite. After the hydrothermal synthesis the hydroxyapatite was spray drayed and the obtained powder was mixed with organic additives in order to obtain a paste with good rheology. Using the EnvisionTec 3D BIOPLOTTER system the paste was extruded, and hydroxyapatite-based 3D structures were obtained. The powder was characterized using X-ray diffraction, scanning electron microscopy, Fourier transform infrared spectroscopy, and dynamic light scattering. The 3D structure was also characterized using scanning electron microscopy and a prediction of the mechanical behaviour of the 3D printed structure was performed using the simulation module of the SolidWorks software.

To conclude, starting from a natural source hydrothermally synthesised hydroxyapatite was successfully obtained and processed via 3D printing.

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References

1. V. Saxena, I. Shukla, L.M. Pandey, Hydroxyapatite: An inorganic ceramic for biomedical applications, Elsevier Inc., 2019. https://doi.org/10.1016/B978-0-12-816909-4.00008-7.
2. A.M. Mocioiu, R. Tutuianu, L.M. Cursaru, R.M. Piticescu, P. Stanciu, B.S. Vasile, R. Trusca, V. Sereanu, A. Meghea, 3D structures of hydroxyapatite obtained from Rapana venosa shells using hydrothermal synthesis followed by 3D printing, J. Mater. Sci. 54 (2019) 13901–13913.

Bacterial Cellulose Use for Templating Growth of MOF Nanoparticles for Oxygen Reduction Reaction Electrocatalytic Activities

Berna Alemdag[1], Aytekin Uzunoglu[2], Semra Unal Yildirim[3], Unal Sen[4], Mustafa Erkartal[5], Cem Bulent Ustundag[1]

[1]Yıldız Technical University, Turkey
[2]Necmettin Erbakan University, Turkey,
[3]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey,
[4]Eskisehir Technical University, Turkey, [5]Abdullah Gül University, Turkey
*Correspondence: alemdagberna@gmail.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Magnetron Sputtered Titania and Carbon Fiber Cloth Composite and its Application in Electrochemical Supercapacitors

Kozlov Aleksei P.[1,2*], Arkhipova Ekaterina A.[1], Savilov Serguei V.[1]

[1]Lomonosov Moscow State University, 119234 Moscow, Russia
[2]Moscow Aviation Institute, 109240 Moscow, Russia
kozlov.aleksei.p@gmail.com

ABSTRACT

Carbon materials are well-known for having variety of allotropes, structural characteristics (such as defects, dopants, functionalities), existence in many forms, from 0D to 3D, as well as tunable chemical and transport properties [1]. Among different carbons there is a special type, an activated carbon, the main feature of which is a rich surface area, typically in order of hundreds and thousands square meters per gram, that is comprised of micro-, meso- or macropores. This allows to use it as adsorbent in many applications, including energy storage, which relies significantly on materials surface area property. While activated carbons exhibit well-developed surface area, thus benefiting in power density, their major drawback in energy storage is low electrochemical activity, meaning lack of contribution from pseudocapacitance, associated with a reversible surface redox reactions. On the other hand, various metal oxides, for instance, manganese dioxide or ruthenium dioxide, demonstrate inferior surface area, but possess outstanding electrochemical activity, therefore making them a suitable choice when high energy density is of top priority [2]. That being the case, combining properties of activated carbons and metal oxides is a way to overcome their disadvantages and achieve both high power and energy density in energy storage.

In this work a metal oxide was deposited on a carbon fiber cloth to create a composite material and test its electrochemical properties. A titanium was used as a metal, and its deposition was achieved with magnetron sputtering technique, resulting in a titanium dioxide (titania) coated carbon fiber cloth. The properties of the composite were probed with a different analytical techniques, such as scanning electron microscopy, x-ray diffraction, raman spectroscopy, x-ray photoelectron spectroscopy, thermoanalysis and N2 adsorption-desorption. The composite was used as electrode material straightforwardly without any binder or current collectors, assembled in a supercapacitor coin-cell framework in a glovebox under Ar atmosphere. Its electrochemical characteristics were explored with a potentiostat in an electrochemical impedance spectroscopy, cyclic voltammetry and galvanostatic charge-discharge experiments.

References

1. E. Frackowiak and F. Béguin, “Carbon materials for the electrochemical storage of energy in capacitors,” *Carbon N. Y.*, vol. 39, no. 6, pp. 937–950, May 2001, doi: 10.1016/S0008-6223(00)00183-4.
2. V. Augustyn, P. Simon, and B. Dunn, “Pseudocapacitive oxide materials for high-rate electrochemical energy storage,” *Energy Environ. Sci.*, vol. 7, no. 5, p. 1597, 2014, doi: 10.1039/c3ee44164d.

Fabrication of MOS Gas Sensors

Ghazala Ansari, Vinod Kumar

ABSTRACT

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Section II. Natural Bioactive Compounds

Determination of Total Poliphenols Content in Taraxacum Officinale Leaves

Ala Fulga[1*], Valeriana Pantea[2]

[1]Department of Biochemistry and Clinical Biochemistry, *Nicolae Testemitanu* State University of Medicine and Pharmacy, Chisinau, Republic of Moldova
[2]Laboratory of Biochemistry, *Nicolae Testemitanu* State University of Medicine and Pharmacy, Chisinau, Republic of Moldova
[*]ala.fulga@usmf.md

ABSTRACT

Taraxacum officinale F. H. Wigg is a species from the Asteraceae family which exhibits anti-inflammatory, antitumor, hypolipidemic and hypoglycemic activities. It exerts also antioxidant properties due to its components, like polyphenols, flavonoids, carotenoids, ascorbic acid and tocopherols.

Key words: *Taraxacum officinale* leaves (TOL), poliphenols.

Aim of the study: to determine the total poliphenols content (TPC) in TOL.

Materials and methods: TOL were harvested from a natural habitat of Republic of Moldova in May 2021. Plants were dried at room temperature, during 2 weeks. Six series (10, 20, 25, 40, 50 and 80%) of leaves ethanolic extracts were made. Determination of TPC in TOL extracts was carried out using the method of S. Arabhani- Delouee and A. Urooj (2007), in our modification [1,2]. TPC in TOL extracts was calculated using the Folin-Ciocalteu reagent and expressed in terms of tannic acid equivalent (µg TAE)/mg dry weight (DW) of plant. The standard curve equation: $y = 3.9712x – 0.1725$, where x is the absorbance measured at 765 nm using spectrophotometer *Synergy H1 Hybrid Multi-Mode Microplate Reader* (*BioTek Instruments, USA*) and y is the µg TAE/mg DW.

Results: The coefficient of determination for TPC in TOL had a good linearity $R^2 = 0.9918$. The concentrations of phenols in the examined TOL extracts range from 97.06 to 144.95 mg TA/g. The content (M±SD, mg/mL) of TPC was: in ethanol of 10% – 97.06±8.07, 20% – 114.86±5.36, 25% – 114.95±4.38, 40% – 135.49±3.51, 50% – 144.95±5.08 and 80% – 132.58±4.62.

Conclusions: *Taraxacum officinale* leaves represent an important source of poliphenols, whose content depends of alcohol concentration. The highest amount was established in ethanolic extracts of 50%, 40% and 80%.

References:

1. Arabshahi-Delouee S, Urooj A. Antioxidant properties of various solvent extracts of mulberry (Morus indica L.) leaves. Food Chemistry. 2007 Jan 1;102(4):1233–40.
2. Gudumac V, Rîvneac V, Tagadiuc O, Sardari V, Rîvneac E, Andronache L, et al. Metode de cercetare a metabolismului hepatic. Elaborare metodică Sub red Gudumac V USMF „Nicolae Testemiţanu" Chişinău. 2012;

Therapeutic Formulations Containing Plant Secondary Metabolites Used to Increase the Efficiency of Antibiotics

Cristina Teodora Dobrota[1,2], Diana Alexandra Florea[1,3], Rahela Carpa[2,4], Gheorghe Tomoaia[5,6], Aurora Mocanu[1], Maria Tomoaia-Cotisel [1,6,*]

[1]Research Center in Physical Chemistry, Faculty of Chemistry and Chemical Engineering, Babes-Bolyai University, Cluj-Napoca, Romania
[2]Department of Molecular Biology and Biotechnology, Faculty of Biology and Geology, Babes-Bolyai University, Cluj-Napoca, Romania
[3]Department of Conservative Dentistry, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania
[4]Institute for Research, Development and Innovation in Applied Natural Sciences, Babes-Bolyai University, Cluj-Napoca, Romania
[5]Department of Orthopedy and Traumatology, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania
[6]Academy of Romanian Scientists, Bucharest, Romania
*Correspondence: maria.tomoaia@ubbcluj.ro mcotisel@gmail.com

ABSTRACT

The rising prevalence of drug-resistant microorganisms has determined scientists to investigate new natural effective drugs. The goal of this paper is to present recent insights concerning the potential of the some natural antibacterial agents generated from plant sources. Secondary metabolites which include phenolic compounds, non-protein amino acids, alkaloids, cyanogenic glycosides and terpenes are used in toothpaste formulations. Several different mechanisms of action of secondary metabolites have been identified. Some of them function as bacterial growth inhibitors, others as exo-polysaccharide production inhibitors, and yet others prevent bacterial adhesion on tooth surface. Of great interest are the phytochemicals which may act as adjutants in antibiotic therapy, especially when used in conjunction with nano-hydroxyapatite (n-HAP)-containing essential elements such as Zn, Mg, and Sr able to re-enforce the bone structure and meanwhile to gradually release the antibiotic.

Bacterial antibiotic resistance is achieved through different mechanisms such as alteration of membrane permeability which prevents the entrance of antibiotics into the cells, enzymatic inactivation of antibiotics, changes of molecular target sites, and efflux pumps which extrude antibiotics out of the cell. Among these mechanisms, antibiotic efflux is effectively targeted by numerous phytochemicals able to block pump activity, acting as specific pump inhibitors (EPIs).

Plant-derived phytochemicals encompass a wide range of chemical adjuvants that synergistically increase the efficiency of antibiotics by many orders of magnitude. Phytochemicals such as piperine isolated from *Piper nigrum* increase ciprofloxacin accumulation through the suppression of efflux pump function being active against *Staphylococcus aureus.* Baicalein**,** a 5,6,7-trihydroflavone isolated from *Thymus vulgaris* leaves, increases clinical susceptibility of *S. aureus* to ciprofloxacin, ampicillin, oxacillin, cefmetazole, and tetrcycline. Some phenolic diterpenes such as carnosic acid and carnosol isolated from *Rosmarinus officinalis* have been reported as EPIs are able to improve the action of tetracycline and erythromycin against *S. aureus.* Betulin and its derivates isolated from *Betula pendula* have also been reported to have antimicrobial activity against *Streptococcus mutans* and *S. aureus*.

Synthesis of Medicinal Plant Based Bioactive Electrospun Nanofibrous Mats and Their Effect on The Antioxidant Activity

Ayşe Betül Demirel [1*], Serap Ayaz Seyhan[1,2], Dilek Bilgiç Alkaya[1,2], Sumeyye Cesur[2,3], Oguzhan Gunduz[2,3]

[1]Marmara University, Faculty of Pharmacy, Department of Analytical Chemistry, Turkey
[2]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[3]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey Romania
*Correspondence: ayse.btl.dmrl@hotmail.com

ABSTRACT

The use of natural compounds such as biocompatible and non-toxic plant extracts, without undesired side effects, in tissue engineering applications, is highly preferred compared to chemical drugs. In recent years, many studies have been carried out to produce nanofibrous materials produced by electrospinning of bioactive plant extracts.

Electrospun nanofibers have very large surface area, controllable pore size and tunable drug release profiles. Several biocompatible polymers with excellent biocompatibility and biodegradability including poly ethylenglycol (PEG) and poly lactic acid (PLA) have been widely used for the synthesis of nanofibers using the electrospun technique.

Rheum ribes L. (RR) is a member of *Polygonaceae* family which is abundant with antioxidant substances and primarily found in Iran, Iraq and east of Turkey. The roots of this plant are traditionally used to cure infections of urinary tract, diabetes and gastric ulcers. Extract of root and stem of RR has high antioxidant activity. The findings reveal that foods containing antioxidants delay the progress of Alzheimer's disease probably due to prevention or neutralization of detrimental effects of free radicals. Previous studies have demonstrated that *Rheum ribes* L. ethanol–water extract (RRE) has antioxidant, antimicrobial, and antiurease effects. In this study, nanofibers were obtained by adding of RR extract at different concentration into PLA by electrospinning technique. Electrospun PLA/PEG/RRE nanofibers were characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FT-IR), thermal analysis (DSC), and tensile strength. Physical analyzes such as density, surface tension, and particle viscosity were performed and antioxidant activity was measured by UV spectroscopy.The resulting structures of nanofibers are suitable for biomedical applications.

References

1. Alkaya, D. B., Seyhan, S. A., & Ozturk, B. N. (2019). Influence of extraction method on antioxidant properties of Rheum ribes root extract. Ovidius University Annals of Chemistry, 30(1), 44-47.
2. Cam, M. E., Cesur, S., Taskin, T., Erdemir, G., Kuruca, D. S., Sahin, Y. M., ... & Gunduz, O. (2019). Fabrication, characterization and fibroblast proliferative activity of electrospun Achillea lycaonica-loaded nanofibrous mats. European Polymer Journal, 120, 109239.
3. Yildirim, M., Degirmenci, U., Akkapulu, M., Comelekoglu, U., Balli, E., Ozcan, T. M., ... & Yalin, S. (2021). The effect of Rheum ribes L. on oxidative stress in diabetic rats. Journal of Basic and Clinical Physiology and Pharmacology, 32(1).

Characterization and Application of Silver Nanoparticles Decorated Electrospun Nanofiber Loaded with Naringenin

Ayşem Birinci [1*], Serap Ayaz Seyhan[1,2], Dilek Bilgiç Alkaya[1,2], Sumeyye Cesur[2,3], Oguzhan Gunduz[2,3]

[1]Marmara University, Faculty of Pharmacy, Department of Analytical Chemistry, Turkey
[2]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[3]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey Romania
*Correspondence: aysembirinci3@gmail.com

ABSTRACT

Nanoparticles are an innovative class of functional materials. Silver nanoparticles (AgNPs) are extensively applied in different fields of science, such as biomedical science, including antibacterial, antiviral, anti-inflammatory, and anticancer therapies. Also, AgNPs are being used to produce various biomedical products to prevent infection. The application of AgNPs has been widened due to recent advances in nanotechnology. AgNPs have several important implications including medical diagnostics, therapeutics, antioxidant, antibacterial, and cytotoxic properties. Many natural biomolecules in plants (inactivated plant tissue, plant extracts and living plant) such as proteins/enzymes, amino acids, polysaccharides, alkaloids, alcoholic compounds, and vitamins could be involved in bioreduction, formation and stabilization of AgNPs.

Naringenin (4′,5,7-trihydroxyflavanone) (NRG) is a bioflavonoid widely present in fruits; it has been reported to have antioxidant, free radical scavenging, anticancer, anti-inflammatory, immunomodulating and memory enhancing properties. Its antioxidant effects may make NRG a potential drug for treating Alzheimer disease (AD). Recently, NRG was found to exhibit neuroprotective effect in models of Parkinson's disease (PD) and AD, such as the ICV-STZ-induced mode of AD and the 6-OHDA model of PD.

Nanocomposite materials consisting of metallic nanoparticles incorporated in or with polymers have attracted much attention because of their distinct optical, electrical and catalytic properties, which have potential applications in the fields of catalysis, bioengineering, photonics, and electronics. Silver nanoparticles have been immobilized into polymer-based nanofibers to introduce hybrid multifunctional substrates for a variety of applications. In this study, nanostructured metal-polymer hybrid (AgNPs-NRG-PLA) nanofibers were obtained by electrospinning technique.The nanostructured metal-polymer hybrid (AgNPs-NRG-PLA) nanofibers were characterized by scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FT-IR), thermal analysis (DSC) and tensile strength and physical analyzes such as density, surface tension, particle viscosity were performed.

References

1. Md, S., Gan, S. Y., Haw, Y. H., Ho, C. L., Wong, S., & Choudhury, H. (2018). In vitro neuroprotective effects of naringenin nanoemulsion against β-amyloid toxicity through the regulation of amyloidogenesis and tau phosphorylation. *International Journal of Biological Macromolecules*, 118, 1211–1219.
2. Bin-Jumah, M., AL-Abdan, M., Albasher, G., & Alarifi, S. (2020). Effects of Green Silver Nanoparticles on Apoptosis and Oxidative Stress in Normal and Cancerous Human Hepatic Cells in vitro. *International Journal of Nanomedicine*, Volume 15, 1537–1548.

Design and Characterization of Medicinal Plant Based Nanofibers and Their Effect on The Antioxidant Activity

Tuğçenur Ekici [1*], Elif Doğrul[1], Dilek Bilgiç Alkaya[1,2], Serap Ayaz Seyhan[1,2], Sumeyye Cesur[2,3], Oguzhan Gunduz[2,3]

[1]Marmara University, Faculty of Pharmacy, Department of Analytical Chemistry, Turkey
[2]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[3]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey Romania
*Correspondence: tugcenurekici270@gmail.com

ABSTRACT

Cancer is a major threat to people's health and life worldwide. According to the data from the World Health Organization, cancer caused about 10 million deaths each day, and is one of the leading causes of death worldwide. More than 60% of drugs, currently in use for cancer treatment, have been isolated from natural products and numerous of them obtained from plant sources. In addition, due to the vast use in traditional medicine, there has been a growing interest in the use of medicinal herbs as a potential candidate for new anticancer therapeutic drugs. Inula *viscosa* (L.) Aiton is popular medicinal plant in the family Asteraceae. It has been used traditionally as a remedy for wounds, skin diseases, rheumatic pains, lung disorders, diabetes, gastroduodenal problems, hypertension, cancer, bronchitis, tuberculosis and infertility. Previous studies have demonstrated that I. viscosa extract (IVE) has antioxidant, antimicrobial, anticancer, cytotoxic, antihypertensive, hypoglycemic, hypolipidemic, abortifacient and anti-implantation effects.

The use of natural compounds such as biocompatible and non-toxic plant extracts, without undesired side effects, in tissue engineering applications, is highly preferred compared to chemical drugs. In recent years, many studies have been carried out to produce nanofibrous materials produced by electrospinning of bioactive plant extracts. Electrospun nanofibers have very large surface area, controllable pore size and tunable drug release profiles. Several biocompatible polymers with excellent biocompatibility and biodegradability including poly ethylenglycol (PEG) and poly lactic acid (PLA) have been widely used for the synthesis of nanofibers using the electrospun technique.

In this study, nanofibers were obtained by adding of IV extract at different concentration into PLA by electrospinning technique. Morphological (SEM), molecular interaction (FT-IR), thermal analysis (DSC), antioxidant activity and physical analysis such as density, electrical conductivity, surface tension, viscosity measurement were carried out after production process. The resulting structures of nanofibers are suitable for biomedical applications.

References

1. Ozkan, E., Karakas, F. P., Yildirim, A. B. B., Tas, I., Eker, I., Yavuz, M. Z., & Turker, A. U. (2019). Promising medicinal plant Inula viscosa L.: Antiproliferative, antioxidant, antibacterial and phenolic profiles. Progress in Nutrition, 21(3), 652-661.
2. Bar-Shalom, R., Bergman, M., Grossman, S., Azzam, N., Sharvit, L., & Fares, F. (2019). Inula viscosa extract inhibits growth of colorectal cancer cells in vitro and in vivo through induction of apoptosis. *Frontiers in oncology*, *9*, 227.
3. Ratheesh, G., Tian, L., Venugopal, J. R., Ezhilarasu, H., Sadiq, A., Fan, T. P., & Ramakrishna, S. (2017). Role of medicinal plants in neurodegenerative diseases. *Biomanufacturing Reviews*, *2*(1), 1-16.

Chitosan, Chitin from Marine Resources - Basic Bricks in The Obtaining of Multifunctional Materials

Oana-Maria Memecică[1,3*], Cătălina Ușurelu[1,2], Ana Maria Albu[1,2], Ileana Rău[1,2,3]

[1]University Politehnica of Bucharest, 011061 Bucharest, Romania
[2]Faculty of Chemical Engineering and Biotechnologies, 011061 Bucharest, Romania
[3]Doctoral School of Faculty of Chemical Engineering and Biotechnologies, 011061 Bucharest, Romania
*Correspondence: maria.memecica@yahoo.com

ABSTRACT

In the global context of the reorganization of the raw materials base for specialized applications, a constant concern of studies in recent years is focused on the recovery of animal or plant waste, with a particular focus on medical and pharmaceutical applications. An interesting perspective is a chitin-chitosan sequence, which differs in a variety of application structures: microparticles/nano, membranes, sponges, and fibers [1-3]. The chitin-chitosan has in its natural shape a number of beneficial properties, such as biocompatibility, biodegradability, and hemostatic activity, and can be used as a primer in wound healing [4, 5]. Furthermore, it can be improved by changing its less desirable features, such as bad mechanical properties and a high cost/performance ratio due to its structural-compositional versatility. Being a natural product, the development of chemical modification is a challenge that must not only elucidate the qualitative-productive experimental technique but also outline the general framework for correlating process parameters with the nature of the raw material [6]. Against the background of these unknowns, our work comes to propose a new grafting technique, based on saturation with Ce^{4+} ions, not yet used for the transformation of such materials.

Experimental Methods

The experimental methods developed in this study aim on the one hand, for synthesis, the validation of the best technique by differentiating the evolutionary particularities in a homogeneous and heterogeneous system, respectively, when promoting grafts on to/from. On the other hand, analytic methods of different types have been used for a very thorough characterization: qualitative methods (FT-IR, UV-Vis, fluorescence spectroscopy), quantitative techniques such as potentiometric titration/conductometry, and structural analysis techniques: XRD; SEM/TEM; TGA-MA; DMA; XPS.

Results and Discussion

The results promote the idea of a composite base material, identifying differences in composition and structure/superstructure.

These specific aspects are the consequence of a transformation whose driving force is the molecular dimension, this sort of chitosan obtained from freshwater crayfish is different from the one obtained, in a previous study by our group, from *Rapana venosa egg* capsules.

Conclusion

Although at an early stage, this study demonstrates that the natural copolymer-like material extracted from crayfish shells diversifies its applicative range through the distinct use of branched and gel high molecular mass sequences.

References

1. Kong, X.Y., Xu, W.H., 2015, *Intern. J. Clin. and Experim. Med*., 2015, **8**, 3498e3505.
2. Safarik, I., Stepanek, M., Uchman, M., Slouf, M., Baldikova, E., Nydlova, L., Pospiskova, K., Safarikova, M., *Mat. Sc.& Eng. C- Materials for Biological Applications* 67, 2016,486e492.
3. Sarkar, K., Kundu, P.P., *International Journal of Biological Macromolecules*, 2012, 859e867.
4. Canas, A.I., Delgado, J.P., Gartner, C., *Journal of Applied Polymer Science*, 2016,**133**, 43814.
5. Rafique, A., et al., S., *Int. J. of Biol. Macrom*., 2016, **87**, 141e154.
6. Pahlevanzadeh F, et al. *Materials*, 2020, **13**, 2663

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Curcumin Loaded Ethyl Cellulose Microparticles on 3D Scaffolds for Diabetic Wound Healing

Melih Musa Ayran[1,2], Songul Ulag[1,3*], Rıdvan Yıldırım[1,4], Oguzhan Gunduz[1,3]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[2]Department of Metallurgical and Materials Engineering, Institute of Pure and Applied Sciences, Marmara University, Turkey
[3]Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
[4]Faculty of Chemical and Metallurgical Engineering, Department of Bioengineering, Yildiz Technical University, Istanbul, Turkey

*Correspondence: songul.ulag@marmara.edu.tr

ABSTRACT

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Mesoporous Silica Materials Loaded with Gallic Acid with Antimicrobial Potential

Gabriela Petrisor[1,2,3*], Denisa Ficai[2,3,4], Ludmila Motelica[1,2,3], Roxana Doina Trusca[1,2,3], Alexandra Catalina Bîrca[1,2,3], Bogdan Stefan Vasile[1,2,3], Georgeta Voicu[1,2,3], Ovidiu Cristian Oprea[2,3,4], Augustin Semenescu[5,6], Anton Ficai[1,2,3,6], Mircea Ionut Popitiu[7], Irina Fierascu[8,9], Radu Claudiu Fierascu[8,9], Elena Lacramioara Radu[10], Lilia Matei[10], Laura Denisa Dragu[10], Ioana Madalina Pitica[10], Mihaela Economescu[10] and Coralia Bleotu[10]

[1] Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University POLITEHNICA of Bucharest, Gh. Polizu 1-7, 011061 Bucharest, Romania;
[2] National Research Center for Food Safety, University POLITEHNICA of Bucharest, Splaiul Independentei 313,
060042 Bucharest, Romania;
[3] National Center for Micro and Nanomaterials, University POLITEHNICA of Bucharest, Splaiul Independentei 313, 060042 Bucharest, Romania
[4] Department of Inorganic Chemistry, Physical Chemistry and Electrochemistry, Faculty of Applied Chemistry
and Materials Science, University POLITEHNICA of Bucharest, Gh. Polizu 1-7, 011061 Bucharest, Romania
[5] Department Engineering and Management for Transports, University POLITEHNICA of Bucharest, 060042 Bucharest, Romania;
[6] Academy of Romanian Scientists, Ilfov Street 3, 050044 Bucharest, Romania
[7] Department of Vascular Surgery and Reconstructive Microsurgery, Victor Babes University of Medicine and
Pharmacy, Timisoara, Piata Eftimie Murgu, Nr. 2, 300041 Timisoara, Romania;
[8] National Institute for Research & Development in Chemistry and Petrochemistry—ICECHIM, Splaiul Independentei 202, 060021 Bucharest, Romania;
[9] University of Agronomic Sciences and Veterinary Medicine of Bucharest, 011464 Bucharest, Romania
[10] Stefan S. Nicolau Institute of Virology, Mihai Bravu 285, 030304 Bucharest, Romania.
*Correspondence : gabriela.petrisor06@yahoo.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Investigation of The Potential of Whey Protein/Vitamin E Particles Coated Whey Protein/PVA Nanofibers for the Treatment of Muscle Loss

Kudret Irem Deniz [1, 2], Songul Ulag[1, 3], Oguzhan Gunduz[1, 3*]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey

[2]Department of Metallurgical and Materials Engineering, Institute of Pure and Applied Sciences, Marmara University, Turkey

[3]Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey

*ucemogu@ucl.ac.uk

ABSTRACT

Sarcopenia, that is, muscle loss due to aging, is defined as a syndrome determined by the general and progressive loss of skeletal muscle mass and strength, as well as the risk of negative consequences such as physical disability, low quality of life, and death. Recently, exercise and physical activity, hormone therapy, and nutrition therapy methods have been used in the treatment of sarcopenia. In previous studies, it has been observed that especially protein, vitamin, and mineral intake play an important role in the treatment of sarcopenia. Whey protein (WP) has long been reported to be an effective dietary supplement in improving skeletal muscle aging. Vitamin E deficiency is associated with loss of muscle strength and muscle weakness in humans also studies confirmed that it plays a vital role for cure skeletal muscle. Unlike other studies, this study aims to examine the controlled drug release by coating the nanofiber scaffold consisting of PVA and WP with nanoparticles consisting of WP and vitamin E and to test the biocompatibility of the scaffolds by culturing them with stem cells. The morphological properties of the nanofiber/nanoparticle scaffolds were examined with SEM. The chemical and thermal characteristics of the scaffolds were analyzed using FT-IR and DSC, respectively. The biocompatibility properties of the drug-loaded PVA and PVA/WP scaffolds were tested with mesenchymal stem cells (MSCs). The drug release behaviors of the scaffolds were examined in vitro. The swelling and degradation behaviors of the scaffolds were also examined in vitro conditions.

Keywords: sarcopenia; whey protein; vitamin E; encapsulation, nanoparticle, electrospray, PVA; electrospinning, nanofiber

Section III. Biomaterials for Tissue Engineering and Regeneration (I)

Production of 3D Printed Dental Membrane Scaffold Reinforced with Pomegranate Extract

Hatice Karabulut[1,2], Songul Ulag[1,3], Oguzhan Gunduz[1,3,*]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[2]Department of Metallurgical and Materials Engineering, Institute of Pure and Applied Sciences, Marmara University, Turkey
[3]Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
*Correspondence: Oguzhan Gunduz, ucemogu@ucl.ac.uk

ABSTRACT

The authors did not agree with the publishing of the abstract.

Nanocomposites Based on Hydroxyapatite and Vitamins

Alexandra Avram[1], Aurora Mocanu[1,] Ossi Horovitz[1], Gheorghe Tomoaia[2, 3], Sorin Riga[1,3], Maria Tomoaia-Cotisel[1, 3,*]

[1] Babeș-Bolyai University of Cluj-Napoca, Faculty of Chemistry and Chemical Engineering, Research Centre of Physical Chemistry, 11 Arany Janos Str., RO-400028, Cluj-Napoca, Romania
[2] Iuliu Hatieganu University of Medicine and Pharmacy, Orthopedics and Traumatology Department, 47 Traian Mosoiu Str., RO-400132 Cluj-Napoca, Romania
[3]Academy of Romanian Scientists, 3 Ilfov Str., RO-050044, Bucharest, Romania
*Correspondence: maria.tomoaia@ubbcluj.ro, mcotisel@gmail.com

ABSTRACT

Individuals with poor bone health have a high risk for fractures, pain and impaired physical mobility. The strength and health of bones depend on a balanced diet. Definitely, some nutrients play a key role in bone health, and an adequate amount is required for proper bone formation and development. As bone tissue tends to undergo constant remodeling, a continuous stream of nutrients such as calcium, magnesium, phosphate, zinc, among others, is needed. Vitamin D is also essential for skeletal health, preventing osteoporosis, as it has a key role in the absorption of calcium. Nevertheless, a vitamin D3 deficit is linked to further deficiencies in both calcium and phosphate ions. On the other hand, a deficiency in vitamin K has been linked to low calcium deposition in bone tissue and a rather high accumulation on the blood vessel walls. Also, a synergistic effect is expected in the case of vitamins D3 and K2, increasing the amount of osteocalcin and improving bone density.

Factors such as poor diets, severe medication or surgical interventions in the digestive area can lead to deficiencies in such nutrients which requires supplementations. However, due to a very rapid release in active substance and a lack of uptake ability of the cells, some supplements might not correct the deficiencies. Considering the importance of various elements that have been proven to support bone health, some nanocomposites based on hydroxyapatite (HAP: $Ca_{10}(PO_4)_6(OH)_2$ and multi-substituted HAP: msHAP) and vitamins (D3 and K2) were synthesized and characterized by XRD, FTIR, SEM, AFM.

New Innovative Dressing with Self-Adapting and Self-Healing Properties for Chronic Wounds Treatment

Simona Tatarusanu[1, 2*], Florentina Lupascu[1], Alexandru Sava[1], Bianca-Stefania Profire[3], Andreea Iacob[1], Anca Rusu[2], Paula Stamate[2], Andra Manaila[2], Lenuta Profire[1]

[1]Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Medicine and Pharmacy "Grigore T. Popa" of Iasi, 16 Universitatii Street, Iași, Romania
[2]Research & Development Department, Antibiotice Company, 1 Valea Lupului Street, Iasi, Romania
[3]Department of Internal Medicine, Faculty of Medicine, University of Medicine and Pharmacy "Grigore T. Popa" of Iasi, 16 Universitatii Street, Iași, Romania
*Correspondence: tatarusanu.simona-maria@email.umfiasi.ro

ABSTRACT

Chronic wound management is a challenge and a continuing concern of the global healthcare system. According to the EWMA (European Wound Management Association), the prevalence of chronic injuries is 3-4/1000, the incidence being 4 million patients/year. Among patients who are hospitalized for acute conditions, 25-50% has or develops wounds during hospitalization at risk of infection and chronic1. In this context, there is a continuing interest of pharmaceutical researchers in the development of innovative products to ensure that all patients have access to safe, fast, effective and affordable treatment. At present, various formulas are available for wound care, such as: dressings, creams, ointments, gels, sprays, powders. Particular attention was paid to the development of hydrogels, which may be based on synthetic, semi-synthetic and/or natural polymers. Traditionally, the main role of hydrogels in the treatment of wounds is to protect the damaged tissue and, secondarily, eventually to facilitate healing. Extensive researches have expanded the functional roles of hydrogels, emphasizing the need to develop "smart" materials that not only protect the wounds, but have the ability to influence all stages of healing2. In the study, we developed new bioactive hydrogels with self-healing and self-adapting capacity, based on functional derivatives of chitosan and/or hyaluronic acid. Firstly, the natural polymers were chemically modified to include carbonyl groups in their structure that can react with NH2 groups in order to form dynamic Schiff bases. The presence of dynamic imine bonds allows hydrogels to modify their three-dimensional matrix so to adapt perfectly to the shape and depth of a wound ("self-adapting" ability). In this way, an intimate contact with the damaged tissue is ensured, the healing processes are accelerated and the protection against harmful environmental factors is higher. The "self-healing" capability allows hydrogels to reorganize their structure according to the environmental conditions to which they are subjected. As a result, the hydrogels will have a superior stability over time and exposure to various stressors (pH changes, temperature variations, mechanical shear), compared to hydrogels obtained by conventional crosslinking methods3.

The presence of carbonyl groups in the structure of the modified polymers was highlighted by spectral analysis (FT-IR, 1H-NMR, 13C-NMR). The appearance of a new peak at 1732 cm-1 on FT-IR spectra confirms the presence of the carbonyl group. The presence of signals in the region of 9-10 ppm indicates the presence of the aldehyde proton in the structure of oxidized hyaluronic acid. In the case of chitosan, in the region of 8.2 ppm, a signal specific to the imine group was observed, confirming the formation of the carbonyl bond as well as the inter and intra-molecular interactions that took place.

The presence of dynamic Schiff base imine bonds in the structure of hydrogel was confirmed by FT-IR analysis through the presence of the absorption band in the range 1690-1620 cm-1. "Self-healing" ability was assessed by analyzing the rheological behavior when applying shear forces. The hydrogels obtained were characterized morphologically by scanning electron microscopy (SEM), by determining the gelation time and hydration capacity.

Crosslinking the hydrogels with oxidized polymers ensures the absence of reaction by-products that occur with the use of conventional crosslinking agents. In consequence toxicological risk to which the patient may be exposed is reduced and the safety of treatment is improved. The results achieved in our study confirm the obtaining of new hydrogels with innovative self-healing and self-adapting properties, which has promising potential for the management of chronic wounds.

References

1. Jarbrink K, Ni G, Sonnergren H, Schmidtchen A et Al. Prevalence and incidence of chronic wounds and related complications: a protocol for a systematic review. Syst Rev. 2016, 5(1):152
2. Li Y, Wang X, Han Y et al. Click chemistry-based biopolymeric hydrogels for regenerative medicine. Biomed Mater. 2021;16(2):022003.
3. Wang Y, Xie R, Li Q, et al. A self-adapting hydrogel based on chitosan/oxidized konjac glucomannan/AgNPs for repairing irregular wounds. *Biomater Sci*. 2020;8(7):1910-1922.

Novel Bioactive Chitosan-PEO-Based Nanofibers for Wound Healing Applications: An *In Vivo* Study

Oana Maria Ionescu[1], Iacob Andreea Teodora[1], Floris Francesca[2], Farci Alessia[2], Hanghicel Teodora[1], Ioannis Gardikiotis[3], Irina-Draga Căruntu[1], Simona Giușcă1, Profire Lenuța[1]

[1]University of Medicine and Pharmacy Grigore T. Popa, Faculty of Pharmacy, Iași, Romania
[2]Faculty of Pharmacy, Cagliari, Italia,
[3]Advanced Centre of Research and Development in Experimental Medicine, Iași, Romania
*Correspondence: ionescu_mariuca@yahoo.com

ABSTRACT

Objectives: The electrospinning technique has recently gained prominence among biomaterials processing technologies. It is not only a common technology with diverse applications, but it is also a versatile method that provides the researcher with several options when choosing polymer characteristics, the benefits or downsides of active chemicals being integrated. The purpose of this work is to investigate the developing of chitosan-based nanofibers as well as the suitable electrospinning parameters and its biological effect in an in vivo study. Materials and procedures: To begin, the polymers under investigation were dissolved in a solvent made of distilled water and acetic acid (1:1). A steady ratio of the two (chitosan and polyethylene oxide) was maintained without surpassing the solutions' ultimate concentration of 3% (wt/v). Most significantly, by using this system of solvents, no additional processes were required to eliminate any remaining harmful solvent. Adding propolis and Calendula officinalis extract to the solution enhanced the electrospinning yield, with a flow rate of up to 1 mL/min. Nonetheless, during this procedure, microscope images (LEICA microscope) and SEM micrographs were collected to validate the nanoscale size and electrospinning features (Nanospinner INOVENSO). Finally, the nanofiber mat with the best preliminary characteristics was tested on an experimental acute (surgical excision) wound model on Wistar rats, conducted accordingly to the Ethics committee guidelines and approved protocol over the course of 18 days, having the wound dressings renewed every three days. The positive control consisted of comercially available dressing, and the negative control consisted of sterile cotton gauze. To assay the healing rate, the wound dimensions were measured (lenghth, width) each time the dressing was changed, and the test dressings were compared to the controls. Results: The nanofibers' morhology was validated by SEM, which revealed continuous, non-rugous, and fine fibers. The diameter of the fibers did not surpass 400 nm (calculated with Fibermetric software), only if the active compound was also present, presumably due to an increase in electric charges causing the fiber to expand due to the electromagnetic field. The evaluation of the wound proved a similar effect between the test group and the positive control, and a significant improvement compared to the negative control group. Conclusion: There is an ongoing need to enhance existing wound dressing materials and develop ways to raise the yield of the procedure while decreasing the dangers associated with the traditional method. Taking into consideration the relatively low cost of the polymers and active compound compared to the positive control, the developed dressings can be considered of interest for future research in this area.

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References

1. Lemma, S.M.; Bossard, F.; Rinaudo, M. Preparation of pure and stable chitosan nanofibers by electrospinning in the presence of poly(ethylene oxide). Int. J. Mol. Sci.2016, 17, doi:10.3390/ijms17111790.

2. Pakravan, M.; Heuzey, M.C.; Ajji, A. A fundamental study of chitosan/PEO electrospinning. Polymer (Guildf).2011, 52, 4813-4824, doi:10.1016/j.polymer.2011.08.034.
3. Zhang, Y.Z.; Su, B.; Ramakrishna, S.; Lim, C.T. Chitosan nanofibers from an easily electrospinnable UHMWPEO-doped chitosan solution system. *Biomacromolecules***2008**, *9*, 136-141, doi:10.1021/bm701130e.

Dox Loaded PVA Tumor Dressing for Cancer Therapy

Gözde Çelik*, Ahsen Yilmaz , Yağmur Şimşek, Cem Bülent Üstündağ

Yildiz Technical University, Bioengineering, Istanbul, Turkey
*Correspondence: gozdecelik17@gmail.com

ABSTRACT

Benign or malignant tumors occur as a result of uncontrolled proliferation of damaged or abnormal cells. Malignant tumors are called cancer. Polymers are seen as the ideal tumor cover material for these types of tumors, and the main reason for this is their drug release potential. Generally, when the drug is taken, the drug shows classical release in the body. What is planned to be realized in this project is the release of the DOX drug used in cancer treatment, together with the PVA polymer, in the body with a controlled release system. In order to realize this controlled release, a 3D bioprinter is used and a tumor dressing is produced by bioprinting. One of the most important features of the produced tumor dressing is its high porosity and surface area. The polymers used in the production of tumor dressing should be biocompatible and biodegradable. In this context, the polymer used in our project is PVA because it has these properties. The use of PVA polymer was deemed appropriate because it is biodegradable, biocompatible and hydrophilic. This polymer is FDA approved for biomedical applications. Doxorubicin is an antitumor antibiotic drug, and it is aimed to provide the treatment of cancer disease in the patient by preventing the growth and proliferation of the tumor with doxorubicin. The tumor dressing to be produced has unique properties in terms of the drug it contains and the polymer used. The composite structure consisting of this drug and polymer has not been used in the production of tumor dressing before. It is aimed to produce a PVA polymeric tumor dressing loaded with DOX, a cytotoxic drug for the treatment of cancer. This tumor dressing will cure the cancerous cells and an unprecedented tumor dressing will be produced that will allow the patient to be treated by releasing the necessary drug in a controlled manner.

Production and Characterisation of PVA/Whey Protein/Hydroxyapatite/Gentamicin Loaded Scaffolds for Bone Tissue Engineering Applications

Tufan Arslan Tut[1,2], Sumeyye Cesur[1], Oguzhan Gunduz[1,3]*

[1] Center for Nanotechnology & Biomaterials Application and Research (NBUAM) Marmara University, Turkey
[2] Department of Bioengineering, Faculty of Engineering, Marmara University, Turkey
[3] Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
*Correspondence: ucemogu@ucl.ac.uk

ABSTRACT

3D printing technology is an approach used in health and it can be a pioneer by making progress in the near future [1]. 3D printers will be of great importance in the production of organs that can replace diseased or damaged tissues. Bone tissue engineering is an innovative treatment method to treat bone defects. In this treatment method, healthy tissues are expected to replace damaged tissues for the treatment of damaged tissues. For healthy tissues to be implanted, they are expected to be biocompatible and have the same physical, chemical and mechanical properties as damaged tissues [2]. The materials used should not have a toxic effect on the body, and the materials should also be suitable for printing for the biofunctional ink of the 3D printer.

In this study, a new approach for bone tissue engineering is considered by using polyvinyl alcohol (PVA), whey protein isolate (WPI), hydroxyapatite (HA) and gentamicin (GEN). Control group (without gentamicin), and containing 12 mg gentamicin scaffolds were fabricated with 3D printing technology and characterisation tests were performed. The characterization of the scaffolds was carried out with Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD) and compression test. The average pore sizes of the PVA/WPI/HA and PVA/WPI/HA/12GEN composite scaffolds was 716.25 ± 101.17 μm and 675.55 ± 60.71 μm, respectively. With the addition of GEN to composite scaffolds, a decrease in average pore size was observed. Compression test results showed that the compressive strength decreased from 1.28 MPa to 1.22 MPa with the addition of GEN to the composite scaffolds. Biocompatibility of PVA/WPI/HA and PVA/WPI/HA/12GEN composite scaffolds was determined with the MTT test. The test results showed that the fabricated composite scaffolds were non-toxic and cellular growth was provided. Gentamicin loaded composite scaffolds were successfully fabricated with 3D printing technology. The fabricated scaffolds have great potential to treat damaged tissue and cells for bone tissue engineering applications.

Keywords: 3D Printing Technology, Bone Tissue Engineering, Drug Release, Hydroxyapatite, Gentamicin

References

1. Yan, Q., Dong, H., Su, J., Han, J., Song, B., Wei, Q., & Shi, Y. (2018). A review of 3D printing technology for medical applications. Engineering, 4(5), 729-742.
2. Perić Kačarević, Ž., Rider, P., Alkildani, S., Retnasingh, S., Pejakić, M., Schnettler, R., ... & Barbeck, M. (2020). An introduction to bone tissue engineering. The International Journal of Artificial Organs, 43(2), 69-86.

Design and Fabrication of Metformin-Loaded Tri-Layer PCL/PVA/PCL Scaffolds for Chronic Wound Healing

Sena Harmanci[1,2], Sumeyye Cesur[1], Oguzhan Gunduz[1,3], Cem Bulent Ustundag[2*]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey

[2]Department of Bioengineering, Faculty of Chemical and Metallurgical Engineering, Yildiz Technical University, Turkey

[3]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey

*Correspondence: cbustundag@gmail.com

ABSTRACT

Chronic wounds occur when an acute wound cannot complete the normal wound healing process that takes 4-8 weeks. The recurrence rate of chronic wounds is 70% and is more common in people with diseases such as diabetes and obesity [1]. Therefore, healing chronic wounds is a very challenging and costly process. Chronic wounds have higher inflammation and reducing inflammation is a promising approach for healing these wounds [2]. Metformin is an antidiabetic drug used for the treatment of diabetes. However, the anti-inflammatory effect of metformin has recently attracted attention for its use in wound healing [3]. 3D-printed scaffolds mimic the extracellular matrix (ECM) to support cell attachment and proliferation at the wound healing site and these scaffolds could be loaded with drugs, growth factors, and other agents for increasing wound healing [4].

In this study, tri-layered PCL/PVA/PCL and PCL/PVA-Met/PCL scaffolds were produced by using an extrusion 3D printer for chronic wound healing. The characterization of the scaffolds was done with Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), and the tensile test machine. The average pore size of the PCL/PVA/PCL and PCL/PVA-Met/PCL scaffolds was 82,96±4,018 and 63,60±4,039 μm, respectively. Both scaffold's pore sizes were within a limit that allows skin regeneration. The FTIR and XRD results were in compromise with each other, demonstrating that Metformin was successfully encapsulated in the polymer solution. In vitro drug release of Metformin was analyzed with a UV spectrophotometer. The upper and lower PCL layer in the tri-layered structure provided sustained release of the drug. Less than 50% of the drug was released in 24 hours, but it reached 100% on day 31. The biocompatibility of the scaffolds was also investigated with the MTT test. The test showed that both scaffolds were non-toxic and these Metformin-loaded tri-layered scaffolds could have a promising potential for the treatment of chronic wounds.

Keywords: Chronic Wounds, Wound Healing, 3D Printing, Scaffolds, Metformin

References

1. Yao, Zexin MPH; Niu, Jun MD, PhD; Cheng, Biao MD, PhD Prevalence of Chronic Skin Wounds and Their Risk Factors in an Inpatient Hospital Setting in Northern China, Advances in Skin & Wound Care: September 2020 33 (9), 1-10.
2. Menke, N. B., Ward, K. R., Witten, T. M., Bonchev, D. G., & Diegelmann, R. F. (2007). Impaired wound healing. *Clinics in dermatology*, *25*(1), 19-25.
3. Bai B and Chen H (2021) Metformin: A Novel Weapon Against Inflammation. Front. Pharmacol. 12:622262.
4. Nosrati, H., Aramideh Khouy, R., Nosrati, A. et al. Nanocomposite scaffolds for accelerating chronic wound healing by enhancing angiogenesis. J Nanobiotechnol 19, 1 (2021).

Biomimetic Chitosan/PEO Nanofibers as Non-Cytotoxic Wound Dressings

Andreea-Teodora Iacob[1], Oana-Maria Ionescu[1], Teodora Iurașcu[1], Maria Apotrosoaei[1], Florentina Lupașcu[1], Ioana Vasincu[1], Alexandru Sava[1], Maria Drăgan[1], Dan Lupașcu[1], Lenuța Profire[1]

[1]University Of Medicine and Pharmacy Grigore T. Popa, Iași
*Correspondence: andreea.panzariu@umfiasi.ro

ABSTRACT

Aim: Nanotechnology offers an unparalleled approach to hasten the healing of acute and chronic wounds by stimulating the different phases of healing. In nanotechnology, nano-sized materials are used to administer cutaneous wound healing active substances/drugs. The aim of this paper is to develop new active electrospinning nanofibers based on chitosan (CS) and polyethylene oxide (PEO) and to evaluate their cytotoxicity character as new dressing materials in the treatment of wounds. Materials and methods: The preparation of CS/PEO matrices was performed in two stages: (i) the formation of biopolymer solutions starts by dissolving CS and PEO in 50% acetic acid by stirring at rt. The two solutions were mixed in appropriate ratios, then, over the resulting mixture, the active substances (propolis and insulin) were added and stirred until a homogeneous solution is obtained; an INOVENSO nanospinner was used, an appropriately sized needle syringe filled with the polymer solution and then different values of flow rate, applied voltage and also different distances from the tip of the syringe to the collecting plate were applied, in depending on each sample. Then the cytotoxicity was determined through MTS assay. Results: The representation of the results obtained for the wound dressings developed at 4 different concentrations after the MTS assay was performed in Fig. 1 Conclusion: The studies and the results obtained justify the evaluation of the biological and pro-healing potential in the treatment of various wounds, starting from the non-cytotoxic/antibacterial/antioxidant effects of chitosan and continuing with the beneficial role of topical propolis/insulin applied in the treatment of wounds. Acknowledgement: This research was supported by the project Development of novel bioactive and biomimetic polymeric nanostructures for wound healing **applications, PN-III-P4-ID-PCE-2020-2687, Contract no. 244/2021.**

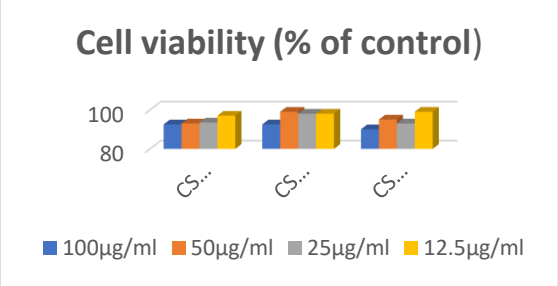


Fig.1. The cell viability representation

References

1. Pakravan, M.; Heuzey, M.C.; Ajji, A. **2011**, *52*, 4813-4824.
2. Ionescu O.M et al. Int J Biol Macromol. **2021**; 193: 996-1008.

Composite Coatings with Graphene Oxide for Dental and Orthopedic Implants

Radu Nartiță [1], Daniela Ioniță [1], Marius Enachescu [2,3], Ioana Demetrescu [1,3]

[1]Department of General Chemistry, Faculty of Applied Chemistry and Material Science, University Polithenica of Bucharest, 313 Splaiul Indepentei, 060042 Bucharest, Romania;
[2] Center for Surface Science and Nanotechnology, University Politehnica of Bucharest, 060042 Bucharest, Romania
[3]Academy of Romanian Scientists, Ilfov Street, 3, 50044 Bucharest, Romania;

ABSTRACT

Graphene and its derivatives, graphene oxide (GO) and reduced graphene oxide (rGO) are the subjects of multiple studies regarding various applications, such as radioactive waste processing, supercapacitor electrodes, food packaging and energy storage systems [1,2]. Besides these, in the last years, they became increasingly researched in the biomedical field for delivery systems, biosensors, tissue engineering and bone implants [3,4]. The presence of multiple functional groups in GO makes it able to bind polymers, pharmaceutically active substances or biomolecules, while also forming a stable aqueous solution [5,6]. Additionally, when negatively charged, the functional groups prevent the adsorption of anions, thus increasing the resistance to corrosion [7]. Furthermore, it seems that GO displays antimicrobial activity against several strains of microorganisms and has the ability to promote osseointegration [4,8]. This is especially important in the context of multidrug-resistant bacteria when alternative options to antibiotics must be found [9,10]. Of course, the concentrations used must be carefully evaluated as adverse effects could appear if high concentrations are entering the bloodstream [11]. Another important aspect that influences the properties of the final material is the way of synthesis. Different starting materials, as well as different methods, create slight differences in the physicochemical characteristic, that have an impact on the biocompatibility manifested [12,13]. It is becoming clear that we could benefit by using these materials as implant coatings and even more as multifunctional composite coatings.

References:

1. Boulanger, N.; Kuzenkova, A.S.; Iakunkov, A.; Nordenström, A.; Romanchuk, A.Y.; Trigub, A.L.; Zasimov, P. V.; Prodana, M.; Enachescu, M.; Bauters, S.; et al. High Surface Area “3D Graphene Oxide” for Enhanced Sorption of Radionuclides. *Adv. Mater. Interfaces* **2022**, 2200510, doi:10.1002/admi.202200510.
2. Iakunkov, A.; Skrypnychuk, V.; Nordenström, A.; Shilayeva, E.A.; Korobov, M.; Prodana, M.; Enachescu, M.; Larsson, S.H.; V.Talyzin, A. Activated graphene as a material for supercapacitor electrodes: effects of surface area, pore size distribution and hydrophilicity. *Phys. Chem. Chem. Phys.* **2019**, *21*, 17901–17912, doi:10.1039/C9CP03327K.
3. Li, X.; Liang, X.; Wang, Y.; Wang, D.; Teng, M.; Xu, H.; Zhao, B.; Han, L. Graphene-Based Nanomaterials for Dental Applications: Principles, Current Advances, and Future Outlook. *Front. Bioeng. Biotechnol.* **2022**, *10*, 1–21, doi:10.3389/fbioe.2022.804201.
4. Shin, Y.C.; Bae, J.H.; Lee, J.H.; Raja, I.S.; Kang, M.S.; Kim, B.; Hong, S.W.; Huh, J.B.; Han, D.W. Enhanced osseointegration of dental implants with reduced graphene oxide coating. *Biomater. Res.* **2022**, *26*, 1–16, doi:10.1186/s40824-022-00257-7.
5. Guo, J.; Cao, G.; Wang, X.; Tang, W.; Diwu, W.; Yan, M.; Yang, M.; Bi, L.; Han, Y. Coating cocrmo alloy with graphene oxide and ε-poly-l-lysine enhances its antibacterial and antibiofilm properties. *Int. J. Nanomedicine* **2021**, *16*, 7249–7268, doi:10.2147/IJN.S321800.

6. Lin, Y.; Yang, Y.; Zhao, Y.; Gao, F.; Guo, X.; Yang, M.; Hong, Q.; Yang, Z.; Dai, J.; Pan, C. Incorporation of heparin/BMP2 complex on GOCS-modified magnesium alloy to synergistically improve corrosion resistance, anticoagulation, and osteogenesis. *J. Mater. Sci. Mater. Med.* **2021**, *32*, doi:10.1007/s10856-021-06497-8.
7. Malhotra, R.; Han, Y.; Nijhuis, C.A.; Silikas, N.; Castro Neto, A.H.; Rosa, V. Graphene nanocoating provides superb long-lasting corrosion protection to titanium alloy. *Dent. Mater.* **2021**, *37*, 1553–1560, doi:10.1016/j.dental.2021.08.004.
8. Bahrami, M.S.; Eshghinejad, P.; Bakhsheshi-Rad, H.R.; Karamian, E.; Chen, X.B. Electrophoretic deposition of bioglass/graphene oxide composite on Ti-alloy implants for improved antibacterial and cytocompatible properties. *Mater. Technol.* **2020**, *35*, 69–74, doi:10.1080/10667857.2019.1648740.
9. Jang, J.; Choi, Y.; Tanaka, M.; Choi, J. Development of silver/graphene oxide nanocomposites for antibacterial and antibiofilm applications. *J. Ind. Eng. Chem.* **2020**, *83*, 46–52, doi:10.1016/j.jiec.2019.11.011.
10. Jang, J.; Lee, J.M.; Oh, S. Bin; Choi, Y.; Jung, H.S.; Choi, J. Development of Antibiofilm Nanocomposites: Ag/Cu Bimetallic Nanoparticles Synthesized on the Surface of Graphene Oxide Nanosheets. *ACS Appl. Mater. Interfaces* **2020**, *12*, 35826–35834, doi:10.1021/acsami.0c06054.
11. Poniatowska, A.; Trzaskowska, P.A.; Trzaskowski, M.; Ciach, T. Physicochemical and biological properties of graphene-oxide-coated metallic materials. *Materials (Basel).* **2021**, *14*, doi:10.3390/ma14195752.
12. Narayanan, K.B.; Kim, H.D.; Han, S.S. Biocompatibility and hemocompatibility of hydrothermally derived reduced graphene oxide using soluble starch as a reducing agent. *Colloids Surfaces B Biointerfaces* **2020**, *185*, 110579, doi:10.1016/j.colsurfb.2019.110579.
13. Tahriri, M.; Del Monico, M.; Moghanian, A.; Tavakkoli Yaraki, M.; Torres, R.; Yadegari, A.; Tayebi, L. Graphene and its derivatives: Opportunities and challenges in dentistry. *Mater. Sci. Eng. C* **2019**, *102*, 171–185, doi:10.1016/j.msec.2019.04.051.

Section IV. Environmental Applications of Materials and Nanomaterials

A Sustainable Solution: Biological Treatment of Morpholine and Its Derivatives (MAID) in Environment

Rupak Kumar[1]

[1]Central Drugs Standard Control Organization, New Delhi-110002, India
*Correspondence: rupakraman@gmail.com

ABSTRACT

The sustainable solution is an ancient core concept (ACC) that continues to be the only solution for healthy and productive life into a distant future. It is a multidimensional and multidisciplinary concept covering almost all spheres of human activity at global, national, local and individual scale. So it has become everybody's cup of tea and observed to have two obligations on its two sides of a coin. One side is the alleviation of poverty and the other, the protection of environment. A perspective solution for environmental sustainability is achieved through the biological route which is considered as one of the cleaner, greener and safer, way of sustainable waste management practices for decontaminating wide range of pollutants and its mitigation.. As per U.S EPA 2010, almost 4 billion pounds of toxic chemicals were released into the environment and increases annually at the rate of 16%. Morpholine and its derivatives (MAID) is one such chemical which is extensively used in myriad industries – from power plants to petroleum refineries. Consequent to its wide range of applications and solubility, significant amount of this chemical is released via industrial effluents into environment. In the natural environment, its secondary amine functionality leads to nitrosation to form N-nitrosomorpholine, a well characterized carcinogen. The large-scale annual usage of morpholine (25,000 CA) and its potentially carcinogenic effects thus have environmental interest for its sustainable solution. The focus of the research is to reduce the pollutant morpholine and its derivatives in environment mainly industrial discharge and investigate the reduction in chemical oxygen demand (COD) via the route of microbial degradation to conserve the natural environment and resources, and to curb the negative impacts on biota. In this study, industrial effluent samples were acquired and the presence of MAID was estimated by spectrometric and gas chromatography analysis. Bacteria isolated from natural sources (soil) were used to treat these effluents by adapting this bacterium (mutant) into increasing concentration of morpholine up to 0.15% as the sole source of carbon, nitrogen and energy nutrition. The potential isolate lead to reduced COD by 17-23% over a period of 48 hour treatment.

References

1. Sielaff B; Andreesen JR; Schräder T. A. Cytochrome P450 and a ferredoxin isolated from *Mycobacterium* sp. strain HE5 after growth on Morpholine, *Appl Microbiol Biotechnol.* 2001; **56**(3-4), 458-64 DOI: 10.1007/s002530100634
2. Magda M. and Aly. Degradation of morpholine by Mycobacterium sp. isolated from contaminated wastewater collected from Egypt. *African Journal of Biotechnology*, 2011; **10** (42); 8351-8358. DOI: 10.5897/AJB11.308
3. Rupak Kumar, Punita Manga, Shivani Gupta, Suman Kapur. Biological approaches for treating industrial effluents containing morpholine. Industrial and Environmental Biotechnology, edited by Krishna Pramanik and Jayant Kumar Patra. Studium Press India Pvt Ltd, New Delhi. 2014; 255-64, ISBN: 9789380012674

CO_2 Capture Performance of Sulfur and Oxygen Doped Carbons Derived from a Molecular Precursor

Ali Can Zaman[1*]

[1*]Science and Technology Application and Research Center, Yildiz Technical University, 34220 Istanbul, Turkey
*Correspondence: aczaman@yildiz.edu.tr

ABSTRACT

Atmospheric CO_2 reached to a level of 411 ppm due to excess CO_2 emissions [1]. Coal-fired power plants account for 40 % of global CO_2 emission [2]. Post-combustion CO_2 capture is the most easy/suitable approach to prevent the release of CO_2 to the atmosphere from coal-fired power plants among the other techniques including oxy-fuel combustion and pre-combustion [3]. Amine scrubbing technique (It relies on chemisorption) is the conventional method for CO_2 capture, which has high regeneration cost and can cause corrosion of equipment. Membrane separation can also be an option. Contrary to chemisorption and membrane separation techniques, adsorption can be a suitable choice for industrial use for CO_2 capture because of its simplicity. From zeolites to metal organic frameworks, there are many materials that are being extensively investigated [4]. Among those carbon materials stand out, because of their ease of synthesis and tailorable properties [5]. Carbon materials are generally produced by polymers like phenolic resins or biomass. However, it is possible to produce carbons from molecular precursors [6], which eliminates the need additional steps like polymerization of monomers. There are limited amount of study about utilization of carbon materials produced from molecular precursors for CO_2 capture applications [7]. In this context, this study deals with production of carbons from p-toluenesulfonic acid, a sulfonic acid contaning molecular precursor, which can be easily produced from sulfonation of toluene, and effect of NaCl templated pyrolysis is investigated on CO_2 sorption performance of resultant carbons by using gas sorption and XPS analyses [8]. In addition, XRD, AFM, SEM-EDS and ATR-FTIR analyses were used to investigate the properties of carbons. The pyrolysis products can capture up to 0.78 mmol g^{-1} CO_2 at 25 °C at 0.15 bar. It was found that NaCl templating increases oxidized sulfur content on the surface and large pores (mesopores and macropores). However, materials are dominantly microporous. Most notably, it was found that CO_2 uptake was found to be related to nonoxidized sulfur content on the surface and pore sizes below 0.5 nm. Interestingly, a negative correlation was found between oxidized sulfur content and CO_2/N_2 gas selectivity.

References

1. R. Pang, T. Lu, J. Shao, L. Wang, X. Wu, X. Qian, X. Hu, Highly Efficient Nitrogen-Doped Porous Carbonaceous CO_2 Adsorbents Derived from Biomass, Energy and Fuels. 35 (2021) 1620–1628. doi:10.1021/acs.energyfuels.0c03832.
2. J.A. Mason, K. Sumida, Z.R. Herm, R. Krishna, J.R. Long, Evaluating metal-organic frameworks for post-combustion carbon dioxide capture via temperature swing adsorption, Energy Environ. Sci. 4 (2011) 3030–3040. doi:10.1039/c1ee01720a.
3. M. Younas, M. Rezakazemi, M. Daud, M.B. Wazir, S. Ahmad, N. Ullah, Inamuddin, S. Ramakrishna, Recent progress and remaining challenges in post-combustion CO_2 capture using metal-organic frameworks (MOFs), Prog. Energy Combust. Sci. 80 (2020) 100849. doi:10.1016/j.pecs.2020.100849.
4. L. Zhou, J. Fan, G. Cui, X. Shang, Q. Tang, J. Wang, M. Fan, Highly efficient and reversible CO_2 adsorption by amine-grafted platelet SBA-15 with expanded pore diameters and short mesochannels, Green Chem. 16 (2014) 4009–4016. doi:10.1039/c4gc00832d.

5. X. Li, Q. Xue, X. Chang, L. Zhu, C. Ling, H. Zheng, Effects of Sulfur Doping and Humidity on CO_2 Capture by Graphite Split Pore: A Theoretical Study, ACS Appl. Mater. Interfaces. 9 (2017) 8336–8343. doi:10.1021/acsami.6b14281.
6. Z.-Y. Wu, S.-L. Xu, Q.-Q. Yan, Z.-Q. Chen, Y.-W. Ding, C. Li, H.-W. Liang, S.-H. Yu, Transition metal–assisted carbonization of small organic molecules toward functional carbon materials, Sci. Adv. 4 (2018) eaat0788. doi:10.1126/sciadv.aat0788.
7. S. Khodabakhshi, M. Taddei, J.A. Rudd, M.J. McPherson, Y. Niu, R.E. Palmer, A.R. Barron, E. Andreoli, Interplay between oxygen doping and ultra-microporosity improves the CO_2/N_2 separation performance of carbons derived from aromatic polycarboxylates, Carbon N. Y. 173 (2021) 989–1002. doi:10.1016/j.carbon.2020.11.080.
8. A.C. Zaman, O.F. Karaaslan, Sulfur/oxygen-doped porous carbons via NaCl-assisted thermolysis of a molecular precursor for CO2 capture, Mater. Chem. Phys. 276 (2022) 125288. doi:10.1016/j.matchemphys.2021.125288.

Comparison of Eco-Friendly and Conventional Remediation Processes Scenarios of Metal-Loaded Wastewaters

Cătălina Filote[1,2], Mihaela Roșca[1,2], Isabela Maria Simion[1], Raluca Maria Hlihor[1]

[1]"Ion Ionescu de la Brad" Iasi University of Life Sciences, Faculty of Horticulture, Department of Horticultural Technologies, 3 Mihail Sadoveanu Alley, 700490 Iasi, Romania
[2]"Gheorghe Asachi" Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection "Cristofor Simionescu", Department of Environmental Engineering and Management, 73 Prof. Dr. Docent D. Mangeron Str., 700050 Iasi, Romania
Email: catalina.filote@uaiasi.ro

ABSTRACT

Heavy metals are priority pollutants which cause serious negative effects on the environment and human health. Most prevalent metals in wastewaters and aquatic ecosystems are lead, cadmium, nickel and mercury. The removal of metal ions can be carried out through both conventional and non-conventional methods, the latter receiving increasing interest from researchers. Non-conventional biosorbents have been developed over the last three decades and were extensively studied as an environmentally-friendly alternative to the conventional adsorbents due to the fact that they are generated from renewable biomass which determines reduced costs for their production and lower environmental impact. Also, research studies conducted so far have demonstrated their higher performance in terms of metal removal from wastewaters, especially for lower metal concentrations. There are many options in terms of both non-conventional and conventional sorbents that can be applied for the removal of metal ions. Adsorbents such as polymeric organic resins, silica gel, zeolites, activated aluminas and activated carbons are the most common conventional choices. The non-conventional sorbents are biomass-based, non-treated as well as treated, including macroalgae, plants and microorganisms in raw form or biochar. In order to apply sustainability analyses such as the Life cycle assessment (LCA) it is important that the process sequence of metals removal is carefully analyzed and designed. Therefore, the current work aims to perform a comparative analysis of eco-friendly and conventional sorbents of heavy metals in terms of scenarios and removal results available based on the scientific literature. This will give a more detailed perspective on the main differences between the two main categories of adsorbents than the one usually found in the scientific literature and provide a base for the decision-making process in environmental impact assessments regarding metal removal from wastewaters.

Keywords: biosorption, biosorbents, heavy metals removal, life cycle assessment, impact assessments

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Statistical and Soft Computing Approaches for the Evaluation and Optimization of Bioremediation Processes

Mihaela Roșca[1*], Raluca-Maria Hlihor[1*], Petronela Cozma[1,2], Isabela-Maria Simion[1], Maria Gavrilescu[2,3]

[1]"Ion Ionescu de la Brad" Iasi University of Life Sciences, Faculty of Horticulture, Department of Horticultural Technologies, 3 Mihail Sadoveanu Alley, 700490 Iasi, Romania
[2]"Gheorghe Asachi" Technical University of Iasi, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management,
73 Prof. D. Mangeron Blvd., 700050 Iasi, Romania
[3]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania
*Correspondence: mihaelarosca@uaiasi.ro; raluca.hlihor@uaiasi.ro

ABSTRACT

The bioremediation of liquid effluents by microorganisms may be affected by a wide variety of biotic and abiotic factors. To evaluate the influence exerted by these factors as well as to determine their values in order to achieve the desired performances, a very large number of experiments are classically required to be performed. In order to reduce the number of experiments as well as the costs and materials resources, but also to save time, the researchers modeled the experimental data with the help of different statistical analysis methods and soft computing approaches. According to research results in the field of heavy metals biosorption by microorganisms, for the empirical modeling of experimental data and process optimization, the artificial neural networks (ANN) and design of experiments (DOE) are the most adequate techniques to use. The ANN models are nonlinear regression techniques, inspired by the human nervous system, useful to map non-linear input and output relationships in a wide range of areas. DOE is a statistical tool through which the relationships between the inputs and the outputs can be characterized by a linear or quadratic mathematical equation. DOE tool can be used both to assess the statistical influence of the factors and to optimize the process. In this context, the main purpose of this paper was to identify the strengths and weaknesses of these tools in empirical modeling and optimization of heavy metal ions biosorption by microorganisms. For example, it is not correct to say that all systems with curvature are compatible with a second-order polynomial model, as DOE tool indicates. To highlight the applicability of these tools for biosorption empirical modeling and optimization we analyzed the published studies that used ANN and DOE tools. The results of these studies showed, that in genaral the efficiency of heavy metals biosorption under variation of influencing factors is predicted with high accuracy by these statistical and soft computing approaches.

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Sampling devices used to collect indoor airborne viruses

Diana Mariana Cocârță[1,2]. **Anca Cristina Gogoncea**[1],. Mariana Prodana [1] Ioana Demetrescu[1,2]
Constantin Streche[1], Adrian Alexandru Badea[1,2]

[1]University POLITEHNICA of Bucharest, 011061 Bucharest, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania
*Correspondence: dianacocarta13@yahoo.com

ABSTRACT

Viruses, together with bacteria fungi, pollen, dust mites and all other living organisms are constituents of airborne biological particles leading to biological contamination.

As demonstrated in the last years, aggressive viruses can generate significant implications at global and conseguently, the sampling devices to collect indoor airborne is an important technical challenge due to the lack of both standardization in sampling indoor airborne viruses, and common approaches for air sampling procedures and their treatment [1]. The pandemic crisis evidenced the need not only of more knowledge in this field, but at the same time the need of a better strategy for the protection of public health.

Effects on humans' health considering different particle size intervals of bioaerosol were investigated and communicated and various advantages and isadvantages of the proposed solutions were highlighted [2].

There are two types of methods used for collecting and analysing airborne viruses named culture-based and culture-independent methods respectively [3,4]. The first type used especially for indoor evaluation is assuming that the virus viability is maintained during and after bioaerosol collection and needs the cultivation of microorganisms from the environmental sample. The second type involves the analysis of nucleic acids from the sample without cultivations.

The aim of the current work is a contribution to the review of the main methods for airborne virus sampling, being evidenced the next techniques: impactors and cyclones, liquid impingers, filters, and condensation-based growth tube collectors.

Biological hazards due to airborne viruses' exposures in occupational environments is presented as well with the hope that public authorities having more understanding and knowlwdge will be able to take the best decisions for the public health policies.

References

1. Kiselev, D.; Matsvay, A.; Abramov, I.; Dedkov, V.; Shipulin, G.; Khafizov, K. Current Trends in Diagnostics of Viral Infections of Unknown Etiology. Viruses 2020, 12, 211
2. Cocârţă, D.M.; Prodana, M.; Demetrescu, I.; Lungu, P.E.M.; Didilescu, A.C. Indoor Air Pollution with Fine Particles and Implications for Workers' Health in Dental Offices: A Brief Review. Sustainability 2021, 13, 599.
3. Diana M. Cocârță , Cristina A. Gogoncea , and Constantin Streche An important challenge in occupational health: sampling indoor airborne viruses MATEC Web of Conferences 343, 10022 (2021)
4. W.G. Lindsley, B.J. Green, F.M. Blachere, S.B. Martin, B.F. Law, P.A. Jensen, M.P. Schafer, in NIOSH Manual of Analytical Methods (National Institute for Occupational Safety and Health, Cincinnati, OH, 2017)
5. Franchitti, E.; Pascale, E.; Fea, E.; Anedda, E.; Traversi, D. Methods for Bioaerosol Characterization: Limits and Perspectives for Human Health Risk Assessment in Organic Waste Treatment. Atmosphere 2020, 11, 452

Nanomaterials as efficient sorbents for the development of sustainable analytical methods

Ruth Rodríguez-Ramos[1], Adrián Conde-Díaz[1], **Bárbara Socas-Rodríguez[1,*]**, Álvaro Santana-Mayor[1], Antonio V. Herrera-Herrera[1,2], Miguel Ángel Rodríguez-Delgado[1]

[1]Departamento de Química, Unidad Departamental de Química Analítica, Facultad de Ciencias, Universidad de La Laguna (ULL). Avda. Astrofísico Fco. Sánchez, s/nº. 38206 San Cristóbal de La Laguna, España

[2]Instituto Universitario de Bio-Orgánica Antonio González, Universidad de La Laguna (ULL), Avda. Astrofísico Fco. Sánchez, 2, 38206 San Cristóbal de La Laguna, España.

*Correspondence: bsocasro@ull.edu.es

ABSTRACT

Within the scope of Green Chemistry and, particularly, Green Analytical Chemistry, the application of nanotechnology has been one of the main actions lines to develop sustainable and greener methodologies which, at the same time, offer great efficiency and high sensitivity and specifity. Those characterisch is are achieved thanks to the the unique features of nanomaterials including their size-dependent properties and excellent surface activity, high mechanical, chemical, thermal, optical, electrical, or biological properties[1]. Among the different materials coomonly used, magnetic nanoparticles (m-NPs) have gained great attention due to their great magnetic susceptibility and, superparamagnetism that favour their separation from the samples, simplifying the procedures, recuding times and costs which make them ideal to be used as sorbents in miniaturised extraction techniques[2].

However, although the application of m-NPs provides numerous advantages, they have hardly been used without further modifications since they can be oxidised and their trend to aggregation. To avoid these problems they are ususally combined with other materials. In addition, these modifications and combinations also provide higher specificity and versatility to the applied materials[2]. In these sense, the coating with polymers has shown good results for the extraction of different kinds of compounds from complex matrices.

In this work, two different polymers (i.e. polypyrrole and polyaniline) were evaluated as coating materials of m-NPs in the preparation of effective sorbents for the extraction of plastic migrants from food matrices. Results, demonstrated that both sorbents can be applied as suitable materials with this propose although polyaniline provided higher sensitivite for some of the target compoounds[3,4].

References

1. 1. S. Irem Kaya, Ahmet Cetinkaya, Sibel A. Ozkan, *Trends in Environmental Analytical Chemistry* 33 (2022) 00157.
2. B. Socas-Rodríguez, A. V. Herrera-Herrera, M. Asensio-Ramos, M. Á. Rodríguez-Delgado, *Processes* 2020, 8, 1140.
3. R. Rodríguez-Ramos, B. Socas-Rodríguez, Á. Santana-Mayor, P. Á. Salazar-Carballo, M. Á. Rodríguez-Delgado, *Journal of Chromatography* A 1637 (2021) 461858.
4. A. Conde-Díaz, R. Rodríguez-Ramos, B. Socas-Rodríguez, P. Á. Salazar-Carballo, M. Á. Rodríguez-Delgado, *Journal of Chromatography* A (2021) (In press).

Study of Nickel, Copper and Silver Co-doped ZnO Based Nanocrystalline DMS

Shaveta Thakur*

Department of Physics, R.R.M.K. Arya Mahila Mahavidyalaya, Pathankot (Punjab), 145001
*Correspondence: salariashaveta@gmail.com

ABSTRACT

Nanoparticles of undoped, Ni, Ag and Cu co-doped ZnO were synthesized using chemical precipitation method. Structural studies were carried out using XRD and FTIR. The X-ray diffraction patterns show hexagonal wurtzite structure (space group P63mc).The crystallite size of undoped and co-doped nanoparticles is determined using Scherrer method. UV-Vis absorption spectra reveals red shift compared to the undoped ZnO in case of Ni, Ag co-doped ZnO due to exchange interaction between band electrons of ZnO and localised d electrons of Ni and Ag and blue shift in case of Ni, Cu co-doped ZnO as compared to undoped ZnO. This is due to increase of carrier density which shifts the Fermi level close to conduction band and band gap increases that is explained through Burstein Moss effect. FTIR studies shows that the bands from 450 - 460 cm-1 are attributed to the stretching modes of ZnO. The presence of Zn–O and Zn–Cu–Ni–Ag-O bonds are confirmed by FTIR analysis. SEM images reveal that the size lies in nanoparticle range. The particle size in case of Ni, Ag co-doped ZnO nanoparticles whereas it decreases in Ni, Cu co-doped ZnO nanoparticles.

Keywords: XRD, FTIR, crystallite size, optical band gap, SEM

Lipid Membrane Hydroperoxidation Favor Ion Permeability

Eulalie Lafarge[1*], Pierre Muller[1], André Schroder[2], Jan Behrends[3], Ekaterina Zaitseva[3], Carlos Marques[1]

[1]Institut Charles Sadron, CNRS, Strasbourg, France
[2]Laboratoire de Mécanique des Contacts et des Structures, INSA, Lyon, France
[3]Institute of physiology, Freiburg, Germany
*Correspondence: firstname.lastname@e-mail.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Section V. Drug Delivery Applications of Nanomaterials and Biomaterials

The Influence of Coordinative Compounds, Thiosemicarbaside Derivates on the Thiol-Disulfide Groups in Human Red Blood Cells

Valeriana Pantea*, Evelina Lesnic, Ala Fulga

Nicolae Testemitanu State University of Medicine and Pharmacy, Chisinau, Republic of Moldova
***Correspondence:** valeriana.pantea@usmf.md

ABSTRACT

An increased interest is actually offered in the evaluation of the impact of the new copper coordinative compounds (CCC) - thiosemicarbaside derivates. CCC showed important antitumoral properties, however their influence on the thiol-disulfide system in human erythrocytes has not been studied. The aim was to study the influence of the new copper coordinative compounds, thiosemicarbaside derivatives, coded as CMA-18, CMC-34, CMD-8, CMG-41 and CMJ-33 on the content of thiol-disulfide groups in proteins of the human erythrocytes in *ex vivo* experiments. As material and methods were used the new CCC, thiosemicarbaside derivatives, coded as CMA-18, CMC-34, CMD-8, CMG-41 and CMJ-33 developed at the State University of Moldova in the Laboratory "Advanced materials in biopharmaceutical and technical" [1, 2, 3, 4]. In order to evaluate the influence of CCC, several *ex vivo* experiments were performed in which was used the peripheral blood samples collected from 8 conventionally healthy individuals. As results the research showed different changes exerted by the new CCC on the content of thiol-disulfide proteins of the human erythrocytes in conventionally healthy individuals. The most pronounced change compared to the initial level was registered for CMC-34, which significantly decreased with 47% ($p<0,001$). The administration of CMG-41, CMJ-33 and CMD-8 diminished with 19% ($p<0,001$) and 17% ($p<0,001$) respectively in comparison with the initial level. No significant change was established by CMA-18, which remained at the same level. In conclusions the influence of studied CCC on the thiol-disulfide system indices in human erythrocytes was selective and differentiate. Further studies are needed to evaluate the mechanisms of action in other biosystems and experiments.

Keywords: copper coordinative compounds, erythrocytes, thiol-disulfide system.

References

1. Gulea A., Roy J., Stavila V.et al. In vitro antileukemia, antibacterial and antifungal activities of some3d metal complexes: Chemical synthesis and structure activity relationships. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 2008; 23(6):806-818.
2. Gulea A., Poirier D., Pahonţu E., Ţapcov V., Bejenari N., Roy J. *Inhibitori ai leucemiei mieloide umane în baza compuşilor coordinativi ai cuprului(II) cu saliciliden-tiosemicarbazide.* Brevet de invenţie MD3890, 2009. BOPI, 2009:4;35.
3. Pahonțu E, Paraschivescu C, Ilieș D-C. et al. Synthesis and Characterization of Novel Cu (II), Pd (II) and Pt (II) Complexes with 8-Ethyl-2-hydroxytricyclo (7.3.1.02,7) tridecan-13-one-thiosemicarbazone: Antimicrobial and in vitro Antiproliferative Activity. *Molecules*. 2016; 21 (5): 674.
4. Pahontu Elena, Usataia Irina, Graur Vasilii et al. Synthesis, characterization, crystal structure of novel Cu (II), Co (III), Fe (III) and Cr (III) complexes with 2-hydroxybenzaldehyde-4-allyl-S-methylisothiosemicarbazone: Antimicrobial, antioxidant and in vitro antiproliferative activity // Appl Organometal Chem. 2019; e 4544.

Antibacterial Ability of Poly Lactic Acid Microspheres Loaded with Hydroxyapatite and Vancomycin

Gertrud-Alexandra Paltinean[1], Sorin Rapuntean[2], Gheorghe Tomoaia[3,4], Sorin Riga[1,4], Aurora Mocanu[1], Maria Tomoaia-Cotisel[1,4,*]

[1]Babeș-Bolyai University of Cluj-Napoca, Faculty of Chemistry and Chemical Engineering, Research Centre of Physical Chemistry, 11 Arany Janos Str., RO-400028, Cluj-Napoca, Romania
[2]University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, 3-5 Manastur Str., RO-400372, Cluj-Napoca, Romania
[3]Iuliu Hatieganu University of Medicine and Pharmacy, Orthopedics and Traumatology Department, 47 Traian Mosoiu Str., RO-400132 Cluj-Napoca, Romania
[4]Academy of Romanian Scientists, 3 Ilfov Str., RO-050044, Bucharest, Romania
*Correspondence: maria.tomoaia@ubbcluj.ro mcotisel@gmail.com

ABSTRACT

Orthopedic surgery carries bone infection risks. These might be prevented by using bone cement based on combining pure hydroxyapatite, HAP, or biomimetic hydroxyapatite, bHAP, poly lactic acid, PLA, and antibiotic drugs, like vancomycin, VCM, for local drug delivery, thus overcoming the disadvantages of systemic antibiotic therapy. Microspheres have recently attracted increased interest of scientists due to antimicrobial activities, thus opening the new opportunities for biomedical applications and controlled release of drugs at the target site.

This research focuses on the antimicrobial activity of PLA microspheres loaded with hydroxyapatite and vancomycin. Hydroxyapatites, HAPs, were used within all experiments and the results show a controlled release of vancomycin from VCM/HAPs/PLA microspheres in aqueous dispersions. PLA microspheres loaded with hydroxyapatites mixed with vancomycin were synthesized and morphologically characterized, by SEM and AFM. The release of vancomycin from PLA/HAPs/VCM microspheres was determined and the antibacterial activity of the aqueous dispersions was evaluated against four pathogenic species: Staphylococcus aureus, Salmonella typhimurium, Bacillus cereus and Micrococcus luteus, and revealed a superior antibacterial activity versus pure vancomycin.

Pharmaceutical Approaches of Nanobodies

Marina Ionela Ilie[1,*], Adrian Siluan Ivan[1], Doina Drăgănescu[1], Bruno Ștefan Velescu[1], Denisa Ioana Udeanu[1], Andreea Letiția Arsene[1]

[1] Faculty of Pharmacy, "Carol Davila" University of Medicine and Pharmacy, 6 Traian Vuia Street, 020956 Bucharest, Romania.
*Correspondence: marina-ionela.ilie@drd.umfcd.ro

ABSTRACT

Introduction

Nanobodies (Nbs) are single-domain antibodies, similar to heavy-chain-only structures initially isolated from camelids and cartilaginous fish. Nbs have a truncated structure, without any light chains and with a single variable domain in the two heavy chains, representing the antigen-binding region.

Materials and methods

Although discovered since the 1990s, nanobody therapies are in development. We aimed to highlight the importance of the use of these molecules in different pathologies, using as working method the analysis of scientific articles published in the literature and indexed in international databases (PubMed, Web of Science Core Collection).

Results and discussions

Nbs exhibit ideal attributes for large-scale manufacture and present numerous advantages over classical human antibodies: ultra-high antigen-binding affinity, recognition of a higher diversity of paratopes, good physicochemical qualities with increased solubility, good tissue penetration and high stability, allowing for oral or inhalation administration. Bi- or multispecific heavy chain antibodies and nanobody-drug conjugates are tested as antitumoral therapeutic strategies with the potential to be used to prevent or treat inflammatory and infectious diseases.

References

1. Jovčevska, I., Muyldermans, S. The Therapeutic Potential of Nanobodies. BioDrugs 34, 11–26 (2020). https://doi.org/10.1007/s40259-019-00392-z
2. Hanke, L., Vidakovics Perez, L., Sheward, D.J. et al. An alpaca nanobody neutralizes SARS-CoV-2 by blocking receptor interaction. Nat Commun 11, 4420 (2020). https://doi.org/10.1038/s41467-020-18174-5
3. Sasisekharan R. Preparing for the Future - Nanobodies for Covid-19? N Engl J Med. 2021 Apr 22;384(16):1568-1571. doi: 10.1056/NEJMcibr2101205. Epub 2021 Apr 7. PMID: 33826817.
4. Elisha R. Verhaar, Andrew W. Woodham, Hidde L. Ploegh, Nanobodies in cancer, Seminars in Immunology, Volume 52, 2021, https://doi.org/10.1016/j.smim.2020.101425.
5. Muyldermans, S. (2020). Applications of Nanobodies. Annual Review of Animal Biosciences, 9(1). doi:10.1146/annurev-animal-021419-083831

Exosomes in Neuroscience as Biomaterials

Jale Odabaşı Bağcı[1], Şule Aydın Türkoğlu[2], Esra Cansever Mutlu[3,4*]

[1]Bolu Abant İzzet Baysal University, Graduate Education Institute Department of Interdisciplinary Neurosciences 14100 Bolu, Turkey

[2]Bolu Abant İzzet Baysal University, Faculty of Medicine, Department of Neurology 14100 Bolu, Turkey

[3]Beykent University, Beykent University, Faculty of Engineering and Architecture, Department of Biomedical Engineering Istanbul, Turkey Department of Biomedical Engineering, 34485 Istanbul, Turkey

[4]University of Birmingham, College of Engineering and Physical Sciences School of Metallurgy and Materials B15 2 TT, UK

*Correspondence: esramutlu@beykent.edu.tr; e.mutlu@bham.ac.uk

ABSTRACT

Exosomes are promising nanoparticles that can been used as biomaterials. They have got many outstanding features; such as being approximately 40–100 nm in size. Besides, various cell types can become genetically programmable self-decoration and secrete their exosomes with adhesive proteins onto versatile amphiphilic lipid molecules of their structures(1).

Extracellular vehicles (EVs) and exosomes represent not only safe information transfer envelopes for antisens oligonucleotides (AONs) but also energy and material communication vehicles between cells. They have well-know known significant roles in cellular communication by transferring functional proteins, metabolites, mitochondria and nucleic acids to recipient cells(2,3). Especially, their contents are abundant with mRNAs, miRNAs, mitochondrial DNA and piRNAs, lncRNAs, ribosomal RNAs and snRNAs(4). Encapsulated nucleic acids in exosomes can impact on protein synthesis and this effects the fate of neurons itself(4,5).

In this talk will examine as discussing issues how rare disease derived exosomes can be isolated, what kind of markers could be detected onto their surface and how they can be engineering in order to used for terapotic and diagnostic purposes.

Keyword: Antisens oligo nucleotides, rare-diseases, terapy, diagnose, EVs, natural nanoparticles

References

1- Mutlu, E.C.; Kaya, Ö.; Wood, M.; Mager, I.; Topkara, K.Ç.; Çamsarı, Ç.; Birinci Yildirim, A.; Çetinkaya, A.; Acarel, D.; Odabaşı Bağcı, J. Efficient Doxorubicin Loading to Isolated Dexosomes of Immature JAWSII Cells: Formulated and Characterized as the Bionanomaterial. *Materials* **2020**, *13*, 3344. https://doi.org/10.3390/ma13153344

2- Al Amir Dache, Z, Otandault, A, Tanos, R, et al. Blood contains circulating cell free respiratory competent mitochondria. The FASEB Journal. 2020; 34: 3616– 3630. https://doi.org/10.1096/fj.201901917RR

3- Gurung, S., Perocheau, D., Touramanidou, L. *et al.* The exosome journey: from biogenesis to uptake and intracellular signalling. *Cell Commun Signal* **19,** 47 (2021). https://doi.org/10.1186/s12964-021-00730-1

4- Liang Y, Duan L, Lu J, Xia J. Engineering exosomes for targeted drug delivery. Theranostics. 2021 Jan 1;11(7):3183-3195. doi: 10.7150/thno.52570. PMID: 33537081; PMCID: PMC7847680.

5- Liu, W., Bai, X., Zhang, A., Huang, J., Xu, S., & Zhang, J. (2019). Role of Exosomes in Central Nervous System Diseases. Frontiers in Molecular Neuroscience, 12, 240. https://doi.org/10.3389/FNMOL.2019.00240/BIBTEX

Novel Highly Efficient Multi-Target Nanoparticles in Type 2 Diabetes Mellitus

Florentina Geanina Lupașcu, Andreea Teodora Iacob, Ioana Vasincu, Maria Apotrosoaei, Georgiana Taușer, Maria Drăgan, Magdalena Bârsan, Alin Focșa, Alexandru Sava, Andra Ababei, Simona Tătărușanu, Profire Lenuța

University of Medicine and Pharmacy Grigore T. Popa, Iași
*Correspondence: lupascu.geanina@yahoo.com

ABSTRACT

Type 2 diabetes (T2DM) is a chronic disorder that affects approximately 4 million people annually. T2DM treatment is a worldwide problem, because until now no effective and safe therapy has been discovered to ensure good glycemic control and minimal side effects. Oxidative stress acting harmful on the development and/or progression of tissue insulin resistance. Recently, a special importance is given to the elaboration of a combined antidiabetic therapy. T2DM associated with oxidative stress causes destruction of cellular structures leading to severe tissue damage. Curcumin (Cur) has been shown to have significant antioxidant activity and a potential hypoglycemic effect in experimental diabetic animal models. Unfortunately, its therapeutic efficacy is limited because it has low oral bioavailability, reduced digestive absorption and fast metabolism. Pioglitazone (Piog) is an efficient hypoglycemic therapeutic agent but with a low oral absorption, low solubility and short half–life. Developing of new multi-target polymer systems for improving the antidiabetic agents' bioavailability is a major concern of researchers. The aims of this study were to formulate and design optimization of the method to obtaining chitosan nanoparticles (CsNp) loaded with Piog and Cur, to analyze loading efficiency of Cur and Piog in CsNp, to investigate in vitro antioxidant activity and its hypoglycemic effects on DM induced with streptozotocin to rats. CsNp and drugs loaded into CsNp were obtained by ionic gelation method. During the process of obtaining nanoparticles, the influence of different parameters on the formulation process was analyzed. Their synthesis was monitored by dynamic light scattering technique. In order to optimize the method for obtaining CsNp it was varied the concentration of chitosan (Cs), TPP, pH of CS solution, stirring speed, reticulation time and the concentration of the active drug. Following the optimization process, it has been established the optimal formula for loading the two active substances in the polymer matrix. Antioxidant activity of pure substances and of its Cs nanoformulations were analyzed by in vitro models including radical scavenging activity against DPPH and ABTS radical, as well as ferric reducing antioxidant power (FRAP) assays. Moreover, compared to the pure Cur, Cur loaded into CsNp showed a dose-dependent manner with a higher radical scavenging activity. To determine the in vivo hypoglycemic effect, Piog, Cur and Cs nanoformulations (CS-P, CS-C, CS-PC) were orally administered on diabetic rats, once per day, for a period of 21 days. During the experiment it was investigated glycaemia and at the final of experiment was analyzed glycosylated hemoglobin (HbA1c). Oral administration of these new polymeric systems significantly reduced the blood glucose levels and HbA1c in reference with the diabetic rats. The best hypoglycemic effect was recorded for CS-PC formulation.

References

1. Deepika, Prasad M, Salar A, Salar RK, In vitro anticancer activity of curcumin loaded chitosan nanoparticles (CLCNPs) against Vero cells, Pharmacological Research - Modern Chinese Medicine 2022, 3: 100116.
2. Ramkanth S, Anitha P, Gayathri R, Mohan S, Formulation and design optimization of nano-transferosomes using pioglitazone and eprosartan mesylate for concomitant therapy against diabetes and hypertension, European Journal of Pharmaceutical Sciences 2021, 162: 105811.

Poster Section (II)

The Synthesis of Novel Polyssacharide Based Nanocomposite Materials. the Study of Inorganic Filler Concentration

Raluca Ianchis[1], **Ioana Catalina Gifu[1]*,** Elvira Alexandrescu[1], Maria Minodora Marin[2,3], Sabina Burlacu[1], Catalin Mihaescu[1], Cristina Lavinia Nistor[1], Cristian Petcu[1]

[1]National R&D Institute for Chemistry and Petrochemistry ICECHIM – Bucharest, Spl. Independentei 202, 6th district, 0600021, Romania
[2]Politehnica University of Bucharest, Faculty of Applied Chemistry and Materials Science, Polizu Street 1–7, s1, 01106, Romania
[3]National Research and Development Institute for Textile and Leather, Division Leather and Footwear Research Institute, Department of Collagen, Ion Minulescu 93, 031215 Bucharest, Romania
*Correspondence: gifu_ioanacatalina@yahoo.com

ABSTRACT

Crosslinked hydrogels obtained from natural resources was considered a suitable alternative for typical hydrogels based on synthetic polymers most of them being non-biocompatible and non-degradable[1]. Hydrogels based on natural polysaccharides may find a myriad of applications such as, in controlled drug release, hygiene products, tissue engineering, wastewater treatment, agriculture, sensors.

In addition to the intrinsic advantages of hydrogels based on natural derivatives, such as easy availability, biocompatibility, non-toxicity and biodegradability, there are also disadvantages of poor mechanical stability, lower water retention characteristics, etc. These drawbacks can be supported by the crosslinking of hydrogels and/or the addition of reinforcing inorganic fillers [1,2]. In recent years, hydrogel nanocomposites obtained with nanoclay particles have been extensively studied for various applications in order to improve the properties of the hydrogel, such as mechanical strength and swelling properties.

Considering these aspects, the present study reffers to the synthesis and characterization of a novel series of microbial polyssacharide crosslinked hydrogel nanocomposite resulted through the variation of the concentration of natural clay. Enhanced structural reinforcement when using natural clay was expected. FTIR and SEM analyses were performed to determine the structure of the crosslinked hydrogels while TGA was used to analyze their thermal behavior. Influence of clay concentration on the water absorption, porosity and mechanical attributes of polyssacharide based hydrogel, was also followed.

Due to their high absorption and high holding capacity, the prospects for these new superabsorbent hydrogels may be related to controlled drug delivery applications.

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References

1. Ianchis R, Ninciuleanu CM, Gifu IC, Alexandrescu E, Nistor CL, Nitu S, Petcu C. Hydrogel-clay Nanocomposites as Carriers for Controlled Release. Curr Med Chem. 2020; 27(6):919-954.

2. Ianchis R, Ninciuleanu CM, Gifu IC, Alexandrescu E, Somoghi R, Gabor AR, Preda S, Nistor CL, Nitu S, Petcu C, Icriverzi M, Florian PE, Roseanu AM. Novel Hydrogel-Advanced Modified Clay Nanocomposites as Possible Vehicles for Drug Delivery and Controlled Release. Nanomaterials (Basel). 2017 Dec 13;7(12):443.

Novel Nanocomposites Based on Mesoporous Titania/Acrylonitrile Obtained by Host-Guest Method

Andreea Miron [1,2], Tanta-Verona Iordache[1], Sorin-Viorel Dolana[1], Marinela Dumitru[1], Ana-Mihaela Gavrila[1], Anamaria Zaharia[1], Horia Iovu[2], Anita-Laura (Radu) Chiriac[1, *]

[1] National Institute for Research & Development for Chemistry and Petrochemistry- ICECHIM Bucharest, Spl. Independentei 202, sector 6, ROMANIA
[2] University Politehnica of Bucharest, 011061 Bucharest, Romania
*Correspondence: anita-laura.radu@icechim.ro

ABSTRACT

The authors did not agree with the publishing of the abstract.

Influence of $CaCO_3$ Addition on Alkali Activated Glass Materials

Adrian Ionuț NICOARĂ[1,2,*], Adelina Carmen IANCULESCU[1,2]

[1]University Politehnica of Bucharest, 011061 Bucharest, Romania
[2]National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
*Correspondence: adrian.nicoara@upb.com

ABSTRACT

The paper presents the synthesis and characterization of alkali-activated materials (AAMs) with good stability in a wet environment, by alkaline activation with NaOH and $Ca(OH)_2$, of glass waste powder (WGP) with CaCO3 additions; the partial substitution of WGP with limestone filler increases the number of calcium ions available for the formation of calcium silicates hydrates and in the same time will contribute to the intumescent behavior of AAM.

WPG is partially substituted with limestone filler ($CaCO_3$) in various dosages (up to 30%), thus obtaining a new series of AAMs with a higher degree of stability in a wet environment and improved mechanical properties. CaCO3 can be also used as aggregate in order to obtain AAM mortars.

Intumescent fire bricks are used to seal cable trays, pipes and other types of penetration in partition walls or floors, to prevent the fire from spreading from one room to another.

The use of this type of aggregate will contribute to the increase of the intumescent phenomenon. High temperatures achieved during the contact of bricks with fire will decompose the calcium carbonate and the resulting gas will contribute to the increase of materials porosity. The intumescent behavior of studied AAM bricks is assessed by the monitoring of weight and volume changes during thermal treatment at different temperatures. The total and open porosities of AAM bricks are assessed before and after thermal treatment. SEM analyses will provide information about the average pore size and distribution. The compressive strength of bricks, before and after thermal treatment is assessed using a Matest machine according to the Romanian norms SR EN 196–1, Part 1.

References

1. Nicoara Adrian Ionut, “Materiale liante activate alcalin cu proprietati intumescente/Alkali-activated binder materials with intumescent properties”, University POLITEHNICA of Bucharest, 2019, doctoral thesis
2. L.E. Menchaca-Ballinas, J.I. Escalante-Garcia, Low CO2 emission cements of waste glass activated by CaO and NaOH, Journal of Cleaner Production 239 (2019) 117992
3. Nicoara, A.I.; Badanoiu, A.I. Influence of Alkali Activator Type on the Hydrolytic Stability and Intumescence of Inorganic Polymers Based onWaste Glass. Materials 2022, 15, 147. https://doi.org/10.3390/ma15010147

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Molecularly Imprinted Supermacroporous Cryogels for Penicillin G Adsorption

Marinela Victoria Dumitru[1,2], Tanta-Verona Iordache[1], Miron Andreea[1], Teodor Sandu[1], Sorin Viorel Dolana[1], Horia Iovu[1], Andrei Sarbu[1], Anita-Laura (Radu) Chiriac[1*]

[1]National Research-Development Institute for Chemistry and Petrochemistry - ICECHIM, Splaiul Independentei 202, district 6, 060021, Bucharest, Romania
[2]University Politehnica of Bucharest, 011061 Bucharest, Romania
*Correspondence: anita-laura.radu@icechim.ro

ABSTRACT

The authors did not agree with the publishing of the abstract.

MAPLE-Coatings from Bioglasses and Antibiotics for Improved Implant Surfaces

Irina Negut[1], Carmen Ristoscu[1], Tatiana Tozar[1,2], Valentina Grumezescu[1], Mihaela Dinu[3], Anca Constantina Parau[3], Marcela Popa[4], Miruna S. Stan[5]

[1]National Institute for Lasers, Plasma and Radiation Physics, 409 Atomistilor street, Măgurele, Ilfov, 077125, Romania, negut.irina@inflpr.ro, carmen.ristoscu@inflpr.ro, tatiana.alexandru@inflpr.ro, valentina.grumezescu@inflpr.ro

[2]Extreme Light Infrastructure-Nuclear Physics, Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering, Magurele, Ilfov, Romania

[3]National Institute of Research and Development for Optoelectronics-INOE2000, 409 Atomistilor St., 077125 Magurele, Romania, mihaela.dinu@inoe.ro ; anca.parau@inoe.ro

[4]Faculty of Biology, Microbiology Immunology Department, University of Bucharest, 077206 Bucharest, Romania, marcela.popa@bio.unibuc.ro

[5]Faculty of Biology, Department of Biochemistry and Molecular Biology, University of Bucharest, 91-95 Splaiul Independentei, 050095 Bucharest, Romania, miruna.stan@bio.unibuc.ro

*Correspondence: negut.irina@inflpr.ro

ABSTRACT

We deposited thin films of bioglass/ciprofloxacin/poly(methyl methacrylate) by the matrix-assisted pulsed laser evaporation (MAPLE) technique. First, a thin layer of the polymeric material was deposited by MAPLE onto Ti substrates. A second layer consisting of bioglass+antibiotic was applied by MAPLE onto the initial coating.

The surface morphology of obtained samples was examined by SEM and the surface topography was evaluated by AFM. The wettability of bioglass/ciprofloxacin/poly(methyl methacrylate) thin films was analysed by the sessile drop method. The stoichiometry and chemical functions integrity of thin films were studied by means of FT-IR. To simulate the phenomena taking place at the tissue-implant interface as a result of interaction with physiological fluids, the coated Ti substrates were immersed in SBF and investigated by FT-IR, after different dipping times. The UV-Vis was used to analyse the SBF solutions containing the released ciprofloxacin from thin films.

The antimicrobial action of bioglass/ciprofloxacin/poly(methyl methacrylate) thin films was assessed on *E. faecalis*, and *P. aeruginosa* strains while the biocompatibility was tested on mouse osteoblast-like cells.

The results of our study showed that the MAPLE-deposited thin films were biocompatible and resilient to microbial colonization and can be used to improve Ti implant surfaces.

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Phosphatic Nanomaterials with High Performances for Organic Pollutants Adsorption

Roxana Ioana Brazdis[1,2], Sorin-Marius Avramescu[3], Irina Fierascu[1,4], Anda Maria Baroi[1,4], Toma Fistos[1,2], Radu Claudiu Fierascu[1,2]

[1] National Institute for Research & Development in Chemistry and Petrochemistry – ICECHIM, 202 Spl. Independentei, 060021, Bucharest, Romania
[2] University "Politehnica" of Bucharest, Bucharest, 1-7 Gh. Polizu Str., 011061, Romania
[3] University of Bucharest, Research Center for Environmental Protection and Waste Management, 36-46 Mihail Kogalniceanu Blvd., 050107 Bucharest, Romania
[4] University of Agronomic Sciences and Veterinary Medicine of Bucharest, Bucharest, 59 Marasti Blvd., 011464, Romania
*Correspondence: roxana.brazdis@icechim.ro

ABSTRACT

In recent years, due to their cost-efectiveness, environmental friendliness and high capacity of adsorption, phosphatic nanomaterials presented a particular interest in the field of organic pollutants removal from wastewater. The content of ibuprofen residues in wastewaters poses high risks, such as chronic or even acute effects to some organisms [1]. Phenol represent another organic pollutant which is found in wastewaters as a result of improper discharges from chemical industries, inducing carcinogenicity and mutagenicity, even at low concentrations [2-3].

The aim of this paper is to evaluate the adsorption capacity towards ibuprofen and phenol from aqueous solutions, using the previously synthesized materials, BaHAP and MnHAP, at different concentrations, in order to demonstrate their efficiency. The potential adsorbents were previously characterized through modern analytical methods, such as X-Ray fluorescence (XRF), Fourier-transform infrared spectroscopy (FTIR), X-Ray diffraction (XRD), thermal analysis (TGA) and transmission electron microscopy (TEM), concluding that the adsorbents have the desired properties.

To the experimental data obtained, several adsorption isotherms models were applied, such as Langmuir, Freundlich, Sips, and Temkin, in order to assess the adsorption capacity of the phosphatic materials and some information regarding adsorbate - adsorbent interactions.

Considering all the obtained analytical data, the synthesized phosphatic materials can successfully be used for the removal of different types of contaminants from wastewaters, especially for organic pollutants, and, also, the technology can be scaled-up for industrial applications, due to adsorbents easy removal.

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References

1. AL Falahi, O.A., Abdullah, S.R.S., et al. Simultaneous removal of ibuprofen, organic material, and nutrients from domestic wastewater through a pilot-scale vertical sub-surface flow constructed wetland with aeration system. J Water Process Eng, **2021**, *43*, 102214.

2. Zhao, C., Zhong, S., Li, C., Zhou, H., Zhang, S. Property and mechanism of phenol degradation by biochar activated persulfate. J Mater Res Technol, **2020**, *9(1)*, 601-609.
3. Fierascu, I., Avramescu, S.M., Petreanu, I.A., Marinoiu, A.,Soare, A., Nica, A., Fierascu, R.C. Efficient removal of phenol from aqueous solutions using hydroxyapatite and substituted hydroxyapatites. React Kinet Mech Catal, **2017**, *122(1)*, 155–175.

Potential Antimicrobial Apatitic Materials Improved with Different Metals for Heritage Science

Toma Fistos[1,2*], Roxana Ioana Brazdis[1,2], Anda Maria Baroi[1,3], Irina Fierascu[1,3], Lia-Mara Ditu[4], Valentin Raditoiu[1], Radu Claudiu Fierascu[1,2]

[1]National Institute for Research and Development in Chemistry and Petrochemistry – ICECHIM, 202 Splaiul Independentei, 060021, Bucharest, Romania
[2]University Politehnica of Bucharest, 313 Splaiul Independentei, 011061, Bucharest, Romania
[3]University of Agronomic Sciences and Veterinary Medicine of Bucharest; 59 Mărăști Blvd., 011464, Bucharest, Romania
[4]University of Bucharest, Microbiology Department, 1-3 Aleea Portocalelor, 060101, Bucharest, Romania*
Correspondence: tomafistos@yahoo.com

ABSTRACT

In the last decades there has been an evolution on all societal levels, this representing at the same time both a disadvantage and an advantage. A major disadvantage of this accelerated evolution is the environmental conditions on this earth that have become more extreme, more unfavorable, and more frequent (tsunamis, storms, global warming, tornadoes, blizzards) leading to a faster degradation of the cultural heritage.

The main advantage is the scientific development that has led to the emergence of numerous fields of research and development of new materials and technologies with a role in the conservation and preservation of cultural heritage. Numerous phosphate compounds have shown consolidating properties, useful for heritage conservation, but an excellent compound in this class is hydroxyapatite. Numerous studies on this compound have shown that the properties of the material are improved when it is substituted with heavy metals, which is the main advantage of hydroxyapatite, to accept a large number of cationic and anionic substituents. Moreover, with the development of nanoscience, it has been observed that the properties of the material are improved when its granules are brought to nano size.

In this study we synthesized apatitic materials substituted with various heavy metals by coprecipitation and sonochemical methods. In order to confirm the obtaining of the desired materials, they were characterized by different analytical methods and in order to verify if they have antimicrobial properties, different qualitative and quantitative tests were performed. To test the effectiveness of the synthesized compounds, they were applied to different types of wood to test the potential change in color and gloss that the support material might suffer.

References

1. McIntyre-Tamwoy S. The impact of global climate change and cultural heritage Grasping theissues and defining the problem. Hist. Environ. 2008;21(1):2–9.
2. Fihri A., Len C., Varma R.S., Solhy A. Hydroxyapatite: A review of synthesis, structure and applications in heterogeneous catalysis. Coord. Chem. Rev. 2017;34:748-76.
3. Fierascu I., Fierascu R.C., Popa O., Babeanu N. Synthesized materials for decontamination of heavy metals polluted aqueous solutions. Rom. Biotechnol. Lett. 2014;19:9196-202

Innovative Drug-Delivery Scaffolds Used for Post Operatory Infections Treatment

Adrian Moraru, Ana-Maria Pușcașu, Cristina Chircov, Alexandra Cătălina Bîrcă, Adrian Surdu, Vladimir Lucian Ene, Ionela Neacșu

Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Chemical Engineering and Biotechnologies, University Politehnica of Bucharest, 011061, Bucharest, Romania
Correspondence: moraruadrian0203@gmail.com

ABSTRACT

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Prevention and Treatment of Nosocomial Infections: Review

Marian Rașcov[1,*], Ecaterina Andronescu[1,2,3], Anton Ficai[1,2,3], Ovidiu Cristian Oprea[1]

[1]Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, Gh. Polizu 1-7, 011061, Bucharest, Romania

[2]National Centre for Micro and Nanomaterials, University Politehnica of Bucharest, 060042, Bucharest, Romania

[3]Academy of Romanian Scientists, Ilfov Street 3, 050044 Bucharest, Romania

*Correspondence: marian.rascov@yahoo.com

ABSTRACT

After decades of treatments with antibiotics, infections with pathogens of hospitalized patients represents again a challenge [1]. The recurrence of the infection after treatment, non-compliance with in-hospital disinfection procedures, improper management of the hospital waste, the unjustified use of antibiotics, the administration of ineffective antibiotics, slow process of obtaining new drugs and the long periods of hospitalization have amplified and accelerated the appearance of resistant bacterial strains [1].

Known as nosocomial infections, the hospital-acquired infections (HAIs), are part of the category of common problems in hospitals today. This type of infections are associated with pain, suffering, high morbidity and mortality, long periods of hospitalization and high costs for healthcare services [2].

Staphylococcus aureus, *Escherichia coli*, *Enterococcus faecium*, *Klebsiella pneumoniae*, *Coronaviruses* or *Candida* are the most responsible pathogens for occurrence and development of nosocomial infections as: hospital-acquired pneumonia (HAP), ventilator-associated infection (VAP), surgical site infection (SSI), catheter-associated urinary tract infection (CAUTI) and central line-associated bloodstream infections (CLABSI) [3-4].

Hand hygiene, frequent cleaning of textile materials from hospitals, surface disinfection using UV-C lamps, using of chemical disinfectants in surface decontamination, sterility of medical devices or implants, ensuring a high-performance ventilation system, continuous education of medical staff are usual measures meant to control the spread of HAIs. In order to reduce new cases of infection and limit the number of people hospitalized due to the HAIs, obtaining of new chemical species and new preventive measures have to be adopted [5-7].

The purpose of this review is to present synthesis methods, applications, physical-chemical characteristics and latest scientific advances regarding the magnetite, bio-glass, cerium oxide, silver and essential oil. The versatility, biocompatibility and biodegradability recommend the using of these chemical species as vectors in many biomedical applications, including HAIs limitation. New drug formulations based on the mentioned nanomaterials can be developed to improve the activity of the drugs. Physical, chemical, biological and non-conventional methods are widely used in nanoparticles synthesis with controlled morphologies, sizes, and size distribution [8].

The nosocomial infections could represent the biggest challenge of the 21st century if limitation of antimicrobial resistance is not achieved quickly [1].

References

1. Ventola, C.L. The antibiotic resistance crisis: part 1: causes and threats. *P & T: a peer-reviewed journal for formulary management*, 2015, 40(4), 277–283.
2. Mediclim. Rezistența la antibiotice – Provocarea Secolului XXI. 2022 [Online] Available from: https://www.mediclim.ro/articole/rezistenta-la-antibiotice-provocarea-secolului-xxi/5 [Accessed 29th May 2022]

3. Nuckchady, D.C. Incidence, Risk Factors, and Mortality From Hospital-Acquired Infections at a Hospital in Mauritius. *Cureus*, 2021, 13(11), e19962. https://doi.org/10.7759/cureus.19962
4. Stewart, S.; Robertson, C.; Pan, J.; Kennedy, S.; Dancer, S.; Haahr, L.; Manoukian, S.; Mason, H.; Kavanagh, K.; Cook, B.; Reilly, J. Epidemiology of healthcare-associated infection reported from a hospital-wide incidence study: considerations for infection prevention and control planning. *Journal of Hospital Infection*, 2021, 114, 10-22. https://doi.org/10.1016/j.jhin.2021.03.031
5. Sikora, A.; Zahra, F. Nosocomial Infections. *In: StatPearls. StatPearls Publishing, Treasure Island (FL)*. 2021, PMID: 32644738.
6. Medichub. Nosocomial infections. 2022 [Online] Available from: https://www.medichub.ro/reviste/infectio-ro/infectiile-nosocomiale-id-87-cmsid-67 [Accessed 29th May 2022]
7. Khan, H.A.; Baig, F.K.; Mehboob, R. Nosocomial infections: Epidemiology, prevention, control and surveillance. *Asian Pacific Journal of Tropical Biomedicine*, 2017, 7(5), 478-482. https://doi.org/10.1016/j.apjtb.2017.01.019
8. Gostine, A.; Gostine, D.; Donohue, C.; Carlstrom, L. Evaluating the effectiveness of ultraviolet-C lamps for reducing keyboard contamination in the intensive care unit: A longitudinal analysis. *American journal of infection control*, 2016, 44(10), 1089–1094. https://doi.org/10.1016/j.ajic.2016.06.012
9. Niculescu, A.G.; Chircov, C.; Grumezescu, A.M. Magnetite nanoparticles: Synthesis methods - A comparative review. *Methods*, 2022, 199, 16–27. https://doi.org/10.1016/j.ymeth.2021.04.018

Development of New Zinc Oxide Antiseptics for the Clinical Treatment of Wounds

Irina Elena Doicin[1], Ionela Andreea Neacsu[1,2,3*], Vladimir Lucian Ene[1,3], Bogdan Stefan Vasile[1,3], Ecaterina Andronescu[1,2,3]

[1]University Politehnica of Bucharest, 011061 Bucharest, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania
[3]National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
*Correspondence: neacsu.a.ionela@gmail.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Thiol-Disulfide Groups in Patients with Pulmonary Tuberculosis

Evelina Lesnic, Valeriana Pantea

Nicolae Testemitanu State University of Medicine and Pharmacy, Chisinau, Republic of Moldova
*Correspondence: evelina.lesnic@usmf.md

ABSTRACT

The evaluation of the thiol-disulfide homeostasis is important to assess the level of the oxidative stress (OS) in patients with pulmonary tuberculosis (PTB) for early detection of metabolic disturbances. Aim: to evaluate the content of thiol-disulfide groups in the serum of the patients with different types of PTB.

Methods and materials: a prospective cross-sectional research, which quantified the serum concentration of thiol-disulfide groups (-SH groups) in 137 patients with PTB was conducted. The patients were distributed in the 1st study group (SG) - 54 new cases with drug-susceptible TB, the 2nd SG -56 new cases of multidrug-resistant TB (MDR-TB) and 3rd SG-27 previously treated with acquired MDR-TB. The groups were compared between them and were compared with a control group (CG) composed of 36 conventional healthy persons. Samples of venous blood were collected, centrifuged for 10 minutes at speed 3500 rpm, with further separation of the serum. The serum content of –SH groups were quantified using the method of G.L. Ellman and Hu M.L modified [1, 2].

Obtained results established a significant decrease of the –SH groups content in serum of patients from all study groups by 20%, 25% and 25% in the 1st , 2nd and 3rd groups respectively compared with CG, without statistical differences between the study groups. The most pronounced decrease was registered in the 3rd SG.

In conclusions, the reduced content of the–SH groups reflects the depletion of thiol-disulfide system and can be used to assess the metabolic disturbances in patients with PTB.

Keywords: tuberculosis, drug-resistance, thiol-disulfide system.

References

1. Ellman G.I. Arch. Biochem. Biophys., 1959, vol. 82, p. 70-77.
2. Gudumac V., Rivneac V., Tagadiuc O. Metode de cercetare a metabolismului hepatic, 2012, Tipografia Tehnica-Info, 162 p.

Barrier Performance of Spray Coated Nanocellulose Film

Kirubanandan Shanmugam[1,2]

[1]Recent PhD Graduate, Department of Chemical Engineering, Monash University, Melbourne, Vic 3800, Australia.
[2]Department of Biotechnology, Sree Sastha Institute of Engineering and Technology (Affiliated to Anna University, India), Sree Sastha Nagar, Chembarabakkam, Chennai – 600123, India.
*Correspondence: kirubanandan.shanmugam@gmail.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Magnetic Core-Shell Nanoparticles Obtained Through Different Synthesis Methods

Dan Adrian Vasile[1-4], Bogdan Stefan Vasile[1-3,5], Anton Ficai[1-3,5]

[1]Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University POLITEHNICA of Bucharest, Gh. Polizu 1-7, Bucharest, Romania
[2]National Research Center for Food Safety, University POLITEHNICA of Bucharest, Splaiul Independentei 313, 060042 Bucharest, Romania
[3]National Center for Micro and Nanomaterials, University POLITEHNICA of Bucharest, Splaiul Independentei 313, 060042 Bucharest, Romania
[4]National Institute for Research and Development in Chemistry and Petrochemistry – ICECHIM, 202 Spl. Independenței, 060021, Bucharest, Romania
[5]Academy of Romanian Scientists, Ilfov Street 3, Bucharest Romania
* *adrian.vasile@icechim.ro*

ABSTRACT

Nanotechnology era brings with her appearance novel materials with new or improved properties, which can be applied in many domains. One type of these materials is represented by the core-shell nanoparticles especially thus with a magnetic core because they can be manipulated, reused and recovered with the help of magnetic field [1,2]. The Fe_3O_4 core was synthesized via a co-precipitation method using a mixture containing $FeCl_3$ and $FeCl_2$, which is added dropwise in a NaOH 10% solution under a certain magnetic field. To obtain Fe_3O_4@SiO_2 structure 2 routes of synthesis were chosen. First, after the obtained magnetite in a wet state, an alcoholic solution of TEOS and 2 mL of NH_4OH was added, ultrasonated for 30 min to facilitate dispersion and then put at mechanical mixing for 20 h. The volume of TEOS was calculated to respect the molar ratio [Fe_3O_4]:[SiO_2] =1:5. The second route involves lyophilization of magnetite, grinding it and following the same procedure. After stirring, the magnetic part was kept through decantation with the help of magnet, following 3 washing steps with water to remove un-reacted TEOS and silica and finally, 3 washing steps with a HCl 5% solution to remove pure (uncoated) Fe_3O_4 nanoparticles. The conformation was especially investigated with TEM analysis. It has been found that the working conditions has a significant impact on the properties of the compound and therefore on the applications of it.

Keywords: Fe_3O_4@SiO_2 core-shell, Stöber process, design and fabrication;

References:

1. K. Al-Saad et al., Smart Synthesis of Trimethyl Ethoxysilane (TMS) Functionalized Core–Shell Magnetic Nanosorbents Fe_3O_4@SiO_2: Process Optimization and Application for Extraction of Pesticides, Molecules **2020**, *25*, 4827.
2. Z.Mokadem et al., Triazole containing magnetic core-silica shell nanoparticles for Pb^{2+}, Cu^{2+} and Zn^{2+} removal, Arabian -Journal of Chemistry **2017**, Vol. 10, 8:1039-1051

Section VI. Controlled Release of Active Substances for Biomedical Applications

Controlled Release of Drugs from Three-Dimensional Scaffolds Containing Drug-Loaded Photocatalytic Bismuth Ferrite Nanoparticles

Sule Ilgar[1,3], Songul Ulag[1,2], Oguzhan Gunduz[1,2,*], Cem Bulent Ustundag[3], Musa Turker[3]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[2]Department of Metallurgy and Materials Engineering, Faculty of Technology, Marmara University, Turkey
[3]Department of Bioengineering, Faculty of Chemistry and Metallurgy, Yildiz Technical University, Turkey
*Correspondence: Oguzhan Gunduz, ucemogu@ucl.ac.uk

ABSTRACT

The authors did not agree with the publishing of the abstract.

The Effect of Crosslinking Time on the Release of Gentamicin from Nanofibers

Esra Pilavci[1,2], Sumeyye Cesur[1], Elif Ilhan[1,3], Mustafa Sengor[1,2], Ewa Kijeńska-Gawrońska[4,5] , Oguzhan Gunduz[1,2,*]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[2]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
[3]Department of Bioengineering, Faculty of Engineering, Marmara University, Turkey
[4]Centre for Advanced Materials and Technologies CEZAMAT, Warsaw University of Technology, Poland
[5]Faculty of Materials Science and Engineering, Warsaw University of Technology
*Correspondence: ucemogu@ucl.ac.uk

ABSTRACT

Crosslinking is a chemical reaction that links polymer chains together. It is made to improve the physical and mechanical properties of polymers.[1] Among all crosslinking agents, Glutaraldehyde (GA) shows lower cytotoxicity. GA is more effective than other aldehydes in forming chemically stable crosslinks. To obtain a controlled drug relase, burst release of drug from polymer can be prevented by using crosslinking. Also, the used polymer in the release of drugs is important. Biopolymeric materials have the feature of being the best choice for drug release carriers.[2] In this study, gentamicin (GEN)-loaded polyvinyl alcohol (PVA), gelatin (GEL) nanofibers were produced by electrospinning method. These nanofibers were crosslinked chemically with glutaraldehyde (GA) at different time intervals (2, 4 and 6 hours). The crosslinking effect was observed via charactherizing the nanofibers. The electrospun nanofibers were characterized by scanning electron microscopy (SEM) for morphological analysis. Fourier-transform infrared spectroscopy (FT-IR) was performed to detect the molecular interactions between the components. Thermal properties were investigated using differential scanning calorimeter (DSC). Tensile strength of the nanofibers was analysed by tensile tesing machine. Drug release test was performed by UV spectroscopy. The morphological test results showed that electrospun nanofibers had smooth and beadless morphology and nanofiber diameters increased as the crosslinking time increased. FT-IR test results proved the interaction between PVA, GEL and GEN components. The thermal characterization results reported that crosslinking effected the thermal points. The tensile testing results proved that crosslinking enhanced the mechanical strength of the nanofibers. In the drug release study, GEN was released faster from non-crosslinked nanofibers. There was no significant difference between crosslinked groups.

Keywords: Crosslinking; electrospinning; nanofiber; gentamicin; drug release

References

1. Ehrmann, A. (2021). Non-Toxic Crosslinking of Electrospun Gelatin Nanofibers for Tissue Engineering and Biomedicine—A Review. Polymers, 13(12), 1973. doi:10.3390/polym13121973
2. J. Li, Y. Wang, L. Zhang, Z. Xu, H. Dai, W. Wu, Nanocellulose/Gelatin Composite Cryogels for Controlled Drug Release, ACS Sustain. Chem. Eng. (2019). https://doi.org/10.1021/acssuschemeng.9b00161.

Release Profile of Some Cyclodextrin-Ibuprofen Derivatives Complexes - *In Vivo* Study

Ioana-Mirela Vasincu[1], Maria Apotrosoaei[1], Florentina Lupașcu[1], Andreea Iacob[1], Maria Drăgan[1], Alexandru Sava[1], Gabriela Dumitrița Stanciu[2], Anca-Roxana Petrovici[3], Narcisa Marangoci[3], Mariana Pinteală[3], Lenuța Profire[1]

[1]"Grigore T. Popa" University of Medicine and Pharmacy, 700115 Iasi, Romania
[2]Center for Advanced Research and Development in Experimental Medicine (CEMEX), „Grigore T. Popa" University of Medicine and Pharmacy, 700115 Iasi, Romania
[3]"Petru Poni" Institute of Macromolecular Chemistry, 700487 Iasi, Romania
*Correspondence: ioana-mirela.vasincu@umfiasi.ro

ABSTRACT

Cyclic oligosaccharides (cyclodextrins) are one of the most used host macrocycles and in the last years there has been a growing interest using them in pharmaceutical field, cosmetics, food or environmental engineering due to bioadaptability and multi-functional features. The most important properties are the formation of inclusion complex that change water solubility or bioavailability, preventing undesired interactions between drugs or improving the toxicological profile. β-cyclodextrin has hydrophilic external part enriched with OH groups and relatively hydrophobic internal cavity. This cavity allows the entrapment of mainly hydrophobic compounds that makes it excellent carrier for many drugs.

Inclusion complexes with non-steroidal anti-inflammatory drugs (NSAIDs) have been reported in literature. Most of these molecules contain both hydrophilic and hydrophobic groups (amphiphilic) and are slightly soluble in water. A well known and prescribed NSAID is ibuprofen which it is recommended for the management of moderate to severe pain, fever, and inflammation in conditions like rheumatic arthritis, osteoarthritis, muscle pain or common cold. Some derivatives of ibuprofen with thiazolidin-4-one sructure proved to have a potential analgesic and antiinflammatory profile but a low solubility.

Using co-precipitation (in molar ratio 1:1.2) and lyophilization methods four new thiazolidin-4-one derivatives of ibuprofen (4b, 4k, 4g, 4m) were included in β-cyclodextrin. After preliminary characterization of the obtained complexes (4b IC, 4k IC, 4g IC, 4m IC) the concentrations from blood plasma of rats were determined by high HPLC–ESI–MS at different time intervals (1 h, 2 h, 3 h, 4 h, 6 h).

In blood plasma 4b and 4k percentages relative to the administrated concentrations were around 100%, proving that almost the entire amount passes into the bloodstream and remains in circulation in active form. The IC of the same compounds are found in a lower concentrations in the blood. The concentration of the 4g compound is found to be around 60% and 4m compound around 15% from the administered amount. demonstrating their very low availability in in vivo conditions.

In conclusion there were synthesised and characterised four new complexes of ibuprofen thiazolidin-4-ones with β-cyclodextrin. The concentration of the compounds was higher than the ICs of the same compound, demonstrating its increased availability when it is not included in cyclodextrin.

References

1. Pereva S, Nikolova V, Sarafska T et al. Inclusion complexes of ibuprofen and β-cyclodextrin: Supramolecular structure and stability. J Mol Struct 2020; 1205: 127575.
2. Deosarkar SD, Sawale RT, Arsule AD et al. Volumetric and ultraacoustic properties of sodium salts of ibuprofen/diclofenac drugs in aqueous and aqueous-β-cyclodextrin solution. J Mol Liq 2020; 297: 111812.

3. Vasincu IM, Apotrosoaei M, Constantin S et al. New ibuprofen derivatives with thiazolidine-4-one scaffold with improved pharmaco-toxicological profile. BMC Pharmacology & Toxicology 2021; 22(1): article number 10.

New Nitric Oxide-Releasing Indomethacin Derivatives: Synthesis and Biological Evaluation

Alexandru Sava[1], Andreea Iacob[2], Ioana Vasincu[2], Florentina Lupascu[2], Maria Apotrosoaei[2], Alin Focsa[3], Maria Dragan[3], Alina Panainte[1], Nela Bibire[1], Frederic Buron[4], Sylvain Routier[4], Lenuţa Profire[2]

[1] Department of Analytical Chemistry
[2] Department of Pharmaceutical Chemistry
[3] Department of Drug , Industry and Pharmaceutical Biotechnology, Faculty of Pharmacy, "Grigore T. Popa" University of Medicine and Pharmacy of Iași, 16 University Street, Iasi, Romania
[4] Institut de Chimie Organique et Analytique ICOA, CNRS UMR 7311, Universit´e d'Orl´eans, Orl´eans, France
*Correspondence: alexandru.i.sava@umfiasi.ro

ABSTRACT

Non-steroidal anti-inflammatory drugs (NSAIDs) are principal drugs which are used to treat different conditions where inflammation is involved [1-3]. They inhibit cyclo-oxygenase (COX) in a wide variety of systems. Therefore, COX inhibition has become definitively the main mechanism that is responsible for both the therapeutic and side effects of these drugs [4]. Briefly, despite the clinical benefits of NSAIDs through nonselective COX inhibition or to the relative COX-1 and COX-2 inhibition, long term use of them increase the incidence of side effects (gastrointestinal, renal, allergic skin reactions, increased risk of acute coronary syndromes, bleeding) [4,5]. To improve clinical efficacy of NSAIDs, two platform strategies are currently emerging. The first one is drug combination in order to reduce the side effects of NSAIDs. The second strategy assumes that a single compound can hit multiple targets (single drug-multiple targets).

Nitric oxide releasing non-steroidal anti-inflammatory drugs (NO-NSAIDs) are a new class of anti-inflammatory drugs consisting of a traditional NSAID to which a NO releasing moiety has been covalently attached by a spacer [6,7]. NO is an endogenous short-lived free radical, produced in mammalians cells through nitric oxide synthase mediated conversion of L-arginine to L-citruline [8]. It is known that NO has a key role in a wide variety of physiological and pathophysiological processes, such as inflammation, vasodilatation, platelet adhesion, thrombosis neurotransmission, neuronal communication and wound healing [9,10].

In this study we present design and synthesis of new nitric oxide-releasing indomethacin derivatives with 1,3-thiazolidine-4-one scaffold (NO-IND-TZDs), as a new safer and efficient multi-targets strategy for inflammatory diseases. The chemical structure of synthesized derivatives was proved by NMR and mass spectroscopic analysis. The synthesized compounds were evaluated in terms of anti-inflammatory and antioxidant effects, using in vitro assays, as well as the nitric oxide (NO) release. The tested compounds showed improved radical scavenging effects, the highest radical scavenging effect being noted for 6n, which contains a 2-(4-nitro-phenoxy)ethyl nitrate moiety. In addition, for this compound it was also noted the highest NO release capacity, which means it could have reduced side effects *to GI level* such as *irritation, bleeding or ulceration. Moreover, t*he best predicted anti-inflammatory effect, measured as BSA denaturation, was showed by 6i which contains a (2,6-dichloro-phenoxy)ethylnitrate moiety, which supports the good influence of chloro substituent for anti-inflammatory effects.

The results of our study strongly support the potential effect of NO-IND-TZDs as multi-target strategy, targeting the inflammation, oxidative stress and NO release.

References

1. Ahmed AU. An overview of inflammation: mechanism and consequences. Front. Biol. 2011, Vol. 6, 274.
2. Honnappa G, Kesavan MA concise review on advances in development of small molecule anti-inflammatory therapeutics emphasising AMPK: An emerging target. Int J Immunopathol Pharmacol . 2016, Vol. 29, 4, pg. 562-571.
3. Wang K, Xiao J, Liu X et all. AICD: an integrated anti-inflammatory compounds database for drug discovery. Sci Rep. 2019, Vol. 9, 7737.
4. Kaur G, Silakari O. Multiple target-centric strategy to tame inflammation. Future Med Chem. 2017, Vol. 9, 12, pg. 1361-1376.
5. Moore N, Duong M, Gulmez SE, Blin P, Droz C. Pharmacoepidemiology of non-steroidal anti-inflammatory drugs. Therapie. 2019, Vol. 74, 2, pg. 271-277.
6. Tatakihara, V.L.H.; Malvezi, A.D.; Panis, C.; Cecchini, R.; Zanluqui, N.G.; Yamauchi, L.M.; Martins, M.I.L.; Da Silva, R.V.; Yamada-Ogatta, S.F.; Rizzo, L.V.; Martins-Pinge, M.C.; Pinge-Filho, P. Nitric oxide-releasing indomethacin enhances susceptibility to Trypanosoma cruzi infection acting in the cell invasion and oxidative stress associated with anemia. Chem. Biol. Interact., 2015, 227, 104–111.
7. Hughes, M.N. Chemistry of Nitric Oxide and Related Species in: Methods Enzymol., 2008: pp. 3–19.
8. Kumar, S.; Singh, R.K.; Bhardwaj, T.R. Therapeutic role of nitric oxide as emerging molecule. Biomed. Pharmacother., 2017, 85, 182–201.
9. Lanas, A. Role of nitric oxide in the gastrointestinal tract. Arthritis Res. Ther., 2008, 10, S4.
10. Santana, A.P.M.; Tavares, B.M.; Lucetti, L.T.; Gouveia, F.S.; Ribeiro, R.A.; Soares, P.M.G.; Sousa, E.H.S.; Lopes, L.G.F.; Medeiros, J.-V.R.; Souza, M.H.L.P. The nitric oxide donor cis-[Ru(bpy)2(SO3)NO](PF6) increases gastric mucosa protection in mice – Involvement of the soluble guanylate cyclase/KATP pathway. Nitric Oxide, 2015, 45, 35–42.

Nanostructured Drug Delivery Systems in Oncotherapy

Paul Adrian Tărăbuță[1-4,*], Anton Ficai[1-3,5]

[1]Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Chemical Engineering and Biotechnologies, University POLITEHNICA of Bucharest, Gh. Polizu 1-7, Bucharest, Romania
[2]National Research Center for Food Safety, University POLITEHNICA of Bucharest, Splaiul Independenței 313, 060042 Bucharest, Romania
[3]National Center for Micro and Nanomaterials, University POLITEHNICA of Bucharest, Splaiul Independenței 313, 060042 Bucharest, Romania
[4]Research and Development Centre, "Cantacuzino" National Institute for Medico-Military Research and Development, Splaiul Independenței 103, 050096 Bucharest, Romania
[5]Academy of Romanian Scientists, Ilfov Street 3, Bucharest Romania
*Correspondence: tarabutapaul@gmail.com

ABSTRACT

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Fluconazole and Cinnamaldehyde Loaded-Multilayer Elektrospun Nanofibers for the Treatment of Fungal Keratitis

Elif Ilhan[1,2], Sumeyye Cesur[1], Faik Nuzhet Oktar[1,2] , Oguzhan Gunduz[1,3*]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey

[2]Department of Bioengineering, Faculty of Engineering, Marmara University, Turkey

[3]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey

*Correspondence : eliffguven@gmail.com

ABSTRACT

Inflammation of the cornea due to physical, chemical and infectious causes is known as keratitis[1]. Fungi are one of the most challenging species to diagnose and treat among the organisms that cause keratitis. Moreover, fungal keratitis has been proven to be more virulent and destructive than keratitis caused by bacterias[2].

In this study, two-layer polyvinyl alcohol and gelatin (PVA/GEL) nanofibers loaded with different biological agents, which accelerate wound closure by suppressing the disadvantages of traditional methods in the treatment of fungal keratitis, were produced by the electrospinning method. Cinnamaldehyde (CA), an FDA-approved volatile molecule found in cinnamon essential oil, and fluconazole (FLU), an antifungal drug, were incorporated into PVA/GEL nanofibers to inhibit the growth and biofilm formation of Candida albicans, one of the pathogens that cause fungal keratitis. The morphology, and chemical structures of the produced pure (PVA/GEL), FLU loaded (PVA/GEL/FLU), CA loaded (PVA/GEL/CA), and combined FLU and CA loaded (PVA/GEL/COM) nanofibers were analysed by scanning electron microscopy (SEM), and Fourier-transform infrared spectroscopy (FT-IR), respectively. The mechanical analysis and drug release kinetics of the nanofibers were investigated. PVA/GEL/FLU, PVA/GEL/CA and PVA/GEL/FLU/COM nanofibers were evaluated for their antifungal and antibiofilm activity against Candida albicans. Results showed that PVA/GEL/FLU and PVA/GEL/COM nanofibers have significant antifungal activity and inhibited biofilm formation by 37% and 49%, respectively.

The originality of this study lays in the design of the multilayer electrospun nanofibers, which are loaded with both biofilm inhibitor agent and an antifungal drug. This kind of construct can be utilised in the treatment of fungal keratitis and to produce patches that accelerate wound healing and allow controlled release of the bio-active agents.

Keywords: Fungal Keratitis, Nanofiber, Fluconazole, Cinnamaldehyde, Cornea Tissue Engineering

References

1. Y. Acharya, B. Acharya, P. Karki, Fungal keratitis: study of increasing trend and common determinants, Nepal J. Epidemiol. 7 (2017) 685–693. https://doi.org/10.3126/NJE.V7I2.17975.
2. Z. Ansari, D. Miller, A. Galor, Current Thoughts in Fungal Keratitis: Diagnosis and Treatment, Curr. Fungal Infect. Rep. 7 (2013) 209–218. https://doi.org/10.1007/S12281-013-0150-110.1007/S12281-013-0150-1.

Graphene-Based Drug Loaded Drug Delivery System for Cancer Treatment

Reyhan Yanıkoğlu[1], Fatih Çiftçi[2], Zeynep Karavelioğlu[1], Rabia Çakır Koç[1], Cem Bülent Üstündağ[1*]

[1]Department of Bioengineering, Faculty of Chemical and Metallurgical Engineering, Yildiz Technical University, Turkey

[2]Department of Biomedical Engineering, Faculty of Engineering, Fatih Sultan Mehmet Vakıf University, Turkey

*Correspondence : reyhanyanikoglu@gmail.com

ABSTRACT

Cancer is a disease that grows and spreads with uncontrolled proliferation of cells, and then leaves no room for normal cells, preventing the body from working as it should. Breast cancer is a type of cancer most commonly seen in women today, whose age of onset is decreasing from day to day and constituting 30% of all types of cancer that occur in women. Today, standard treatment methods such as surgical treatment, radiotherapy, chemotherapy and hormonotherapy are applied for breast cancer treatment.

Graphite (pencil, solid lubricants) and diamond are the most well-known allotropes of carbon, but there are also nanotubes and fullerenes among the newly discovered allotropes of carbon. Graphene is one of the honeycomb lattice structures of the carbon atom. The intercarbon bonds in graphene are very strong, and this strength gives graphene one of the strongest materials known in the world. Graphene is commonly produced by layer separation method (exfoliation method), epitaxial growth, silicon-carbon method and chemical separation method. There are several methods for producing graphene oxide like wet chemical method. In this study we used wet chemical method for producing graphene oxide.

In this study, methotrexate loaded graphene oxide carriers were produced and characterized. Graphene oxide were produced modified Hummers method, methotrexate loaded to graphene oxide and folic acid bonded to drug delivery system respectively. The synthesized methotrexate loaded graphene oxide particles were characterized with zeta potential test, dimensional analysis and franz diffusion test and tested for cytotoxicity in the MDA-MB-231 breast cancer cell line. From the results obtained, it was observed that methotrexate was successfully loaded on graphene oxide, and it was observed that the drug release system produced on the MDA-MB-231 breast cancer cell line had a higher killing effect than methotrexate alone.

Keywords: Graphene, Drug, Cancer, Drug Carrier, Methotrexate

Section VII. Advanced Biomedical Applications

Structural Analysis of Dibenzepine and Butyrophenone Derivatives in the Context of Ventral Striatum Abnormalities in Schizophrenia

Łukasz Grabowski[1,2]

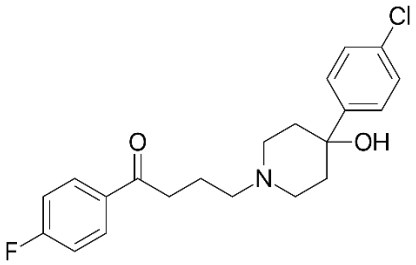
[1]Polish Anatomical Society, Szczecin, Poland
[2]Nicolaus Copernicus University in Toruń, Poland
*Correspondence : 890403@protonmail.ch

ABSTRACT

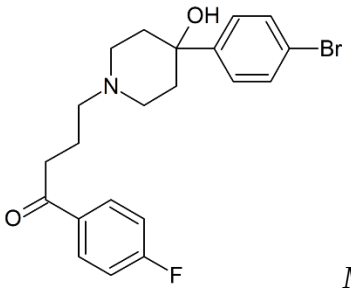
The aim of the lecture was to analyze several widely-used antipsychotic drugs, which are known as dibenzepine or butyrophenone derivatives. In particular attention, clozapine ($C_{18}H_{19}ClN_4$; MW = 326.8 g/mol), clothiapine ($C_{18}H_{18}ClN_3S$; MW = 343.9 g/mol), loxapine ($C_{18}H_{18}ClN_3O$; MW = 327.8 g/mol), haloperidol ($C_{21}H_{23}ClFNO_2$; MW = 375.9 g/mol) and bromoperidol ($C_{21}H_{23}BrFNO_2$; MW = 420.3 g/mol) were discussed. All of these compounds are commonly used in clinical practice and schizophrenia treatment.

Schizophrenia (ICD-10: F20; ICD-11: 6A20) is a severe psychotic disorder with the global course of its symptoms. Two groups of symptoms can be divided: positive (delusions, hallucinations, pseudohallucinations, sensory automatisms) and negative (autism, ambivalence, ambitendency, ambisentence). The most of antipsychotic agents is more effective in the treatment of positive symptoms than negative, but several drugs have some anti-autistic properties, because of their combined pharmacodynamics. Dibenzepine derivatives have an asymmetric structure with seven-membered middle ring; mainly substituents in 2nd position indicates neuroleptic action. Butyrophenone derivatives, such as haloperidol, are characterized by strong antipsychotic effect; the presence of fluor atom in 4th position is associated with optimal neuroleptic activity.

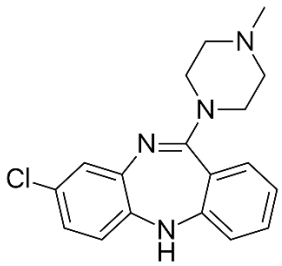
Ventral striatum plays a key role in schizophrenia pathogenesis by its position through the primary dopaminergic pathway – from substantia nigra to striatum. It was indicated, that the abnormalities in D2 and D3 receptors density, among others [1], correlate with the appearance of positive symptoms. Inhibition in dopamine transmission in ventral striatum can contribute to remission state in schizophrenia.



Molecule 1. Haloperidol



Molecule 2. Bromoperidol



Molecule 3. Clozapine

Keywords: schizophrenia, haloperidol, clozapine, clotiapine, loxapine, bromoperidol

References

1. Ł. Grabowski, The application of mass spectrometry in searching for biomarkers in the group of mental and neurodegenerative disorders. In: I. Młynarczuk-Biały, Ł. Biały, Advances in Biomedical Research – Cancer and Miscellaneous (eds.), Wydawnictwo Naukowe Tygiel, Warszawski Uniwersytet Medyczny, Lublin-Warszawa (2021), p. 230-247. https://bc.wydawnictwo-tygiel.pl/publikacja/AA60CB34-1A06-4ECD-748B-83D6A9A5B19C

Advanced Oxidation Protein Products Variation in Experimental Ovarian Torsion

Cornelia Lazăr[1*], Olga Tagadiuc[1], Silvia Stratulat[1]

[1]Department of Biochemistry and Clinical Biochemistry, Nicolae Testemitanu State University of Medicine and Pharmacy, Chisinau, Republic of Moldova
*Correspondence: cornelia.lazar@usmf.md

ABSTRACT

Chlorinated oxidants and the enhancement of the oxidative stress increase the advanced oxidation protein products (AOPPs) *in vivo* [1].

Key words: advanced oxidation protein products, ovarian torsion, reperfusion injury.

Aim of the study: to evaluate the changes of AOPPs levels in ovarian torsion (OT) with different detorsion procedures in order to assess the efficacy of the controlled technique (CT) of the restoration of the blood flow as a way for preventing the augmentation of the oxidative reperfusion injuries.

Materials and methods: The study included females rats (Rattus albicans), 70 subjects, which were randomly allocated by 10 into 7 lots: 1st (control) – no intervention; 2nd (sham) – only laparotomy; 3rd – 3 hours OT; 4th and 5th – 3 hours OT with 1 hour simple or CT reperfusion; 6th and 7th – 3 hours OT with 24 hours simple or CT reperfusion. The CT was used for two minutes at the beginning of the detorsion period by opening and closing the clips on the ovarian annexes every ten seconds. The measurement of the AOPPs levels was performed spectrophotometrically at 340 nm according to Capeillère-Blandin C., et al. method [2], modified by Gudumac V., et al. [3], using the spectrophotometer *PowerWave HT* (BioTek Instruments, USA). *Welch's ANOVA and Games-Howell post hoc tests* were used to analyze the results. The Research Ethics Committee approved the study.

Results: No significant difference was identified between the AOPPs amounts in the 1st and 2nd lot ($p>0,05$). OT augmented insignificantly the AOPPs ($p>0,05$), while reperfusion increased them in all detorsion lots ($p<0,05$) compared to 1st lot. The differences between 3rd and 5th (1 hour CT reperfusion) lots were not statistically significant ($p>0,05$), while simple reperfusion lots (4th and 6th) and 24 hours CT reperfusion lot (7th) AOPPs levels were significantly higher compared to 3rd lot values ($p<0,05$).

Conclusions: AOPPs are useful biomarkers to assess the intensity of oxidative stress in OT. The proposed CT of reperfusion is beneficial in the initial stage after ovarian detorsion.

References:

1. Cao W, Hou FF, Nie J. AOPPs and the progression of kidney disease. *Kidney Int Suppl (2011)*. 2014;4(1):102-106. doi:10.1038/kisup.2014.19
2. Capeillère-Blandin C, Gausson V, Descamps-Latscha B, Witko-Sarsat V. Biochemical and spectrophotometric significance of advanced oxidized protein products. *Biochim Biophys Acta* 2004; 1689(2): 91-102. doi: 10.1016/j.bbadis.2004.02.008
3. Gudumac V, Tagadiuc O, Andronache L, Ștîrba O, Sardari V. Procedeu de dozare a produșilor proteici de oxidare avansată. Certificat de inovator nr. 5164 din 14.12.2012

Bismuth Nitrate Added Polymer-Based Strain Sensors for Biomedical Applications

Merve Sırtıkara[1,2], Mustafa Şengör[1,3]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[2]Department of Metallurgical and Materials Engineering, Institute of Pure and Applied Sciences, Marmara University, Turkey
[3]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
*Correspondence: srtkaramerve@gmail.com

ABSTRACT

Polymer-based strain sensors developed for biomedicine are widely used to detect small physical movements and mechanical deformation [1]. Furthermore, it remains a challenge to produce highly sensitive and responsive sensors that are desirable to wear comfortably to capture physiological signs of the human body [2]. In this study, alternative solutions are offered due to their negative features such as high cost, poor long-term durability, unsuitable for disposable solutions, and poor shape memory. A low-cost polyurethane (PU)-based strain sensor was produced and 4% graphite (G), 8% carbon black (CB), and 10 ml dimethylformamide (DMF) and tetrahydrofuran (THF) were used as solvents to ensure its conductivity. Adding bismuth nitrate brought a new approach to the field of nanocomposites with the production of PU/CB/G sensors. In addition to the superiorities of carbon-based composite materials, it is necessary to consider the percolation threshold and the negative effect of mechanical strength while providing good electrical conductivity performance. With its bismuth nitrate content, it has been ensured to increase both mechanical strength performance and repeatability by preventing the negative effect on mechanical strength. Likewise, the negative feature of the high percolation threshold has been prevented with the use of both carbon black and graphite simultaneously. As a result, promising results and a promising exemplary application for the biomedical field have been shown with the use of compound materials in the production of strain sensors.

Keywords: Polyurethane, Bismuth Nitrate, Carbon-Based Materials, Strain Sensor, Biomedical Application

References

1. F. Martinez, G. Obieta, I. Uribe, T. Sikora, E. Ochoteco, Polymer-based self-standing flexible strain sensor, Hindawi, Journal of Sensors. 2010 (2010) 1-5. https://doi.org/10.1155/2010/659571.
2. J. Wang, Y. Lou, B. Wang, Q. Sun, M. Zhou, X. Li, Highly sensitive, breathable, and flexible pressure sensor based on electrospun membrane with assistance of AgNW/TPU as composite dielectric layer, Sensors. 20 (2020) 1-13. https://doi.org/10.3390/s20092459.

Section VIII. Materials and Nanomaterials for Advanced Applications

The Role of Micro- and Nanoparticles in Stratospheric Ozone Depletion

Serguei V. Savilov, Natalia E. Strokova, Natalia N. Kuznetsova

ABSTRACT

The authors did not agree with the publishing of the abstract.

Barrier Performance of Spray Coated Nanocellulose Film

Kirubanandan Shanmugam[1,2]

[1]Recent PhD Graduate, Department of Chemical Engineering, Monash University, Melbourne, Vic 3800, Australia.

[2]Department of Biotechnology, Sree Sastha Institute of Engineering and Technology (Affiliated to Anna University, India), Sree Sastha Nagar, Chembarabakkam, Chennai – 600123, India.

*Correspondence: kirubanandan.shanmugam@gmail.com

ABSTRACT

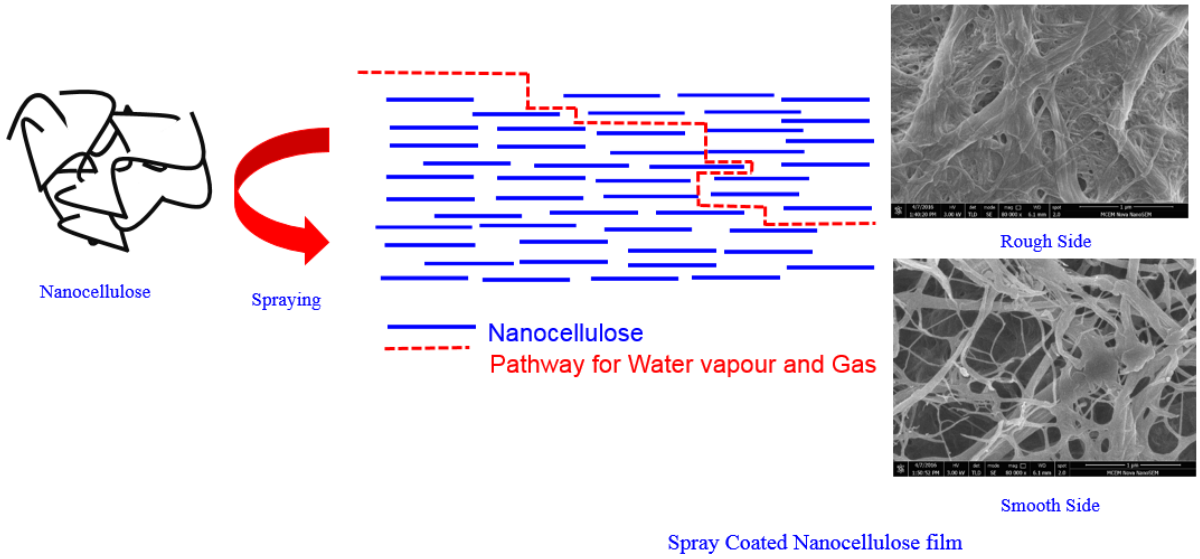
Nanocellulose (NC) is one of the predominant cellulose nanofiber substrates developing high-performance barrier material that is renewable, recyclable and biodegradable. The film developed from nanocellulose have very low oxygen permeability, however, their water vapour permeability is significantly higher than conventional packaging plastics, such as Low-Density Poly-ethylene (LDPE).

Water vapour permeability (WVP) of the NC film has been decreased by forming the film via various methods. The method of preparation of film is one of the criteria for promoting their barrier performance. Vacuum filtration is commonly used to form NC film. However, it has poor drainage time and exponentially increasing with solid content in the suspension for forming the film. The method for spray-coating nanocellulose is developed to form a compact film which two unique surfaces namely smooth on the base side and rough on free side[1,2]. The density of the film can be tailored via simply adjusting solid content in the NC suspension. Spraying improves both the ease of preparation of the film and reduces the water vapour permeability via tailoring the density of the film.

The air permeance of the spray coated film prepared spraying of NC from 1.0 wt. % to 2.0 wt. % NC suspension is less than 0.003 µm /Pa.S confirming that be an impermeable film confirming a good packaging material. The effect of suspension consistency on the barrier performance of the film is also investigated. For NC films prepared via spraying with basis weight between 86.26±13.61 to 155.85±18.01 g/m^2, WVP ranged from 6.99±1.17 x 10^{-11} to 4.19±1.45 x 10^{-11} g/ m Pa S. In comparison, 100 g/m^2 NC film prepared via vacuum filtration which had WVP of 5.50±0.84 x 10^{-11} g/ m Pa S, spray-coated film (of 96.6 g/m^2) show similar permeability at around 5.34±0.603 X 10^{-11} g/ m Pa S.

The water vapour permeability of the spray coated film from 1.75 wt. % and 2.00 wt. % NC could be reduced below that achieved with vacuum filtration. The best performance achieved with the spraying of 2.0 wt. % NC was a water vapour permeability of 3.91 X 10^{-11} g/m.s.pa. This value shows an impermeable film for packaging applications. Considering the barrier performance of the film, spray-coated nanocellulose film can perform as an effective barrier material and a potential alternative to synthetic plastics.

Graphical Abstract



References

1. Shanmugam, K., Doosthosseini, H., Varanasi, S., Garnier, G., & Batchelor, W. (2018). Flexible spray coating process for smooth nanocellulose film production. Cellulose, 25(3), 1725–1741. doi: 10.1007/s10570-018-1677-7.
2. Shanmugam, K., Varanasi, S., Garnier, G., & Batchelor, W. (2017). Rapid preparation of smooth nanocellulose films using spray coating. Cellulose, 24(7), 2669–2676. doi: 10.1007/s10570-017-1328-4.

Glass Fabrics Functionalisation for the Development of High Performance Sandwich Structures

George-Valentin Săftoiu[1,2], Carolina Constantin[1,3], Adrian-Ionuț Nicoară[1], George Pelin[4], Anton Ficai[1,5]

[1]Faculty of Applied Chemistry and Materials Science, University POLITEHNICA of Bucharest, Gh. Polizu 1-7, Bucharest, Romania
[2]ROMAERO S.A., Bulevardul Ficusului, number 44, Sector 1, Bucharest, Postal Code 013975
[3]National Research and Development Institute for Soil Science, Agrochemistry and Environment – ICPA Bucharest, Bd. Marasti, no. 61 CODE 011464 Bucharest, ROMANIA
[4]National Institute for Aerospace Research "Elie Carafoli", Bd. Iuliu Maniu No. 220, Sector 6, Code 061128.
[5]Academy of Romanian Scientists, Ilfov Street 3, Bucharest Romania

ABSTRACT

The advanced composite materials were made starting from glass fabrics and particles, were functionalised by silanization with (3-aminopropyl) triethoxysilane and embedded into an epoxy resin. In recent years, glass waste in powder form has been used to strengthen composite materials with fiberglass fabric inserts, the purpose being environmentally friendly and to improve the glass fabric by adding a mixture of glass powder consisting of three types of different glass. This study aims at optimizing the mechanical behavior of the reinforced composite materials, the major factor being related to the compatibility of the phases, by chemical surface modification.

The aim is to improve the physical and mechanical properties obtained in the previous article by adding a larger amount of resin, hardener and glass powder. Also, two sets of specimens were made in order to optimize a pressure depending on the results obtained. The importance and efficiency of the addition of glass powder to the resin and hardener mixture are tested in order to obtain superior results than those existing on the current market, but also to the recovery of waste obtained from glass.

We are trying to demonstrate the efficiency of materials made of fiberglass, given that we can get the same physical or mechanical results or even better, and parts made of fiberglass are much lighter than those made of alloys, this helps enormously especially in the case of parts that are made to be used in aggressive environmental conditions and in which the weight is a plus, such as aircraft. [1]

Keywords: composite materials, aerospace industry, fiber glass

References

1. ISO 527-4 Tensile Properties of Isotropic and Orthotropic Fiber-Reinforced Plastic Composites

DLP 3D Printing of GelMA Microneedles

Dilruba Baykara[1,2], Tuba Bedir[1,3], Elif Ilhan[1,4], Cem Bulent Ustundag[2]*, Oguzhan Gunduz[3]

1Center for Nanotechnology and Biomaterials Application and Research (NBUAM), Marmara University, 34722, Istanbul, Turkey
2Department of Bioengineering, Faculty of Chemical and Metallurgical Engineering, Yildiz Technical University, 34210, Istanbul, Turkey
3Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, 34722, Istanbul, Turkey
4Department of Bioengineering, Faculty of Engineering, Marmara University, 34722, Istanbul, Turkey
*Correspondence: cbustundag@gmail.com

ABSTRACT

Microneedles are promising devices with microscale needle arrays that can be used for the delivery of therapeutic molecules. Traditional methods that use for microneedle fabrication have limitations in producing microneedles with desired geometry. In this study, we present the production of gelatin methacryloyl (GelMA) microneedles with the digital light processing (DLP) 3D printing technique, which is one of the new generation printing techniques. With this production technique, high-resolution microneedles with desired geometries can be printed. The presence of methacryloyl groups attached to GelMA was confirmed by 1H NMR analysis. The influence of different needle heights (1000 µm, 750 µm, and 500 µm) and exposure times (30 s, 50 s, and 70 s) on microneedles were investigated by measuring needle height, tip radius and angle. In addition, morphological and mechanical properties were tested. It was determined that as the exposure time applied increased, the height of the microneedles increased and sharper tips were obtained. It also showed good mechanical performance without breakage up to 0.3 mm displacement as a result of mechanical testing. According to these results, GelMA microneedles have great potential for the delivery of different therapeutic agents.

Keywords: Gelatin Methacryloyl, Microneedle, DLP 3D Printing

References

1. Y.-C. Kim, J.-H. Park, and M. R. Prausnitz, “Microneedles for drug and vaccine delivery.,” *Adv. Drug Deliv. Rev.*, vol. 64, no. 14, pp. 1547–1568, Nov. 2012, doi: 10.1016/j.addr.2012.04.005.
2. R. F. Donnelly *et al.*, “Optical coherence tomography is a valuable tool in the study of the effects of microneedle geometry on skin penetration characteristics and in-skin dissolution.,” *J. Control. release Off. J. Control. Release Soc.*, vol. 147, no. 3, pp. 333–341, Nov. 2010, doi: 10.1016/j.jconrel.2010.08.008.
3. Q. Yang *et al.*, “Recent progress of 3D-printed microneedles for transdermal drug delivery,” *Int. J. Pharm.*, vol. 593, p. 120106, Jan. 2021, doi: 10.1016/J.IJPHARM.2020.120106.

Indazole as an Inhibitor of Brass Corrosion in Chloride Solution 1 M HCl: Electrochemical/Surface Studies

Zakia Aribou[1,2], Nidal Khemmou[1,2], Moussa Ouakki[1,3], Sara Sibous[1,3], Rida Alah Belakhmima[1,2], Abdelaziz Souizi[1,3], Mohamed Ebn Touhami[1,2]

[1]University Ibn Tofaïl PB. 133-14000, Kenitra, Morocco
[2]Laboratory of Advanced Materials and Process Engineering, Faculty of Sciences, University Ibn Tofaïl PB. 133-14000, Kenitra, Morocco
[3]Laboratory of Organic Chemistry, catalysis and Environment, Faculty of Sciences, Ibn Tofaïl University, PB. 133-14000, Kenitra, Morocco.
*Correspondence: zakia.aribou@uit.ac.ma

ABSTRACT

Acidic solutions are commonly used in industry for several purposes like acid cleaning, acid pickling, acid descaling and acidification of oil wells. Due to the aggressiveness of acid solutions, the practice of inhibition is generally used to reduce the corrosive attack on the metallic materials. Therefore, the investigation of corrosion inhibitors for metallic corrosion in acid solutions is not only important for its academic meaning but also for its practical applications. This process mainly managed by the modification of one of the elementary reactions (transport of species in solution, adsorption of the species on the surface of the solid phases and charge transfers electronic). The present paper examines the adsorption of the novel heterocyclic compound of the indazole derivatives, against corrosion of Brass in molar HCl medium. The experimental investigation was carried out using several techniques including Electrochemical Impedance Spectroscopy (EIS) and Potentiodynamic Polarization (PDP). The inhibition efficiency of the compound followed the order of 90.0%. The adsorption process of this inhibitor on the Brass surface follows the Langmuir adsorption model. Surface characterization analysis using Scanning Electron Microscopy (SEM) coupled with Energy dispersive X-ray analysis (EDS) supported the formation of a barrier layer that covers the Brass surface.

References

1. M. Oubaaqa, M. Ouakki, M. Rbaa, A. S. Abousalem, M. Maatallah, F. Benhiba, M. Ebn Touhami, A. Zarrouk, (2021). Journal of Molecular Liquids, 334, 116520.
2. Dkhireche, N., Galai, M., Ouakki, M., Rbaa, M., Ech-chihbi, E., Lakhrissi, B., & EbnTouhami, M. (2020). Inorganic Chemistry Communications, 121, 108222.
3. M. Ouakki, M. Galai, Z. Benzekri, Chandrabhan Verma, E. Ech-chihbi, S. Kaya, S. Boukhris, Eno E. Ebenso, M. Ebn Touhami, M. Cherkaoui. Colloids Surf, A Physicochem Eng Asp., 611 (2021) 125810.
4. M. Galai, M. Rbaa, M. Ouakki, K. Dahmani, S. Kaya, N. Arrousse, N. Dkhireche, S. Briche, B. Lakhrissi, M. Ebn Touhami. Chem. Phys. Lett. 776 (2021) 138700.

Section IX. Biomaterials for Tissue Engineering and Regeneration (II)

Fabrication of PLA/PVA/Graphene Oxide Nanofibers for Biomedical Applications

Fatih Altun[1,2], Mustafa Şengör[1,3], Songul Ulag[1,3], Oguzhan Gunduz[1,3,*]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[2]Department of Metallurgical and Materials Engineering, Institute of Pure and Applied Sciences, Marmara University, Turkey
[3]Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
*Correspondence: ucemogu@ucl.ac.uk

ABSTRACT

The authors did not agree with the publishing of the abstract.

Biocompatible Coatings with Antimirobial Properties on Stainless Steel Supports

Maxim Maximov[1,2,3,4,*], Roxana Trusca[3,4] and Anton Ficai[1,3,4,5]

[1]Department of Science and Engineering of Oxide Materials and Nanomaterials, Politehnica University of Bucharest, Gh Polizu Street 1-7, 011061 Bucharest, Romania;
[2]SC Microsin SRL, Pericle Papahagi Street 51-63, 032364 Bucharest, Romania
[3]National Centre for Micro- and Nanomaterials, University Politehnica of Bucharest, Splaiul Independentei 313, 060042 Bucharest, Romania;
[4]National Centre for Food Safety, University Politehnica of Buharest, Splaiul Independentei 313,060042 Bucharest, Romania
[5]Academy of Romanian Scientists, Splaiul Independentei Street 54, District 5, 050094 Bucharest, Romania
* Correspondence: maxim.maximov88@yahoo.com

ABSTRACT

Diseases caused by bone damage affect millions of patients each year. Orthopedic implants have become important options for replacing, augmenting or repairing damaged parts of the bones. Metal alloys are often used to make durable and mechanically resistant implants, but they are bioinert and lack antibacterial properties. The manufacture of metal implants coated with bioactive substances allow to obtain mechanically resistant bio-devices, with fast osseointegration and with antibacterial properties.

In this paper we used the spin-coating technique to cover stainless steel supports with 45S5 bioactive glass, followed by the deposition of a uniform layer of miramistin by dip-coating. Miramistin, a drug developed in the former USSR, which is rarely mentioned in English literature, is a substance that possesses antiseptic, antimicrobial, antifungal, antiviral properties, with good tolerability in patients[1]. The deposition techniques used are simple, with a low cost, which would allow the manufacture of affordable implants. The coatings obtained were analyzed by FTIR and SEM microscopy. The biological tests on the samples will also be performed in the future.

Keywords: Sol-gel, Bioactive glass, Spin-coating, Miramistin, Antibacterial.

References

1. A. Osmanov, Z. Farooq, M. D. Richardson, D.W. Denning, The antiseptic Miramistin: a review of its comparative in vitro and clinical activity, FEMS Microbiol. Rev. 44(4) (2020) 399-417. https://doi.org/10.1093/femsre/fuaa012.

Production of Antimicrobial Manganese Loaded Hydroxyapatite/Sodium Alginate Bone Scaffolds with Additive Manufacturing

Muge Koyun[1,2], Selin Yasar[1,3], Elif Ilhan[1,4], Nazmi Ekren[1,5], Bilal Cinici[1,6], Oguzhan Gunduz[*1,2]

1 Center for Nanotechnology & Biomaterials Application and Research (NBUAM) Marmara University, Turkey
2 Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
3 Department of Bioengineering, Faculty of Chemical and Metallurgical Engineering, Yıldız Technical University, Turkey
4 Department of Bioengineering, Faculty of Engineering, Marmara University, Turkey
5 Department of Electrical-Electronics Engineering, Faculty of the Technology, Marmara University, Turkey
6 Department of Mechanical Engineering, Faculty of Engineering, Marmara University, Turkey
*mugekoyun@marun.edu.tr

ABSTRACT

Treatment of bone defects caused by trauma and nonunion remains a clinical challenge in orthopedics. Bone tissue engineering aims to develop structures that mimic natural bone and accelerate the treatment of defects with different combinations of cells, growth factors, and biomaterials. In this research, 3D printed sodium alginate (SA), hydroxyapatite (HA) and manganese (Mn) microporous composite structures have been successfully developed for the treatment of bone defects. The main component of the natural bone, HA can increase Ca+2 levels stimulating osteoblast proliferation and promoting the growth and differentiation of mesenchymal stem cells[1]. Mn enhances the mechanical and thermal stability of the scaffold while improving blood compatibility and osteoblast proliferation. Previous studies have shown that Mn enhances osteocalcin stimulation, improves collagen type I production, and helps the extracellular matrix remodel itself[2]. The antibacterial property of the Mn will overcome infections that are caused by gram-positive and negative bacteria[3]. In this study, Mnloaded scaffolds in different concentrations (2%, 4%, and 6%) were produced using 3D printer technology that provides precise adjustments. Pore size plays a crucial role in vascularisation, bone formation, and production of the extracellular matrix[4]. Therefore infill density was adjusted to %40 and nozzle diameter is 22G resulting in 580 – 600 µm pore size. Printed bone scaffolds were sintered at certain degrees after this process, the pore sizes of the scaffolds became smaller, their mechanical strength increased, and the solvent in the bone tissue scaffold will be removed. Then, the temperature was increased gradually so that the structure will hold onto each other more strongly. The mechanical (compression test), biological (antibacterial), and chemical (FTIR) properties of the produced scaffolds were investigated to analyze their compatibility with natural bone. The analyzes have shown that the obtained bone tissue scaffolds can constitute an alternative option for bone tissue engineering applications.

Keywords: Bone Tissue Engineering, 3D-printed Scaffolds, Manganese, Hydroxyapatite

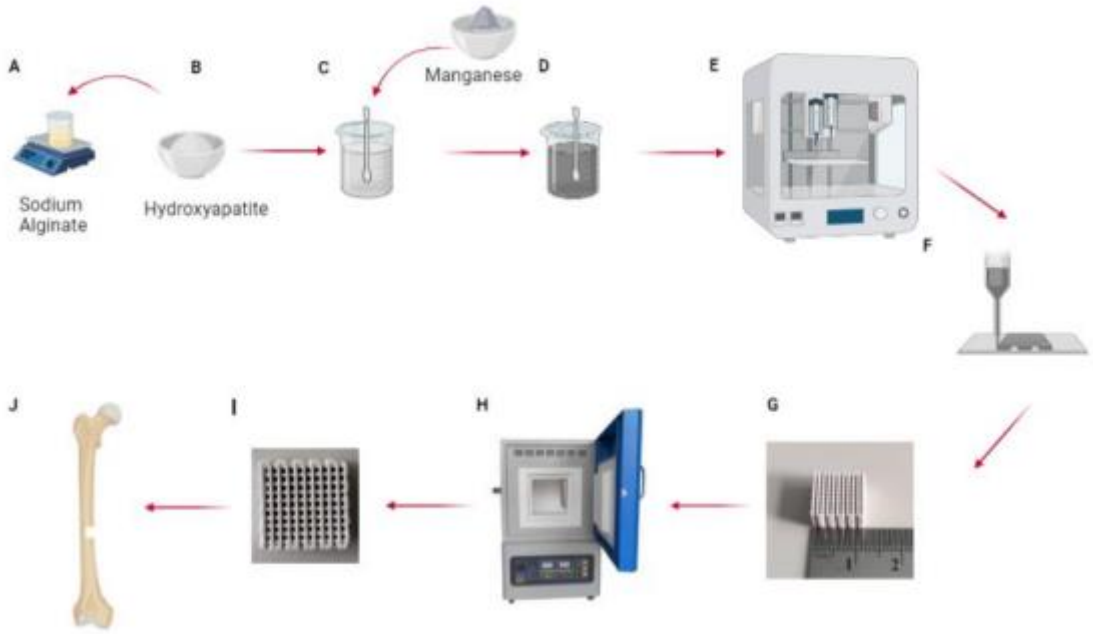


Figure 1. A) Preparing the sodium alginate solution B) Adding HA to the prepared solution C) Adding the element of Mn to the prepared HA-SA solution D) Mixing the solution homogeneously E) Setting up the 3D printer F) Printing the prepared bio-ink G) Image of the printed scaffold H) Sintering of the printed scaffolds I) Final image of the bone scaffold J) Application of the produced bone scaffold to the damaged bone tissue

References

1. H. Shi, Z. Zhou, W. Li, Y. Fan, Z. Li, and J. Wei, "Hydroxyapatite based materials for bone tissue engineering: A brief and comprehensive introduction," Crystals, vol. 11, no. 2, pp. 1–18, 2021, doi: 10.3390/cryst11020149.
2. S. Muthusamy, B. Mahendiran, S. Sampath, S. N. Jaisankar, S. K. Anandasadagopan, and G. S. Krishnakumar, "Hydroxyapatite nanophases augmented with selenium and manganese ions for bone regeneration: Physiochemical, microstructural and biological characterization," Mater. Sci. Eng. C, vol. 126, no. February, p. 112149, 2021, doi: 10.1016/j.msec.2021.112149.
3. Westhauser, F.; Wilkesmann, S.; Nawaz, Q.; Hohenbild, F.; Rehder, F.; Saur, M.; Fellenberg, J.; Moghaddam, A.; Ali, M. S.; Peukert, W.; Boccaccini, A. R. (2020). Effect of manganese, zinc and copper on the biological and osteogenic properties of mesoporous bioactive glass nanoparticles. Journal of Biomedical Materials Research Part A, (), jbm.a.37136–. doi:10.1002/jbm.a.37136
4. I. Fernández-Cervantes et al., "Polylactic acid/sodium alginate/hydroxyapatite composite scaffolds with trabecular tissue morphology designed by a bone remodeling model using 3D printing," J. Mater. Sci., 2019, doi: 10.1007/s10853-019-03537-1.

Production of 3D-printed PVA-Sodium Alginate-GelMA based Wound Dressing Scaffolds for the Treatment of Burns

Muhammet Sefa Izgordu[1,2], Songul Ulag [1,2*], Oguzhan Gunduz[1,2]

1 Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Istanbul, Turkey
2 Center for Nanotechnology & Biomaterials Applications and Research (NBUAM), Marmara University, Istanbul, Turkey
*ulagitu1773@gmail.com

ABSTRACT

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Cerium-substituted Hydroxyapatite for Bone Regeneration

Alexandra-Cristina Burdusel, Ecaterina Andronescu, Alexandru-Mihai Grumezescu, Anton Ficai, Alina Maria Holban

ABSTRACT

Osteoporosis is a public health issue, with bone loss as the most common symptom. Hydroxyapatite (HA) is a bioceramic that has been widely utilized to promote bone formation. This study proposed a cerium-containing HA (Ce-HA) functionalized with thyme essential oil, and we explored its antibacterial and bone-inducing capabilities. The material synthesis was realized by co-precipitation and by microwave-assisted hydrothermally then the samples were functionalized with thyme essential oil to enhance the antimicrobial effect. The synthesized powders were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), and FT-IR (Fourier Transform Infrared Spectroscopy). The study concluded the antimicrobial effect of the hydroxyapatite substituted with cerium functionalized with thyme oil and the low toxicity of the samples.

Three-Dimensional Polycaprolactone Scaffold Combined with Tetracycline-Loaded Electrospray Particles

Rabia Betul Sulutas[1,2*], Sumeyye Cesur[1], Oguzhan Gunduz[1,2]

[1]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[2]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey
ucemogu@ucl.ac.uk

ABSTRACT

The methods used in drug transport systems have been replaced by many different and advanced modeling systems with the developing technology. The treatment methods developed as a result of combining synthetic and natural polymers with new generation nanotechnological products such as 3D devices lead studies in interdisciplinary fields such as medical science, pharmacy and bioengineering.[1]

Drug delivery systems are one of the popular fields of study where the maximum therapeutic efficacy of active ingredients is investigated. Nanotechnological developments aim to realize drug release more effectively. [2] Electrospray method is a more preferred option than conventional methods for this target. Electrospray particles composed of different polymers or polymer blends have been investigated as potential carriers for drug delivery and release. [3]

In this study, a total of 7 layers of polymer scaffolds containing PCL were prepared using a 3D printer. Tetracillin-loaded PVP particles were electrosprayed into layers 2, 5 and 7 of the 7-layer PCL polymer scaffold. These spherical particles were optimized in a 1:1 solution of % 13 w/v PVP dissolved in chloroform and DCM.

The resulting scaffold and particles had a layered structure. The particles sprayed on different layers of the scaffold were optimized at 8 cm needle tip and collector distance, 0.8 ml/h flow rate and 13.5 kV voltage. Scanning electron microscopy (SEM) was applied for morphological analysis of particle-loaded scaffolds, Fourier transform infrared spectroscopy (FT-IR) to observe chemical bonds and molecular interaction, and differential scanning calorimetry (DSC) tests to examine thermal behavior. In addition, the drug release test of tetracillin was performed with a UV spectrophotometer. Inspired by the sandwich modeling design, this model, which has 2 different designs, is a potential candidate method that can be used in a more effective drug release profile for antibiotic group drugs.

Keywords: Drug release, 3D Printing, Electrospray, Biomaterials, Tetracillin

References:

1. Figueiredoa, M. P., Géraldine, L., Hébraudb, A., (2020). Design of 3D multi-layered electrospun membranes embedding iron-based layered double hydroxide for drug storage and control of sustained release. European Polymer Journal, 131, 109675
2. Kamaruddin, I., Sriyanti, D., Edikresnha, M., (2018). Electrosprayed Polyvinylpyrrolidone (PVP) Submicron Particles Loaded by Green Tea Extracts. IOP Conf. Series: Materials Science and Engineering, 367, 012036
3. Narváez-Muñoz, C., Ryzhakov,P., Pons-Prats, J., (2021). Determination of the Operational Parameters for the Manufacturing of Spherical PVP Particles via Electrospray. Journal of Polymers, 529, 13040529

Retinoids for Dermatological Applications – Cosmetic Formula with Retinol Impregnated in Bioglass – Overview of Skin Aspect Improvement on Patient with Acne

Ioana Lixandru Matei, Sava Bogdan Alexandru

University Politehnica of Bucharest, 011061 Bucharest, Romania
*Correspondence: ioana@clinica-plush.ro

ABSTRACT

The authors did not agree with the publishing of the abstract.

Poster Section (III)

Molecularly Imprinted Surfaces Doped with Conductive Polymers for Lipopolysaccharide Recognition

Ana-Lorena Neagu[1,2], Bianca-Elena Stoica[1], Ana-Mihaela Gavrila[1], Andreea Miron[1], Sorin Dolana[1], Andrei Sarbu[1], Horia Iovu[2], Tanta-Verona Iordache[1*]

[1] National Institute for Research & Development in Chemistry and Petrochemistry – ICECHIM Bucharest, 060021 Bucharest, Romania
[2]University Politehnica of Bucharest, 011061 Bucharest, Romania
*Correspondence: tanta-verona.iordache@icechim.ro

ABSTRACT

The authors did not agree with the publishing of the abstract.

Design and *In Vitro* Evaluation of New Electrospun Nanofibers Based on Chitosan/Polyvinyl Alcohol for Wound Healing

Teodora Iurașcu, Teodora A. Iacob, Alexandru Sava, Oana M. Ionescu, Lenuța Profire

University of Medicine and Pharmacy "Grigore T. Popa" of Iasi, Faculty of Pharmacy, University Street no 16, 700115, Iasi
*Corresponding author: Email address: teodora.hanghicel@yahoo.com ; teodora-l-hanghicel@d.umfiasi.ro

ABSTRACT

The authors did not agree with the publishing of the abstract.

The Influence of Nanomaterials on the Grapevine Stomata

Daniela-I. Sărdărescu[1,2]*, Diana E. Vizitiu[1], Radu C. Fierăscu[2], Irina Fierăscu[2], Liliana C. Soare[3], Camelia Ungureanu[4], Elena C. Buciumeanu[1], Anda M. Baroi[2]

[1]National Research and Development Institute for Biotechnology in Horticulture, Stefanesti, 117715, Romania
[2]The National Institute for Research & Development in Chemistry and Petrochemistry, 060021, Bucharest, Romania
[3]University of Pitesti, 110040, Pitesti, Romania
[4]University Politehnica of Bucharest, 011061 Bucharest, Romania
*Correspondence: ionela.toma93@yahoo.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Chitosan/Hydroxyapatite Based Composite Structures for Bone Cancer Treatment

Alina Florentina Vladu[1,2*], Ludmila Motelica[2], Alexandra Ene[1], Ecaterina Andronescu[2,3], Ionela Neacsu[2], Anton Ficai[2,3]

1 The National Research and Development Institute for Textile and Leather, 030508 Bucharest, Romania
2 Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, 011061 Bucharest, Romania
3 Academy of Romanian Scientists, 050044 Bucharest, Romania
*Correspondence: alina_vladu_1995@yahoo.com

ABSTRACT

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Bee Derived Products and Their Applications in Skin Tissue Engineering

Corina Dana Dumitru[1*], Ionela Andreea Neacsu[1,2,3], Alexandru Mihai Grumezescu[1,2,4], Ecaterina Andronescu[1,2,3], Denisa Ficai[3,5]

[1] Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, 011061 Bucharest, Romania
[2] Academy of Romanian Scientists, 3 Ilfov Street, 050044 Bucharest, Romania
[3] National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
[4] Research Institute of the University of Bucharest—ICUB, University of Bucharest, 050657 Bucharest, Romania
[5] Department of Inorganic Chemistry, Physical Chemistry and Electrochemistry, Faculty of Chemical Engineering and Biotechnologies, University Politehnica of Bucharest, 011061 Bucharest, Romania
*Correspondence : corina.dumitru95@yahoo.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Coordination Compounds of Cu(II) and Bi(III) with Ethylenediaminetetraacetate Ions and 2-Acetylpyridine Thiosemicarbazones

Elena Neguta[1*], Greta Balan[2], Aurelian Gulea[1], Ion Bulimestru[1]

[1]Moldova State University

[2]State University of Medicine and Pharmacy "N. Testemitanu"

*Correspondence : neguta26elena@gmail.com

ABSTRACT

Thiosemicarbazones have a wide range of pharmacological applications as anticancer, antiviral antifungal and antimicrobial agents [1]. Many thiosemicarbazones, such as marboran or triapine, are already used in medical practice in clinical trials [2]. Generally, biological activity of thiosemicarbazones increase considerably as a result of coordination to transition metal ions [3]. Copper(II) complexes with thiosemicarbazones display high antineoplastic activity against a large number of various tumours [4]. Bismuth(III) compounds have various applications, especially in the antimicrobial field, due to the local antiseptic, astringent, protective, antacid, antisecretory and gastrointestinal properties. Bismuth(III) compounds are also used in dressings as an antiseptic for application to the skin and for infections of the mouth and upper respiratory tract. Particular emphasis has recently been placed on the use of bismuth compounds in the treatment of duodenal ulcers, peptic diseases and the eradication of *Helicobacter pylori* [5].

The research is focuses on the synthesis and investigation of the biological activity of homometallic compounds of Cu(II) and Bi(III) with 2-acetylpyridine thiosemicarbazone (HAcpytsc) and 2-acetylpyridine 4-ethylthiosemicarbazone (4Et-HAcpytsc) with the general formulas $[\{Cu(4XAcpytsc)\}_2Cu(edta)]\cdot nH_2O$ and $[Bi(Hedta)(4XHAcpytsc)_m]\cdot nH_2O$ (n = 1 - 7; m = 1 or 2; $edta^{4-}$ = ethylenediaminetetraacetate; X = H or C_2H_5) with the monodeprotonated (4XAcpytsc) or non-deprotonated (4XHAcpysc) 2-acetylpyridine thiosemicarbazone or 4-ethylthiosemicarbazones. Ethylenediaminetetraacetate ions were used as chelates with high coordination potential capable to combine two different metals ions and having the ability to amplify the solubility of complexes in water.

Aiming at obtaining synergistic effects due to the presence of two biologically active metal ions and different ligands, heterometallic coordination compounds with the same organic compounds were also synthesized. Thus, a series of heterometallic Cu(II)-Bi(III) complexes with mixed ligands were synthesized having the general formulas $[\{Cu(4XAcpytsc)\}Bi(edta)]\cdot nH_2O$ (n = 3 - 5; X = H or C_2H_5), where both thiosemicarbazones are in monodeprotonated forms.

Both homometallic and heterometallic coordination compounds were tested against three bacterial strains: *Staphylococcus aureus* (ATCC 25923), *Escherichia coli* (ATCC 25922), *Acinetobacter baumannii* (BAA-747) and against *Candida albicans* (ATCC 10231) fungal strain.

The results demonstrated that MIC and MBC values for Cu(II) homometallic compounds are in 7,8-0,24 μg/mL range, Bi(III) homometallic compounds have the values 7,8- 0,98 μg/mL, while the heterometallic compounds have MIC and MBC values in 15-0,061 μg/mL domain. The highest antimicrobial activity (0,061 μg/mL) was displayed by Cu(II)-Bi(III) heterometallic compound based on 2-acetylpyridine 4-ethylthiosemicarbazone, followed by its Cu(II) homometallic analogue (0,24 μg/mL).

The synthesized compounds have antifungal activity with MIC and MFC in 62 - 0,98 μg/mL range. The highest activity (0,98 μg/mL) against *Candida albicans* (ATCC 10231) has Cu(II) homometallic compound based on 2-acetylpyridine 4-ethylthiosemicarbazone.

Keywords: Copper(II), Bismuth(III), Coordination Compounds, Homometallic, Heterometallic, Thiosemicarbazones, Aminopolycarboxylate, Biological Activity.

References:

1. A. Hameed, M. al-Rashida, M. Uroos, S.A. Ali, K.M. Khan. Schiff bases in medicinal chemistry: a patent review. Expert opinion on therapeutic patents. 27(1) (2017) 63-79. https://doi.org/10.1080/13543776.2017.1252752.
2. R.A. Finch, M.-C. Liu, S.P. Grill, W.C. Rose, R. Loomis, K.M. Vasquez, Y.-C. Cheng, A.C. Sartorelli, Triapine (3-Aminopyridine-2-carboxaldehyde-thiosemicarbazone): A Potent Inhibitor of Ribonucleotide Reductase Activity with Broad Spectrum Antitumor Activity. Biochemical Pharmacology. 59 (2000) 983–991. https://doi.org/10.1016/S0006-2952(99)00419-0.
3. D.X. West, A.E Liberta, S.B. Padhye, R.C. Chikate, P.B. Sonawane, A.S. Kumbhar, and R.G Yerande, Thiosemicarbazone complexes of copper(II): structural and biological studies. Coord. Chem. Rev. 123 (1993) 49–71. doi: 10.1016/0010-8545(93)85052-6.
4. C. Santini, M. Pellei, V. Gandin, M. Porchia, F. Tisato, C. Marzano, Advances in Copper Complexes as Anticancer Agents. Chem. Rev. 114 (2014) 815-862. https://doi.org/10.1021/cr400135x.
5. I.P. Ferreira, E.D. Piló, A.A. Recio-Despaigne, et. al. Bismuth (III) complexes with 2-acetylpyridine-and 2-benzoylpyridine-derived hydrazones: Antimicrobial and cytotoxic activities and effects on the clonogenic survival of human solid tumor cells. Bioorganic & medicinal chemistry. 24(13) (2016) 2988-2998. https://doi.org/10.1016/j.bmc.2016.05.007.

Black Phosphorus: Properties, Synthesis, and Applications

Andra-Maria Sîrmon[1*], Ecaterina Andronescu[1,2,3], Ionela-Andreea Neacșu[1,2,3], Vasile-Adrian Surdu[1,2,3], Alexandru Mihai Grumezescu[1,2,4]

[1] Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, 011061 Bucharest, Romania
[2] Academy of Romanian Scientists, 3 Ilfov Street, 050044 Bucharest, Romania
[3] National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
[4] Research Institute of the University of Bucharest—ICUB, University of Bucharest, 050657 Bucharest, Romania
*Correspondence : andra.maria29@yahoo.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Optimization of Alginate Micro/Nanoparticles Preparation by Emulsification/Internal Gelation Method Using Box-Behnken Design

Naima Faghmous[1,2*], Djallel Bouzid[1,2]

[1]Laboratory of Process Engineering for Sustainable Development and Health Products, National Polytechnic School of Constantine, Algeria
[2]Department of Process Engineering, National Polytechnic School of Constantine, Algeria
*Correspondence : naima.faghmous@enp-constantine.dz

ABSTRACT

The authors did not agree with the publishing of the abstract.

Formulation and Characterization of Topical Niosomal Gel Containing Aceclofenac and Serratiopeptiase

Rama Shukla

Department of Pharmaceutics**,** Lakshmi Narain College of Pharmacy, Raisen Road, Bhopal (M.P.) India

*Correspondence: shukla.pharma15@gmail.com

ABSTRACT

Aceclofenac is classified as a BCS Class II drug because of its low water solubility. Systemic adverse effects, such as anticoagulant effects, have been described when SRP is taken orally. The goal of this study was to see how well a topical Niosomal gel containing Aceclofenac (ACE) and Serratopeptidase (SRP) could deliver the drugs. Particle size, shape, entrapment efficiency, and in vitro properties of Niosomal formulations produced using the thin film hydration process at varied cholesterol and Span 40 ratios were studied. The average particle size of the niosomal formulation was determined to be between 2 and 2 μm[1]. The entrapment efficiency of the niosomal formulations F2 (1:1:1) and F6 (1: 2: 1) of cholesterol and surfactant was 65 percent and 66.4 percent, respectively. Niosomal formulation (F2 and F6) displayed high percentage of drug release after 18 h. For the convenience of application, greater stability, reduced aspect effects, greater affected person compliance, and the convenience of discontinuation on desire, there were numerous advantages to deliver ACE through topical route. Therefore, topical therapy isn't most effective promising at the protection and efficacy fronts however additionally at the financial fronts too. *In vitro* evaluation confirmed that niosomal gel had higher pores and skin permeation [2,3].

Keywords: ACE,SRP, Topical niosomal gel, Niosomal gel.

References:

1. Vinita Singh *et al.*, Design and Evaluation of Topical Hydrogel Formulation of Aceclofenac for Improved Therapy. Journal of Drug Delivery & Therapeutics,9(5):118-122:2019.
2. Jadhav. S.B , N.Shah, A.Rathi *et al.* Serratiopeptidase: Insights into the therapeutic applications. Biotechnology reports 28(2020).
3. Singh Varsha *et al.* Formulation and Evaluation Of Aceclofenac Topical Emulgels. IJMPR 2021, 5(4), 151-157

Analysis of Upconversion Luminescence in Y_2O_3:Er, Yb Phosphors

Liviu Dudaș[1], Angela Enachi[2], Daniela Berger[1], Cristian Matei[1]

[1]"Politehnica" University of Bucharest, Inorganic Chemistry, Physical Chemistry & Electrochemistry Department, Bucharest, 011061, Romania
[2]National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Magurele, 077125, Romania
*Correspondence: liviu_dudas@yahoo.com

ABSTRACT

The authors did not agree with the publishing of the abstract.

Gelatin Cryogels in Wound Healing: Properties and Synthesis

Daniela Alina Ionita[1*], Ecaterina Andronescu[1,2,3], Ionela Andreea Neacsu[1,2,3], Vasile Adrian Surdu[1,2,3], Alexandru Mihai Grumezescu[1,2,4]

[1] Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, 011061 Bucharest, Romania
[2] Academy of Romanian Scientists, 3 Ilfov Street, 050044 Bucharest, Romania
[3] National Research Center for Micro and Nanomaterials, University Politehnica of Bucharest, 060042 Bucharest, Romania
[4] Research Institute of the University of Bucharest—ICUB, University of Bucharest, 050657 Bucharest, Romania
*Correspondence: daniela.ionita0924@stud.fim.upb.ro

ABSTRACT

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Fate of ESKAPE Bacteria from Hospital to Water Bodies – Lessons from RADAR Project

Fate of the Bacterial Load From Hospitals to WWTP and Natural Aquatic Bodies

Monica Vaideanu[1,2], Alina Banciu[1], Catalina Stoica[1], Irina Lucaciu[1], Stefania Gheorghe[1], Mihai Nita-Lazar[1]

[1]National Research and Development Institute for Industrial Ecology- ECOIND, 57-73 Drumul Podu Dambovitei Street, 060652, Bucharest, monica.vaideanu@ecoind.ro, Romania
[2]University of Bucharest, Faculty of Biology, 91-95 Splaiul Independentei, R-050095, Bucharest, Romania

ABSTRACT

Hospitals are hot spots for pathogenic bacteria and play a major role in emergence and spreading of pathogenicity characteristics. Large number of these microorganisms could be found in the municipal wastewaters and subsequently released via wastewater treatment plant (WWTP) effluents into natural emissaries, being an important source of pathogenic bacterial contamination for the aquatic environment. At the present, in Romania, there is a lack of a legislative framework to regulate bacteriological parameters values of the hospital effluents. Unfortunately, this could generate a pathogenic dissemination pattern via wastewaters treatment system which will end into the environment, aquatic bodies.

The main goal of this study was to evaluate the bacterial load between hospitals and natural emissaries via WWTP. Samples of wastewater and aquatic bodies were collected (between 2019 and 2021) from 7 important cities of Romania (Iasi, Cluj-Napoca, Timisoara, Ramnicu Valcea, Targoviste, Galati and Bucharest), each one having important medical infectious disease treatment and WWTP facilities. The samples consisted of tap drinkable water, effluent wastewater from hospitals and municipal WWTP as well as natural aquatic bodies (upstream and the downstream WWTP receiving natural emissaries). The microbiological evaluation levels of these samples were quantitative assessed based on the Most Probable Number for coliforms group and by membrane filtration method for enterococcus analyses. The results showed that wastewater from hospital units had a microbial load comparable to WWTP influents, around $10x10^6$ colony forming units (CFU) / 100 ml of sample. The bacterial load decreased to $10x10^{3-4}$ CFU/100ml after wastewater treatment steps. The overall bacterial load contribution to the environmental aquatic bodies was not as high as the fecal bacterial contribution load into the environment. The fecal bacterial contribution load into the WWTP downstream areas increased at least twice compared cu upstream areas. The overall results showed a clear dissemination path of the pathogenic bacteria from hospital units to natural aquatic bodies via WWPT.

Keywords: bacterial load, WWTP.

Emerging Antimicrobial Nanotechnologies

Denisa Ficai[1-3], Georgiana Dolete[2-4], Alexa-Maria Croitoru[2-4], Marcela Popa[5], Laura Boanţă[6], Dan Eduard Mihaescu[2,3,7], Anton Ficai[2-4,8], Ecaterina Andronescu[2-4,8], Mariana Carmen Chifiriuc[5,8,9]

[1]Department of Inorganic Chemistry, Pgysical Chemistry and Electrochemistry, Faculty of Chemical Engineering and Biotechnology; University POLITEHNICA of Bucharest, Gh Polizu 1-7, Bucharest, Romania;
[2]National Research Center for Food Safety, University POLITEHNICA of Bucharest, Spl Independentei 313, Bucharest, Romania);
[3]National Centre of Micro and Nanomaterials, University POLITEHNICA of Bucharest, Spl Independentei 313, Bucharest, Romania;
[4]Department of Science and Engineering of Oxide Materials and Nanomaterials, Faculty of Chemical Engineering and Biotechnology; University POLITEHNICA of Bucharest, Gh Polizu 1-7, Bucharest, Romania;
[5]University Bucharest, Faculty of Biology, Department of Biochemistry and Molecular Biology, Splaiul Independentei 91-95, Bucharest, Romania;
[6]Faculty of Power Engineering, Department of Hydraulics, Hydraulic Machinery and Environmental Engineering, POLITEHNICA University of Bucharest, 313 Splaiul Independentei, District 6, 060042 Bucharest, Romania;
[7]Department of Organic Chemistry, Faculty of Chemical Engineering and Biotechnology; University POLITEHNICA of Bucharest, Gh Polizu 1-7, Bucharest, Romania;
[8]Academy of Romanian Scientists, Ilfov st. 3; Bucharest, Romania
[9]Romanian Academy, Calea Victoriei 125, District 1, 010071 Bucharest, Romania

ABSTRACT

The work is presenting three approaches in modifying the (inner or outer) surface of different materials. Two approaches are designed to modify the surface of different materials, including stone, marble, glass, concrete, wood etc., these materials being used for civil engineering (buildings, bridges, wastewater plants, etc.) but also for the protection of the national and international cultural heritage. For this purpose, two approaches are considered, a biomimetic one using chemically bonded surfactant-like moieties and a nanotechnologically modified technique based on chemically bounded nanoparticles with antimicrobial activity. Om both cases the chemically attachment is important in long-lasting effect but also in avoiding the release of these agents into the nature and thus to induce pollution. A third approach will be applied to modify some porous materials by developind photocatalysts inside the pores. In this case, the pollutants, especially antibiotics will be absorbed and degraded to eco-friendly substances, which will not enhance the antibiotic resistance. This approach is easy to be implemented in the wastewater treatment (especially municipal, zootehnical but also from hospitals) requiring only an additional treatment tank. Comparing to the classical, pure adsorption route, where the sorption / desorption equilibrium assure a long term release of the antibiotics, at low level induce a long contact of these antibiotics with the bacterial strain and generate resistance, the as proposed technology assure the degradation of these pollutants and thus a lower risk of antibiotic resistance.

Keywords: surface treatment, antimicrobial nanotechnology, degradation of pollutants

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Evaluation of Antioxidative Status in *Carassius Gibelio* Collected from Bucharest Lakes

Cristina F. Alistar, Ionela C. Nica, Sorina N. Voicu, Nicolai Craciun, Miruna S. Stan*, Anca Dinischiotu

Department of Biochemistry and Molecular Biology & Research Institute of the University of Bucharest (ICUB), Faculty of Biology, University of Bucharest, 91-95 Spl. Independentei, 050095 Bucharest, Romania

*Correspondence: miruna.stan@bio.unibuc.ro

ABSTRACT

Fish can accumulate by gills or ingestion various contaminants of aquatic environment, with negative consequences on their intestine, being continuously threatened worldwide by the xenobiotics resulted from human activities. By eating the contaminated fish meat, the health of other species can be affected. Therefore, our study aimed to perform a comparison between the changes of the antioxidative status gut tissue of *Carassius gibelio* individuals collected from different artificial lakes in Bucharest (Romania), used by people for leisure and fishing. Our results showed that fish from Bucharest lakes designed for leisure (Chitila, Floreasca and Tei lakes) have an increased level of oxidative stress in intestine tissue, revealed by the affected antioxidant enzymes activities and GSH levels, as well as the high degree of lipid peroxidation, compared to the fish from a protected environment (Vacaresti Lake). It could be suggested that the modified antioxidative status was a consequence of the high amount of xenobiotics accumulated in the gut of those fish. In conclusion, our study could expand the knowledge regarding the current state of urban aquatic pollution in order to impose several environmental health measures.

Abundance of ESKAPE Bacteria in Municipal Waste Waters and Receiving Water Bodies

Popa Marcela[1], Niță-Lazăr M.[2], Măruțescu Luminița[1], Gheorghe Irina[1], Czobor Ilda[1], Popa Laura[1], Mariana Carmen Chifiriuc[1]

[1]University of Bucharest
[2]National Institute for Research and Development for Industrial Ecology – INCD ECOIND

ABSTRACT

Since 2011, antibiotic resistance (AR) has been considered the first of the eight disease threats with the potential to become significantly more problematic due to globalization, environmental, social and demographic changes and health system capacity. AR is responsible of high mortality rates (reaching 10 million people deaths every year by 2050) and increase of health care costs, economic losses (2% to 3.5% reduction in Gross Domestic Product, which would cost the world up to 100 trillion USD), failures of infectious diseases control measures, threatening the return to the pre-antibiotic era. Understanding the flux and dynamics of AR units throughout diverse ecosystems is crucial for assessing, preventing and eventually predicting the possible emergent resistant strains before they reach and enter health institutions. Wastewater treatment plants (WWTPs) have been recently suggested to be hotspots able to provide the perfect environment for the enrichment, recombination and selection of AR "super-bugs" which could eventually be discharged into downstream aquatic systems entering different crops/vegetables/animals and subsequently could adversely impact the environment and the human health, highlighting the necessity for strategies of water quality improvement. In the present study, we investigated the abundance of ESKAPE bacteria (*Escherichia coli, Staphylococcus aureus, Klebsiella pneumonia, Acinetobacter baumannii, Pseudomonas aeruginosa, Enterococcus faecalis/faecium)* in seven cities from Romania in municipal waste waters and receiving water bodies.

Phenotypic Evaluation of the Enterobacterales Antibiogram: Lessons for Practice through the RADAR Project

Codiță Irina[1], Cristea Daniela[1], Dinu Sorin[1], Dragomirescu Cerasella Cristina[1,2], Drăgulescu Carmina[1], Lixandru Brândușa[1], Militaru Cornelia[1], **Muntean Andrei-Alexandru[1,2]**, Muntean Mădălina-Maria[1,2], Oprea Mihaela[1], Preda Mădălina[1,2], Usein Codruța[1], Prof. Dr. Mircea Ioan Popa[1,2]

[1]Cantacuzino National Military Medical Institute for Research and Development
[2]Carol Davila University of Medicine and Pharmacy

ABSTRACT

Evaluation of the antibiogram permits the phenotypic evaluation of resistance to antimicrobials, a key point for surveillance and treatment.

Materials and Methods. Standardized disc-difussion antibiograms were performed through the Kirby-Bauer method. In the course of the RADAR project, nearly 2.000 Enterobacterial antibiograms were evaluated, primarily of *Escherichia coli* and *Klebsiella pneumoniae* isolates and a few *Enterobacter* spp. isolates recovered from flowing waters and waste water treatment plants (WWTP) from Bucharest and 6 additional counties allows for ample evaluation of the phenotypic resistance with valuable insights for clinical practice. Selective media were used to retrieve microorganisms with relevant antimicrobial resistance, while overall contamination of water was evaluated through the use of enumeration media.

Results.

Escherichia spp. strains showed overall variable resistance (25-50%) to amino- and ureidopenicilins, as well as (mostly) decreased susceptibility to Cefotaxim (25-75%), depending on the site of strain sampling. Resistance to aminoglycosides was generally low (<5%) with the exception of two counties where rates approached 25%. Fluoroquinolone and the antimetabolite association of trimetoprim-sulfomethoxazole. Resistance gradually increased with the use of selective media, reaching upwards of 90% resistance to Cefotaxim using ESBL-selective media and upwards of 90% resistance to carbapenems on OXA-48 and Carbapenemase selective media.

Klebsiella pneumoniae and *Enterobacter* spp. showed slightly higher phenotypic resistance levels, as these were evaluated for resistant strains. OXA-48 selective media isolated bacteria significantly more resistant to 3rd generation cephalosporins, as compared to *E. coli* (75% vs 25% resistance) showing that the co-acquisition of resistance mechanisms is frequent.

Of note, upstream-downstream susceptibility profiles were similar, showing escape of antibiotic resistant bacteria in the dowstream of WWTP.

Detailed susceptibility profiles are included here.

Conclusions

The evaluation of the antibiogram of Enterobacterales strains isolated from flowing waters and WWTP showed significant levels of antibiotic resistance, especially when considering treatment options for beta-lactam resistant microorgainsms.

Extended Genotypic Analysis of ESKAPE Resistome in Clinical and Environmental Samples

Marius Surleac[1], **Ilda Czobor Barbu[2,3,4]**, Irina Gheorghe[2,3], Simona Paraschiv[1], Mariana Carmen Chifiriuc[2,3,4] Dan Oțelea[1]

[1]National Institute of Infectious Diseases – Prof. Dr. Matei Balș
[2]Microbiology Dept., Faculty of Biology, University of Bucharest
[3]Research Institute of University of Bucharest
[4]The Academy of Romanian Scientists

ABSTRACT

Background. The designated group of ESKAPE pathogens (Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, Enterobacter sp.) are a major concern to public health, due to their ability to acquire and spread antibiotic resistance genes. The RADAR project was designated to follow the dissemination of the bacterial clones and their resistome into the environment, via hospital wastewaters and urban wastewater treatment plants (WWTPs).

Materials/methods. Following the isolation (membrane filtration method and inoculation on selective chromogenic culture media), identification (MALDI-Tof), antibiotic susceptibility testing (disk-diffusion method) and selection, 695 ESKAPE strains were subjected to whole genome sequencing (WGS) using Illumina MySeq and NextSeq platforms, as well as Oxford Nanopore MinION platform. Subsequent bioinformatic analyses were performed using a Ubuntu-based platform and Geneious software for genomes assembly, annotation and phylogenetic analyses.

Results. The WGS output for the 695 ESKAPE strains (283 K. pneumoniae, 136 E. coli, 131 A. baumannii, 83 E. faecium, 36 P. aeruginosa, 20 Enterobacter sp. and 4 other Enterobacterales) revealed the presence of clinically relevant high-risk clones (i.e. K. pneumoniae ST101 and ST258, A. baumannii ST1 and ST2, P. aeruginosa ST357 and ST233, E. faecium ST117 and ST80) in the transmission chain from hospital to surface waters. These strains also harbored clinically relevant antibiotic resistance genes (ARGs), including extended spectrum β-lactamases (ESBLs) genes (bla_{CTX-M}, bla_{SHV}, bla_{OXA-10}, bla_{VEB}, bla_{GES} etc.), carbapenemases (bla_{NDM}, bla_{OXA-48}, bla_{KPC}, bla_{VIM}, bla_{OXA-23}, bla_{OXA-24}, bla_{OXA-72} etc.), vancomycin resistance genes (vanA, vanB). The presence of transposons, integrons and genomic islands harboring ARGs was observed as well in certain cases related to heavy metal resistance genes (mercury) and biocides tolerance genes (oqx). The pangenome analyses of some A. baumannii strains revealed that the strains are related to the globally disseminated high-risk ST1 and ST2 clones.

Conclusions. The RADAR study revealed not only the transmission of clinically relevant ESKAPE pathogens to the environment via wastewater network, but the main presence amongst the resistant bacteria of the high-risk clones resistant to last resort antibiotics. These findings could represent a cornerstone of the improvement of the wastewater treatments, in order to reduce the number of antibiotic resistant bacteria and ARGs.

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