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Proceedings of The International VI Congress on Nanoscience and Nanotechnology ICNN 2025

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Universidad de las Fuerzas Armadas - ESPE

February 06 - 07, 2025

ABSTRACTS

Acknowledgements

We would like to thank all the contributors, authors, and reviewers who participated in this edition of ICNN2025. Their efforts made this congress a great success. All presentations that are accepted, registered, and presented will be published in the conference book with the ISBN.

We also extend our sincere gratitude to the Universidad de las Fuerzas Armadas - ESPE for providing exceptional infrastructure and unwavering support through CENCINAT. Their contributions have been instrumental in the successful organization and execution of this event.

Letter from the Editor

Proceedings of The International Congress on Nanoscience and Nanotechnology ICNN2025

Universidad de las Fuerzas Armadas ESPE February 06 - 07, 2025

It is an honour to present the Proceedings of the International Congress on Nanoscience and Nanotechnology ICNN2025, an event that reflects the growing impact of nanotechnology in Ecuador and its projection in Latin America. Nanotechnology has emerged as a fundamental field in science and technology, with applications ranging from health and energy to industry and sustainability. In this context, ICNN2025 is positioned as a key space for the dissemination of scientific and technological advances in the region.

Since the creation of the Centre for Nanoscience and Nanotechnology (CENCINAT) at the University of the Armed Forces ESPE in 2013, it has promoted the development of nanotechnology in Ecuador, strengthening research, training of human talent and collaboration with national and international institutions. This congress highlights the importance of generating scientific cooperation networks, facilitating the exchange of knowledge and experiences between researchers, academics, students and representatives of the productive sector.

The papers presented in this volume reflect the diversity and potential of nanotechnology in the region, addressing scientific and technological challenges with an impact on various areas of knowledge. Furthermore, these studies contribute significantly to the positioning of Ecuador as a benchmark in the development of emerging technologies.

We thank all participants, speakers, authors and collaborators for their invaluable contribution to this event. Their effort and commitment are fundamental to consolidate the growth of nanotechnology in Ecuador and Latin America, promoting scientific and technological development for the benefit of society.

We hope that these Proceedings will be a source of inspiration and knowledge for the scientific community and that they will foster new collaborations in the region and beyond.

Marbel Torres, Ph.D.
Editor-in-Chief, Proceedings of ICNN2025
Universidad de las Fuerzas Armadas - ESPE

Contents

PANELISTS 6 February 2025

1) Organic devices: OLEDs and beyond

Author: Marco Cremona, PhD.

Affiliation: Physics Department, Pontifical Catholic University of Rio de Janeiro, PUC-Rio
Rio de Janeiro, RJ 22453-970, Brazil.
e-mail: cremona@fis.puc-rio.br
ORCID: 0000-0003-1306-4639

Abstract: The research in organic semiconductors is a key element to boost the development of new devices enabling new commercial applications in the field of Organic Electronics (OE), such as the production of cold light for lighting environments and car panels, transistors, photovoltaic cells, sensors, and flexible devices. OLEDs, which derive their name from the organic molecules used to produce light through the phenomenon of electroluminescence, have been developed to the point that they have become a mainstream display technology for mobile devices and televisions. However, organic electroluminescence can also be used for applications beyond the more fascinating world of displays.

Organic Up-converter Devices (OUDs), for example, have attracted considerable research interest due to potential applications in optical communications, biomedical applications, night vision, biological imaging, telemetry and security. The OUD consists in a tandem structure with NIR sensitive organic photodetector (OPD) stacked in an efficient visible OLED. In the dark the device is in the off-state. When NIR light is absorbed by the PD, electron-hole pairs are formed. Under the appropriate bias, holes are driven into the OLED where they recombine with electrons injected from the cathode, thus leading to light emission.

OLEDs can be used also as flexible and biocompatible light sources for photodynamic therapy (PDT). The PDT mechanism is non-invasive treatment for surface lesions, such as human skin, which uses visible light to excite a photosensitizer (PS), which is a photosensitive drug. The PS molecule in its ground state can absorb a photon and pass to its excited state and, at the end of this process, reactive oxygen species, mainly singlet oxygen, are produced. The oxygen produced is reactive and can destroy nearby cells such as bacteria, fungi, and tumor cells.
In this presentation, we will describe the challenges and opportunities in the OLEDs applications described above.

2) Fabricación de supercapacitores

Author: Cristian Patricio Santacruz Terán, PhD.

Affiliation: Departamento de Física, Escuela Politécnica Nacional

Abstract: Global warming and river precipitation cycles have significantly reduced river flow in Ecuador. Given that rivers are the primary sources to produce potable water, it is essential to preserve their integrity. One of the main sources of river pollution is household wastewater, industrial waste, and hospital waste. Contaminants such as antibiotics, pigments, and various organic compounds can be treated through various purification processes. Photocatalytic degradation of contaminants in water using titanium dioxide is a practical alternative. However, the photocatalytic process is limited by the generation and recombination of electrical charges. In particular, only around 8% of the generated charges lead to a photocatalytic process, while the rest are lost in various physicochemical processes. Addition of graphene quantum dots to titanium dioxide enables the creation of np junctions that facilitate charge separation and increase the number of charge carriers available for photocatalysis. However, the synthesis methods provided in literature produce physisorption of graphene quantum dots. These physical bounds are weak, so the funtionalized material is unstable and thermal energy causes desorption of the quantum dots and generates further pollution. We have developed a synthesis method that allows for the chemisorption of graphene quantum dots onto titanium dioxide nanoparticles, increasing the efficiency of the photocatalytic process and reducing the desorption of the graphene quantum dots.

3) Nanopolymeric layers as a strategy to improve electron transport in photovoltaic devices

Author: Estefani Almache, PhD.

Affiliation: Escuela de Ciencias Fisicas y Nanotecnologias, Universidad Yachay Tech

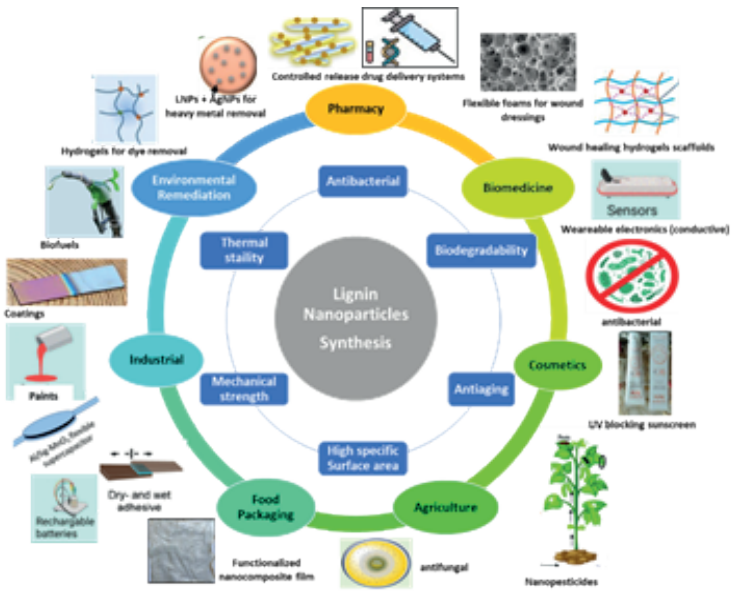
Abstract: Kesterite-based thin-film solar cells (Cu2ZnSnSe4) present a highly promising alternative for photovoltaic devices, thanks to their composition of earth-abundant elements, low-temperature fabrication processes, and exceptional optical absorption properties. Moreover, this absorber material offers a tunable bandgap energy ranging from 1 to 1.5 eV, making it an excellent candidate for use as either a top or bottom cell in tandem solar technologies when paired with transparent selective contacts. However, conventional kesterite devices typically incorporate a toxic CdS layer as the electron-selective contact, generating hazardous chemical waste that poses significant disposal challenges. This presentation investigates the potential of replacing CdS-based contacts with a stack of ZnO and aluminum-doped ZnO (AZO) films deposited via Atomic Layer Deposition (ALD). Additionally, the incorporation of a polyethylenimine (PEI) interlayer as a dipole layer is explored to enhance electrical contact performance. For the transparent back contact, an ALD-deposited V2Ox thin film is utilized atop an FTO conductive electrode. The fabricated kesterite solar cells demonstrate impressive photovoltaic parameters under front illumination, achieving a photocurrent density of 35 $mA \cdot cm^{-2}$, an open-circuit voltage of approximately 260 mV, and efficiencies reaching 3.5%. Under back illumination, the devices exhibit bifacial functionality, delivering a photocurrent density of 5.3 $mA \cdot cm^{-2}$, an open-circuit voltage of 160 mV, and an efficiency of 0.3%. These results highlight the potential of the proposed structure for advancing bifacial solar cell technologies.

4) Sustainable Nanolignins from biomass/bioresidues: Synthesis, properties, performance and applications – Towards Innovation in Value Chain and Circularity

Author: Lourdes M. Orejuela, PhD.

Affiliation: Profesora emérito del Departamento de Ingeniería Química del Colegio Politécnico, Universidad San Francisco de Quito.

Abstract: This research objective is to highlight the nanolignins or lignin nanoparticles (LNPs) as promising nanoparticles derived from lignin, the second most abundant biomass and bioresidues natural polymer. The cross-linking polyphenolic network structure of lignins provides them with unique properties, and can be transformed into nano-scale particles. LNPs enhance properties such as high specific surface area, thermal stability, biodegradability, and mechanical strength; enabling their performance in functional nanocomposites. LNPs display compatibility with other polymers, and exhibit antioxidant and stabilization capabilities. LNPs applications range from pharmacy; cosmetics; biomedicine; agriculture; food packaging; industrial (adhesives, binders, dispersants, coatings, paints, biosensors/bioimaging); energy (biofuels, energy storage materials); to environmental remediation (heavy metal and dye absorption).



Graphical abstract: Sustainable Nanolignins Synthesis, properties, performance and applications – Towards Innovation in Value Chain and Circularity.

5) Towards the application of photocatalytic materials based in BixOyIz for wastewater treatment

Author: Miguel Quishpe, MSc.

Affiliation: Regional Amazonian University Ikiam

Abstract: Water pollution is a major environmental concern in contemporary society. As the global population grows, new water contaminants arise, thus posing additional threats to the protection and conservation of this vital resource. Thus, our research has taken up the challenge of providing clean water using BiOI micro/nano photocatalysts activated by visible light as a tool to degrade and inactivate the water pollutants. In these sense, BiOI flower-like microspheres were synthetized for the degradation of chemical pollutants and waterborne microbial pathogens. Then, the prepared sample was first characterized using a set of instrumental techniques, such as x-ray diffraction, scanning electron microscopy, energy-dispersive x-ray spectroscopy, and transmission electron microscopy. The characterization results reveal the successful preparation of BiOI with a flower-like morphology. The photocatalytic tests showed that BiOI microspheres could degrade and inactivate up to 90% of Bisphenol A and cyanobacteria, respectively. Moreover, in presence of BiOI flower-like microspheres the number of bacteria decreased from 107 to 106 cfu/mL. The results showed that BiOI photocatalysts could be excellent candidates for the removal and inactivation of contaminants of emerging concern present in water effluents without cause a negative impact on the aquatic life and human health.

6) Modified Natural Diatomite with Metallic Nanoparticles and Its Environmental Potential

Author: Sarah Briceño and Gema Gonzalez

Affiliation: School of Physical Sciences and Nanotechnology. YachayTech University – Ecuador.

Abstract: Natural diatoms are currently a topic of interest for several applications due to their facilities, low cost, and biocompatibility. In our laboratory, we work on the chemical modification of diatoms Aulacoseria genus microalgae derived biosilica from Guayllabamba - Ecuador, decorated with metallic nanoparticles to study the in vitro loading and release properties for their potential use in agriculture. The decoration and structural properties of the diatoms will be confirmed using Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), Raman spectroscopy, and Magnetometry. We follow the In-vitro loading and release using Ultraviolet-Visible Spectroscopy (UV–vis). The advantage of this work is the control of the structural and optical properties of diatoms decorated with metallic nanoparticles for their potential use in agriculture.

7) Antimicrobial Activity of Chitosan Biofilms Modified with Copper Nanoparticles

Authors: Valverde-Durán[1,2]*,Carlos Cuenca-Jumbo[1], Bryan Pardo-Castillo[1], Víctor H. González[1], Silvana G. Manzanares[1], Alexis Debut[3]

Affiliation:
[1]Faculty of Chemical and Health Sciences, Universidad Técnica de Machala, Ecuador
[2]Department of Applied Chemistry-POLYMAT, Universidad del País Vasco, España
[3]Center for Nanoscience and Nanotechnology, Universidad de las Fuerzas Armadas, Quito-Ecuador
*Corresponding author: svalverded@utmachala.edu.ec

Abstract: To address antibacterial resistance, the synthesis of chitosan biofilms modified with copper nanoparticles (CuNPs) was proposed, utilizing the antimicrobial properties of these materials. In the first stage, the co-precipitation method was implemented to synthesize copper nanoparticles from solutions of 0.5 M Copper(II) Sulfate ($CuSO_4$), 0.2 M ascorbic acid ($C_6H_8O_6$), 3 mM sodium citrate ($Na_3C_6H_5O_7$), and 1 M sodium hydroxide (NaOH).
In the next stage, the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of CuNPs were determined using the microdilution method, resulting in an MIC of 1500 µg/mL and an MBC of 3000 µg/mL. Chitosan biofilms were synthesized using a sol-gel method and subsequently modified by adding CuNPs at the determined MBC.
For the microbiological study, Pseudomonas aeruginosa ATCC 10145 was used, employing the agar diffusion sensitivity technique. The results showed that the incorporation of copper nanoparticles into the chitosan biofilms enhanced their antimicrobial effect, achieving an inhibition diameter of 17.33 mm in the modified biofilms.
In conclusion, the developed material exhibited antimicrobial activity against Pseudomonas aeruginosa and was successfully synthesized, as evidenced by its characterization.

8) Unraveling viruses as nanosystems: Insights from Dengue and Zika Viruses through multiscale simulation techniques and artificial intelligence

Author: Miguel Ángel Méndez, PhD.

Affiliation: Schola Smart BioLab

Abstract: The exploration of viruses as nanosystems presents a significant challenge due to their intricate nature and hierarchical organization. In recent years, researchers have turned to multiscale simulation techniques and artificial intelligence methods to better understand these complex systems, with promising results in the study of Dengue and Zika viruses. In the case of Dengue and Zika viruses, multiscale simulation techniques and machine learning have been instrumental in understanding their behavior and properties.

By leveraging these methods, we have been able to identify influential residues in the NS2B-NS3 protease, a critical component in the DENV replication process. Furthermore, these techniques have enabled the study of the NS2b cofactor in ZIKV, revealing its significant role in the function and stability of the ZIKV NS3 protease domain. The utilization of computational biology techniques not only aids in understanding virus behavior but also provides a framework for analyzing nanosystems and understanding microbial behavior. Moreover, these methods can help in the computer-aided design of nanostructures for biotechnological and medical applications. As simulation techniques continue to evolve, researchers can expect to gain even more valuable insights into the behavior and properties of complex nanosystems, ultimately leading to advancements in nanotechnology and biomedical applications.

PANELISTS 7 February 2025

1) Engineering micro-arrays for the fast detection of pathogenic bacteria

Author: Yoann Roupioz, PhD.

Affiliation: Senior Researcher, French National Center for Scientific Research

Abstract: Microbiological analyses are carried every day worldwide to ensure food safety and healthcare. In these domains, the main challenge remains the fast specific detection of pathogens, present at very low (few bacteria per gram or ml) in the sample.
The standard microbiological protocol for bacterial detection in agronomic fields remains the microbial culture on selective media, which may take days to identify pathogens and specifically confirm their presence in the sampled foodstuff. Such delay is mainly due to the requirement of an enrichment phase allowing bacterial amplification before running the characterization assay. This time lag is a real bottleneck for setting up more performing and cheaper assays. Besides food safety, similar issues are also shared for the diagnosis of bacterial infections, leading to sepsis. The main differences are the fact that samples (mostly blood) from healthy patients are sterile and that, in case of sepsis, even less bacteria might be present in 20-50 millilitres of blood. But once again, the time lap required for bacteria detection/identification is crucial. Thus, there is a strong need to develop new techniques to identify pathogenic bacteria in a shorter time.
To achieve this goal, Surface Plasmon Resonance imaging (SPRi) technology has been successfully used for the specific detection of bacterial populations growing on microarrays functionalized with antibodies targeting bacterial strains [1] (Listeria, Salmonella, E. coli, Cronobacter, etc). This strategy of simultaneous bacterial growth monitoring and bacterial strain specific detection enabled the detection of only few bacteria per millilitre, within few hours. Interestingly, the time-delay is directly linked to the bacterial concentration of the processed sample and allows quantitative assessment of the initial concentration by comparison to calibration experiments [2]. Our quantitative results are consistent with the expected doubling time of bacteria reported in the literature. More recently, we also engineered peptide microarrays for the universal detection of bacteria (presence/absence), without any prerequisite on the identity of the contaminating bacteria. Interestingly, this peptic based probing strategy gave access to new insights regarding bacteria/surfaces interactions [3].
All these aspects will be presented in this talk, along with recent references published in the literature.

References:

[1] Mondani et al., J Appl Microbiol. 2014 Aug;117(2):537-46. doi: 10.1111/jam.12522; Mondani et al., Lett Appl Microbiol. 2016 Jan;62(1):39-46. doi: 10.1111/lam ; Morlay et al., Lett Appl Microbiol. 2016 Jun;62(6):459-65. doi: 10.1111/lam.12570
[2] Bouguelia et al., Lab Chip. 2013 Oct 21;13(20):4024-32. doi: 10.1039/c3lc50473e
[3] Pardoux et al., Talanta. 2019 Oct 1;203:322-327. doi: 10.1016/j.talanta.2019.05.062.

2) An Atomic Force Microscopy study from single particles to cells: the case of Extracellular vesicles

Author: Pietro Parisse, PhD.

Affiliation: Istituto Officina dei Materiali / Elettra Sincrotrone Trieste S.C.p.A.

Abstract: Extracellular vesicles (EVs) are tiny lipid-bilayers enclosed containers sending messages through their cargo and surface markers from one cell to another. Initially considered as "trash", they are getting more and more recognized as intercellular mediators and actual players in the intercellular communications and extracellular matrix remodeling [1]. Due to their heterogeneity in size (from 30 nm to micrometer scale) and in origin (endosomal or from cell membrane budding) their isolation and characterization are not yet standardized hampering their actual use in diagnosis and/or therapy. Among the different characterization techniques of EVs, Atomic Force Microscopy starts to be a quite common tool for the direct visualization of single vesicles and for the evaluation of size distribution [2]. Moreover combined with force-spectroscopy can provide nanomechanical characterization helping in distinguishing vesicles from other co-isolated particles and in defining peculiar properties of specific subpopulations of EVs. Here we will show how AFM can turn useful not only for the single vesicle studies, but also for the investigation of the interaction of EVs with biomimetic membranes (resembling the plasma membrane) [3], giving morphological and structural insights on the fusion mechanisms, and on the functional effects of EVs on biomechanical properties of the recipient cells

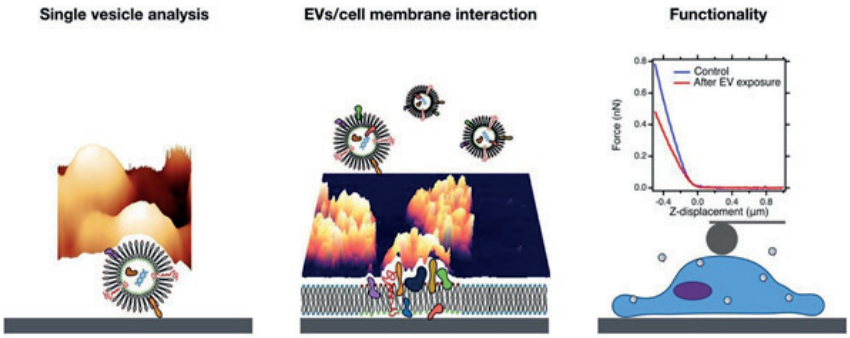


Figure 1: Schematic of the different experiments where Atomic Force Microscopy is employed to study different properties of EVs. (Left panel) Three-dimensional 100nmx100nmx30nm Atomic Force Microscopy micrograph of EVs deposited on oxygen-plasma cleaned glass. Measurements performed in PBS buffer in AC mode (Olympus BL-AC40TS cantilever, spring constant: 0.1 N/m, 10 nm radius of curvature). Central panel: Three-dimensional 2µmx1µmx15nm Atomic Force Microscopy micrograph of EVs interacting with a DOPC supported lipid bilayer on mica. Measurements performed in PBS buffer in AC mode (Olympus BL-AC40TS cantilever, spring constant: 0.1 N/m, 10 nm radius of curvature). Right panel: Force-distance curves of MDA-MB-231 cells before (blue line) and after (red line) EV exposure. Measurements performed in PBS buffer with a CSG01-NTMDT tipless cantilever (spring constant: 0.004 N/m) with a glued silicon bead of 10 µm in diameter.

References:

[1] M. Mathieu, et al. Nat Cell Biol 2019, 21, 9; [2] P. Parisse et al. Eur. Biophys. 2017, 46, 813, [3]F. Perissinotto et al., Nanoscale 2021 13, 5224 [4] Senigagliesi et al., Nanomedicine NMB, 2022 44, 102582

3) Metallic nanoparticles in Biomedicine

Author: Fernanda Pilaquinga, PhD.

Affiliation: Pontificia Universidad Católica del Ecuador, Facultad de Ciencias Exactas y Naturales, Escuela de Ciencias Químicas, mfpilaquingaf@puce.edu.ec

Abstract: Nanomedicine has emerged as an innovative discipline with a significant impact on the diagnosis, treatment, and prevention of various diseases, especially in the viral field. In this context, metal nanoparticles (NPs), such as gold (AuNPs), silver (AgNPs), and superparamagnetic iron oxide (Fe3O4NPs), have shown great potential due to their unique molecular properties and ability to interact with biological structures.

A recent study evaluated the antiviral properties of AuNPs and AgNPs, comparing them with sodium borohydride-prepared control nanoparticles. Using PhiX174 and Phi6 bacteriophages as models for SARS-CoV-2, NPs were synthesized using Solanum mammosum L. (Sm) extracts, a plant known for its moderate antiviral activity. The results showed that AuNPs-Sm, with an average size of 5.34nm, inactivated 99.30% of the virus at a concentration of 1 mg/ml, while AgNPs-Sm, which were larger (15.92 nm), achieved 99.94% viral inactivation at 0.01mg/ml. Additionally, both types of nanoparticles were less toxic than their metal precursors, highlighting their effectiveness as models for studying SARS-CoV-2.

Another approach in nanomedicine involves the use of Fe3O4NPs coated with DNA (DNA-Fe3O4NPs) as non-viral vectors for gene delivery into human cell lines. These nanomaterials, derived from biological sources such as banana (Musa sp.), demonstrated excellent colloidal stability, with an average size of 14.69 nm. Successful internalization of the NPs into the cytoplasm and nucleus of the cells was confirmed by confocal microscopy. Cytotoxicity assays revealed that the DNA-Fe3O4NPs had no harmful effects on human cells, suggesting their biocompatibility and potential in gene therapy applications.

Finally, AgNPs have also been used in the control of disease vectors such as dengue, chikungunya, and Zika. A study on Ambrosia arborescens extract and green-synthesized AgNPs demonstrated significant larvicidal activity against Aedes aegypti larvae. AgNPs showed higher toxicity compared to the plant extract, suggesting that these nanoparticles could serve as an effective and eco-friendly alternative in mosquito vector control.

4) Gold-based nanosystems for trageted nuclei acid delivery and sesing in cancer cell lines

Authors: Margarita Sánchez-Domínguez[1], Jessica Victoria Martínez-Saraoz[1], Maria Edith Navarro-Segura[1], Ana María Pinilla-Torres[1], Samuel Longoria-García[2], Hugo Leonid Gallardo-Blanco[3], Celia Nohemí Sánchez-Domínguez[2]

Affiliation:
[1]CIMAV S.C. Subsede Monterrey, Alianza Norte 202, Parque PIIT, Apodaca 66628, Nuevo Léon, México.
[2]Departamento de Bioquímica y Medicina Molecular. Facultad de Medicina, Universidad Autónoma de Nuevo León, Monterrey 64460, México.
[3] Servicio de Oncología, Centro Universitario Contra el Cáncer (CUCC), Hospital Universitario ¨Dr. José Eleuterio González¨, Universidad Autónoma de Nuevo León, Monterrey 64451, México.

Abstract: The present contribution lies in the area of Nanomedicine. Our research is devoted to gold nanosystems for cancer therapies and diagnosis. By developing gold nanosystems with the appropriate composition, shape, size, and biofunctionalization, we aim for the detection of prostate cancer cells (LNCaP cell line) using a Surface Enhanced Raman Spectroscopy (SERS) based immunoassay; as well as for therapies based on targeted nucleic acid delivery towards cancer cell lines with HER2 overexpression such as certain breast cancer tumor cells.
For the development of the gold nanosystem for targeted nucleic acid delivery, it was first necessary to design a strategy for the modification of branched polyethyleneimine (b-PEI). This cationic polymer is well known for its transfection capabilities, as well as its proton sponge properties which are very interesting for targeting cancer cells; however, it is also well known that the use of PEI is limited due to its cytotoxicity. Thus, b-PEI was modified with a natural polysaccharide, namely mesquite gum (MG), via carboxymethylation of the latter followed by a coupling reaction to form an amide bond between the carboxymethylated gum and b-PEI [1]. The obtained PEI-MG copolymer retained the proton sponge properties of b-PEI, and it was able to also act as a reducing and stabilizing agent for the formation of gold nanoparticles (AuNPs) with an appropriate size (around 12 nm) and positive charge (+31 mV). Afterwards, a negatively charged conjugate made of HeA2_3 aptamer and 4-arm-PEG maleimide was prepared and added to the positively charged AuNPs, to form the final nanosystem bearing the AuNps stabilized with PEI-MG, together with the HeA2_3 aptamer and PEG chains. The resulting nanosystem was evaluated for hemocompatibility and citotoxicity. Hemolysis assay was carried out according to the ASTM F756-13 norm, resulting in non-hemolytic character at concentrations equal or lower than 1 ppm and slightly hemolytic at 2.5 ppm.

Cytotoxicity was assessed following the ISO 10993-5 norm by means of the MTT assay; the nanosystem was cytotoxic to cancerous cells HCC1954 which overexpresses HER2 at 0.5 and 1 ppm; whereas at these concentrations it was not cytotoxic to healthy VERO CCL-81 cells.
Regarding the proposed SERS-tag immunoassay, multiarm AuCu nanostars were synthesized, and a methodology to functionalize them with the Raman reporter 4- aminethiophenol as well as with EPCAM antibody was developed (AuCu nanostar SERStag).
We were able to distinguish between PC-3 and LNCaP prostate cancer cells, thanks to the high EPCAM antibody expression of the latter and nule expression of the former.

The obtained results demonstrate the potential of the developed gold-based nanosystems for cancer therapies and diagnosis.

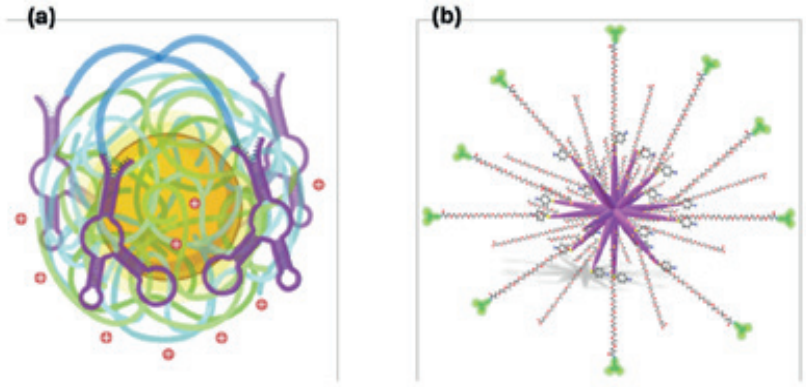


Figure 1: (a) AuNPs stabilized with PEI-MG and functionalized with HeA2_3 aptamer / 4-arm-PEG maleimide conjugate for targeted nucleic acid delivery. (b) AuCu nanostar SERS-tag functionalized with 4-aminethiophenol and EPCAM antibody.

References:

[1] Pinilla-Torres, A. M., Carrión-García, P. Y., Sánchez-Domínguez, C. N., Gallardo- Blanco, H., & Sánchez-Domínguez, M. (2021). Modification of branched polyethyleneimine using mesquite gum for its improved hemocompatibility. Polymers,
13(16), 2766.

5) Sol-gel synthesis of tailored nanoparticles and nanostructures

Author: Sara Aldabe Bilmes, PhD.

Affiliation: Instituto de Química, Física de los Materiales, Medioambiente y Energía (INQUIMAE, CONICET), DQIAQF, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Plaza Gregorio Klimovsky, Ciudad Universitaria, C1428EHA-Ciudad Autónoma de Buenos Aires, Argentina.

Abstract: The rational synthesis of single, hybrid or composite nanoparticles and nanostructures involves knowing the reaction path and its perturbations to the synthesis variables.
Here I will present the sol-gel synthesis of tailored SiO2 nanoparticles and nanostructures in aqueous solution.
Sol-gel processes have the advantage of being scalable and operating at low temperatures, which facilitates the construction of hybrid organic-inorganic materials, particles or mesoporous films. The latter give rise to a collection of nano-reactors where confined chemical reactions can be performed, or molecules can be confined for subsequent delivery. This mild synthesis allows also to combine biological cells with silica hydrogels giving rise to materials with biological activity. Finally, I will present a case study where we try to understand the reaction mechanism using machine learning.
Our aim is to design materials for different purposes, such as decontamination of water with sun-light, bio-remediation and bio-sensors, as well as nanovehicles for targeted delivery of molecules into specific cells.

6) Optimized Synthesis of Single-Walled Carbon Nanotubes via Iron(III)

Authors: Johnny Chimborazo[1], Luis Corredor[2], Johanna Pilicita[1]

Affiliation:
[1]School of Physical Sciences and Nanotechnology, Yachay Tech University, Urcuquí, Imbabura 100115, Ecuador
[2]School of Chemical Sciences and Nanotechnology, Yachay Tech University, Urcuquí, Imbabura 100115, Ecuador

Abstract: Single-walled carbon nanotubes (SWCNTs) are renowned for their exceptional mechanical, electrical, and thermal properties, which position them as pivotal materials for advanced applications in nanotechnology. This study investigates the synthesis of SWCNTs using a catalyst prepared from iron(III) nitrate and ethanol, combined with a negative photoresist containing synthetic resin polyisoprene. Three deposition techniques for catalyst placement on silicon substrates were evaluated: airbrush spraying, spin coating, and sonication. Among these, the spin coating method demonstrated superior performance, producing the most uniform catalyst distribution, which translated to higher-quality SWCNTs with improved yield. Raman spectroscopy was employed to characterize the synthesized SWCNTs, focusing on structural quality and nanotube formation. Key spectral features, including the G-band and D-band ratio (I_G/I_D), confirmed the synthesis of SWCNTs and highlighted variations in defect density across the deposition methods. This work emphasizes the critical role of deposition technique in determining the quality and efficiency of SWCNT synthesis, paving the way for enhanced fabrication processes in nanomaterials research.

7) Polymeric nanoparticles-in-microparticles system for the targeted treatment of lung diseases

Authors: Alison Tatiana Madrid Sani[1,2], Khellida Loiane V Ramos Rocha, Patrícia Léo[1], Natália Neto Pereira Cerize[1], Maria Helena Ambrosio Zanin[1], Valker Araújo Feitosa[1,2], Marcelo Henrique da Cunha Chaves[3], Helvécio Vinícius Antunes Rocha[3], Carlota de Oliveira Rangel-Yagui[2]

Affiliation:
[1]Bionanomanufacturing Center, Technological Research Institute, 05508-901 São Paulo, Brazil;
[2]Department of Biochemical and Pharmaceutical Technology, University of São Paulo, 05508-000 São Paulo, Brazil.
[3]Laboratory of Micro and Nanotechnology – Farmanguinhos, FIOCRUZ, Av. Brasil 4036, Rio de Janeiro, 21040-361, Brazil
Corresponding author's email: alisonmadrid@usp.br

Abstract: The COVID-19 pandemic has raised the concern regarding diseases of respiratory system and oral inhalation stands out as an attractive non-invasive route of administration for pulmonary diseases such as chronic bronchitis, cystic fibrosis, COVID-19 and community-acquired pneumonia. In this context, we encapsulated azithromycin and remdesivir in polycaprolactone nanoparticles with phospholipids rich in dipalmitoylphosphatidylcholine and further produced a fine powder formulation by spray-drying with monohydrated lactose. Nanoparticles were obtained by the solvent emulsion-evaporation technique and subsequently characterized by dynamic light scattering, corresponding to particles of 195-228 nm and polydispersity index in the range of 0.047-0.147. Nanoparticles-in-microparticles system were obtained by spray-drying at different inlet/outlet temperatures, atomizing air flow, aspirator air flow and feed rate, resulting in a maximal process yield of 63% and an encapsulation efficiency of 83%. Excipients and the dry powder formulations were characterized in terms of morphology, chemical structure, crystallinity, thermal analyses and particle size by SEM, FTIR, XRD, DSC/TGA and Laser Light Diffraction. The results indicated spherical particles with 90% at 4.06 μm, an adequate size for pulmonary delivery. NGI performance confirmed good aerosolization characteristics of the fine powders with MMAD values in the inhalable range (< 10μm). Microbiological assays (diffusion disc) showed that the formulation preserves the azithromycin antimicrobial effect against Staphylococcus aureus and Streptococcus pneumoniae strains, with halos above 18 mm. In addition, no formulation-related cytotoxicity was observed against the human cell lines BEAS-2B (lung epithelial), HUVEC (endothelial) and HFF1 (fibroblasts).

a) Sustainable Production of Silver Nanoparticles via Guayusa Extract as a Bio-Reducing Agent

Authors: Vincent Noguera[1], Daheny López[1], Johnny Chimborazo[1]

Affiliation: [1]School of Physical Sciences and Nanotechnology, Yachay Tech University, Urcuquí, Imbabura 100115, Ecuador

Abstract: There is global interest in silver nanoparticles (AgNPs) due to their antibacterial properties, despite conventional chemical synthesis methods exhibiting a broad range of toxicity in humans and a negative environmental impact. To mitigate these issues, biosynthesis (green synthesis) of metal nanoparticles is proposed as a cost-effective and environmentally friendly alternative. Illex Guayusa, known for its medicinal properties, contains caffeine, antioxidants, theobromine, and amino acids, which can reduce silver ions to produce AgNPs. In this study, AgNPs were prepared using an eco-friendly method with Illex Guayusa plant extract serving as both a reducing and stabilizing agent. Water, ethanol, and isopropanol were used as solvents. The AgNPs were characterized using XPS and UV-Vis spectroscopy. The results confirmed the presence of nanoparticles with all solvents used, with isopropanol yielding the highest quantity of AgNPs. The XPS spectra confirmed the presence of both silver oxide and metallic silver. Future investigations will analyze the antimicrobial and antifungal properties of AgNPs synthesized using Illex Guayusa.

b) Influence of pre annealing treatment to improve DW-CNT synthesis on steel substrate

Authors: Fausto Chicaiza Acevedo[1], Pedro Zamora[1], Rosa Almache Hernandez[1]

Affiliation: [1]School of Physical Sciences and Nanotechnology, Yachay Tech University, Urcuquí, Imbabura 100115, Ecuador

Corresponding author's email: fausto.chicaiza@yachaytech.edu.ec

Abstract: Carbon nanotubes are materials with potential to improve and reinforce the properties of other compounds, as well as the ability to revolutionize the actual technologies. The increasing demand for advanced materials in industries such as electronics, aerospace, and energy storage has highlighted the need for scalable methods for producing these nanostructures. In other hand, one of the main challenges lies in scaling up their synthesis at an industrial level using viable and simple processes. This research develops and validates a feasible method to synthesize double-walled carbon nanotubes (DWCNTs) and multi-walled carbon nanotubes (MWCNTs) using nickel (Ni)-coated steel substrates; additionally, the aim is to optimize the growth conditions on the quality of the nanotubes. In this context, nickel-coated steel, deposited by sputtering, has been used as a substrate for the growth of double-walled carbon nanotubes (DW-CNTs). The synthesis of these nanostructures was carried out by the chemical vapor deposition (CVD) technique, using acetylene as precursor gas in an inert atmosphere at a temperature of 750 °C. A comprehensive characterization was performed by Raman spectroscopy to analyze the structural properties of the synthesized nanotubes. The experimental results revealed a successful growth of double-walled nanotubes (DWCNTs). The growth of carbon nanotubes shows distinctive patterns in the RBMs, the D band, the G band, and the 2D band in the Raman spectrum, where each parameter of growing shows a different behavior in the RBMs and the bands .A purification process implemented at 400 °C in an atmospheric pressure air environment proved highly effective, ensuring the removal of impurities and obtaining better quality nanotubes, as evidenced by an improvement in the G band, indicating reduced defects in the carbon nanotubes. These findings demonstrate the feasibility of the proposed synthesis method for various applications. The analysis highlighted the effectiveness of the proposed approach, establishing a promising foundation for the scalable production of high-quality DWCNTs. The optimized process parameters and demonstrated quality control measures suggest that this method could bridge the gap between laboratory-scale synthesis and industrial production requirements, potentially advancing the implementation of carbon nanotubes in various technological applications.

c) Synthesis and Computational Modeling of Carbon Quantum Dots: Linking Experimental Observations to Electronic, Vibrational, and Optical Properties

Authors: David Lara[1], Marlene Puchaicela[1], Johnny Chimborazo[1]

Affiliation: [1]School of Physical Sciences and Nanotechnology, Yachay Tech University, Urcuquí, Imbabura 100115, Ecuador

Abstract: Carbon Quantum Dots (CQDs) hold significant promise for diverse applications such as bioimaging, sensing, and optoelectronics. Understanding their structure-property relationships is crucial for optimizing these properties for real-world applications. This research integrates experimental characterization with computational modeling to explore the electronic, vibrational, and optical properties of CQDs.

Goals of the Research:

- Synthesis of CQDs: Fabricated from watermelon seeds using a hydrothermal method.
- Experimental Characterization: Detailed analysis of structural, optical, and vibrational properties using techniques like UV-Vis, FTIR, Raman, XPS, AFM, and TEM.
- DFT Simulations: Computational modeling of the electronic, vibrational, and optical properties, emphasizing how size, surface functional groups, and structural defects modulate these properties.
- Validation: Comparing theoretical predictions with experimental data,especially UV-Vis absorption spectra, to validate computational models.

Scope of the Research:

This study investigates CQDs derived from watermelon seeds, focusing on how their size, surface functional groups, and structural defects influence their electronic, vibrational, and optical properties.

Limitations of the Research:

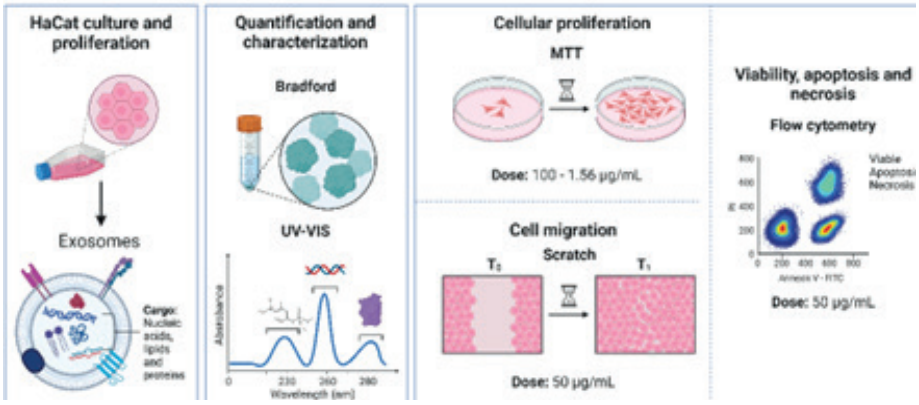
- Simplified DFT Models: The models may not fully account for the complex nature of experimental CQDs.
- Synthesis Variability: Differences in synthesis could lead to variations in CQD properties.
- Environmental Factors: Theoretical models do not fully capture experimental conditions such as temperature or environmental effects.

d) Cellular Exosomes: Therapeutic potential in wound healing and angiogenesis stimulation

Authors: Fernanda Toscano[1], Marbel Torres Arias[1,2]

Affiliation:
[1]Departamento de Ciencias de la Vida, Laboratorio de Inmunología y Virología, GISAH, Universidad de las Fuerzas Armadas ESPE, Av. Gral. Rumiñahui s/n, P.O. Box 171-5-231B, Sangolquí, Ecuador.
[2]Centro de Nanociencia y Nanotecnología, Universidad de las Fuerzas Armadas ESPE, Av. Gral. Rumiñahui s/n, P.O. Box 171-5-231B, Sangolquí, Ecuador.

Abstract: Exosomes, nanoscale extracellular vesicles (30-150 nm), function as intercellular messengers, carrying a diverse of biomolecules that modulate cellular activity, particularly in tissue repair. Their unique properties position them as a promising therapeutic tool for chronic wounds and other skin conditions, with significant potential nanomedicine applications.
This study, exosomes were isolated from HaCaT cells and characterized. Protein quantification via the Bradford assay revealed an average concentration of 929.60 µg/µL. UV-VIS spectroscopy identified characteristic peaks at 280 nm (protein) and 260 nm (nucleic acid). Functional assays demonstrated that exosomes influence HaCaT cell behavior in a time- and dose-dependent manner. The MTT assay validated cell viability, while the Scratch assay demonstrated enhanced cell migration, indicating wound-healing potential. Additionally, flow cytometry analysis showed that exosomes do not disrupt apoptosis rates, ensuring cellular homeostasis.
In conclusion, HaCaT-derived exosomes promote cell proliferation and migration, while preserving the apoptosis rate of keratinocytes and fibroblasts. These findings highlight their potential as promising nanoscale candidates for drug delivery, immunotherapy, and precision wound therapies. Nevertheless, the study is currently limited to in vitro experiments. Further in vivo studies are essential to confirm the therapeutic efficacy of these exosomes in clinical applications.



e) Structural analysis of bacterial membrane response to silver-doxycycline nanoparticles by atomic force (AFM)

Authors: Oscar Enríquez[1], Yolanda Angulo[1], Marcelo Grijalva[1]

Affiliation: [1]Centro de Nanociencia y Nanomedicina CENCINAT Universidad de las Fuerzas Armadas ESPE, Av. Gral. Rumiñahui s/n, P.O. Box 171-5-231B, Sangolquí, Ecuador.

Abstract: Antimicrobial resistance (AMR) due to genetic mutations or inadequate antibiotic usage is increasingly prevalent in clinical scenarios and in the community. Hence the importance of finding new methods to combat these pathogens, the most promising candidates at present are Silver nanoparticles have emerged as a novel option to combat these pathogens, and the study of the response of the bacterial membrane to these particles provide important information regarding potential mechanisms of antibacterial activity. Atomic force microscopy (AFM) has proven to be a powerful tool to advance our understanding of the effects of biological membranes disruption as it provides important physical information about them, having quantifiable data such as Young's modulus or roughness that allows a more reliable comparison of the damages occurred after an antibiotic treatment.

We aimed to evaluate the effect of silver nanoparticles conjugated with doxycycline (AgNPs-DOX) in the bacterial membrane of clinical strains of Staphylococcus aureus by assessing physical parameters (roughness and Young's modulus) using atomic force microscopy.

a) Standardized protocols for isolation and extraction of microRNAs from plasma exosomes

Authors: Jonathan Trigueros[1], Ana Fletes[2], Iñaki Álvarez[3], Rosa Navarro[4,5], Jacqueline Noboa[3,4]

Affiliation:

[1]Carrera de Ingeniría en Nanotecnología. Centro Universitario de Tonalá, Universidad de Guadalajara, Guadalajara, México.

[2]Instituto de Investigación en Enfermería y Salud Traslacional. Departamento de Enfermería Aplicada. Centro Universitario de Ciencias de la Salud, Universidad de Guadalajara, Guadalajara, México.

[3]Departamento de Biología Celular, Fisiología e Inmnunología, Institut de Biotecnologia i Biomedicina. Campus de Bellaterra, 08193, Bellatera. Barcelona, España.

[4]Doctorado en Ciencias Biomédicas. Secretaría Académica. Centro Universitario de Ciencias de la Salud, Universidad de Guadalajara, Calle Sierra Mojada No. 950, Colonia Independencia, C.P. 44340. Guadalajara, Jal., México.

[5]UDG-CA-701. Inmunometabolismo en Enfermedades Complejas y Envejecimiento. Departamento de Biología Molecular y Genómica, Centro Universitario de Ciencias de la Salud, Universidad de Guadalajara, Calle Sierra Mojada No. 950, Colonia Independencia, C.P. 44340. Guadalajara, Jal., México.

Corresponding author's email: jacqueline.noboa2713@alumnos.udg.mx

Abstract: One of the ways to obtain microRNAs is through the isolation of exosomes. For this purpose, there are various methods that may require special techniques or expensive equipment due to the lack of simpler or cheaper methods. We will present our findings and observations of isolating exosomes by the precipitation method (commercial kit, CK) and size exclusion chromatography (SEC).

The isolation of exosomes by both methods makes use of cheap materials such as CK or SEC columns. The concentrations of microRNAs reflected a higher yield and less variability when isolating by SEC, while by CK lower and more variable concentrations were found. Regarding the purity values of microRNAs, greater purity was found when isolating by SEC than by CK. However, when it came to working, the CK method was much simpler and faster, while isolating by SEC was more laborious and time-consuming.

We hope that in the future this work will serve to explore the isolation of exosomes in other body fluids.

b) Green Synthesis of Metal Nanoparticles with Borojó (Borojoa patinoi) Extracts and Their Application in As Removal in Water Matrix

Authors: Erika Murgueitio Herrera [1,2],* , Gissela Jacome[2], Carina Stael[1], Geovanna Arroyo[1], Andrés Izquierdo[1], Alexis Debut[1], Patricio Delgado[3], and Gemma Montalvo

Affiliation:

[1]Centro de Nanociencia y Nanotecnología, Universidad de las Fuerzas Armadas ESPE, Av. Gral. Ruminahui s/n, Sangolquí P.O. Box 171-5-231B, Ecuador; castael@espe.edu.ec (C.S.); gvarroyo@espe.edu.ec (G.A.); padelgado2@espe.edu.ec (P.D.); arizquierdo@espe.edu.ec (A.I.); apdebut@espe.edu.ec (A.D.)

[2]Departamento de Ciencias de la Tierra y de la Construcción, Universidad de las Fuerzas Armadas ESPE, Av. Gral. Ruminahui s/n, Sangolquí P.O. Box 171-5-231B, Ecuador; gejacome2@espe.edu.ec

[3]Departamento de Ciencias Exactas, Universidad de las Fuerzas Armadas ESPE, Av. Gral. Ruminahui s/n, Sangolquí P.O. Box 171-5-231B, Ecuador

[4]Departamento de Química Analítica, Química Física e Ingeniería Química, Universidad de Alcalá, Ctra. Madrid-Barcelona km 33.6, 28871 Alcalá de Henares, Madrid, Spain; gemma.montalvo@uah.es

[5]Instituto Universitario de Investigación en Ciencias Policiales, Universidad de Alcalá, Libreros 27, 28801 Alcalá de Henares, Madrid, Spain

* Correspondence: esmurgueitio@espe.edu.ec

Abstract: The predominant aim of the current research was to generate a proposal for the removal of arsenic, a highly toxic pollutant, encountered within the Papallacta Lagoon in Ecuador. The average concentrations of As yielded ranges between 18 to 652 µg/L, through the use of metallic nanoparticles. Sampling was performed in the lagoon with their respective geographic locations and "in situ" parameters. Nanoparticles of Mn3O4 NPs, Fe3O4 NPs, and CuO NPs were synthesized at a 0.5 M concentration, using the precipitation method, and borojó (Borojoa patinoi) extract was added as an anti-caking agent as well as antioxidant. The nanoparticles were characterized by visible spectrophotometry, scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray diffraction (XRD), and Raman spectroscopy. After arsenic removal treatment using nanoparticles, a randomized experimental design of different concentrations (5mg/L, 10 mg/L, 25 mg/L, 50 mg/L, 100 mg/L, and 150 mg/L) was applied at laboratory level. The average diameter of Fe3O4NPs ranged from 9 nm to 36 nm, Mn3O4 NPs were 15–20 nm, and CuO NPs ranged from 25 nm to 30 nm. Arsenic removal percentages using Fe3O4 NPs with a concentration of 150 mg/L was 87%; with Mn3O4 NPs, the removal was 70% and CuO NPs of about 63.5%. Finally, these nanoparticles could be used in a water treatment plant for the Papallacta Lagoon.

c) Peptide-gold nanostar conjugates for site-specific photothermal treatment of breast and cervical cancer

Authors: Verónica Quilumba-Dutan[1] Clara Carreón-Álvarez[2] Swaroop Chakraborty[3], Eugenia Valsami-Jones[3], Gladis Labrada-Delgado[1] Rubén López-Revilla[4] and José Luis Rodríguez-López[1]†

Affiliation:
[1]Advanced Materials Division, Instituto Potosino de Investigación Científica y Tecnológica, San Luis Potosí, Mexico.
[2]Departamento de Ciencias Naturales y Exactas, Centro Universitario de los Valles, Universidad de Guadalajara, Guadalajara, Mexico.
[3]School of Geography Earth & Environmental Sciences, University of Birmingham, Birmingham, United Kingdom.
[4]Molecular Biology Division, Instituto Potosino de Investigación Científica y Tecnológica, San Luis Potosí, Mexico.

†Present address: Circ. Jardines de los Pinos, Valle de Jacarandas, San Luis Potosí, SLP, México.

Corresponding author's email: veronica.quilumba@ipicyt.edu.mx

Abstract: Breast and cervical cancer are the most diagnosed and major causes of cancer deaths in women. Cancer treatments include surgical tumor resection complemented by radiotherapy or chemotherapy, but these methods usually have severe side effects due to their low specificity. Current research aims to identify ligands targeting cancer-specific proteins to improve therapeutic selectivity for efficient and safer cancer treatments. Peptides are outstanding candidates for improving targeted cancer diagnosis and therapy due to their high specificity, low immunogenicity, rapid tissue penetration, stability, and ease of synthesis. Furthermore, by functionalizing peptides on the surface of multibranched gold nanoparticles (MBAuNPs), which exhibit photothermal properties, the system could be used as a potential tool in actively targeting thermal ablation of cancer. Herein, we report the development of the nanostructured system MBAuNPs@Pep12, constituted by MBAuNPs synthesized by a seed-mediated chemical method and dodecapeptides with high affinity to HeLa and MDA-MBA-231 (MDA) cancer cells identified by phage display technology and their affinity to cell-surface proteins assessed by molecular docking. MBAuNPs exhibited broad absorbance in the near-infrared (NIR) spectrum region, centered at 745 nm, suggesting heating capacity. The photothermal property was measured by irradiating MBAuNPs with an 808 nm NIR laser, which produced a temperature increase of □5 °C in phantom gels. Via phage display technology, 44 dodecapeptide sequences were identified and the dodecapeptide FKQDAWEAVDIR (P1) was selected as a potential ligand to target MDA and HeLa cancer cells since it appeared repeatedly during phage display sequencing, it showed specificity for both cell lines, and it contains the motif QDAWEAVDIR. The binding affinity between the 44 dodecapeptides and 9 potential cell-surface receptors in MDA and HeLa was analyzed using virtual screening. Through this method, we selected the peptides TYPYNLQVRHWT (P2) and FLSGCGGTAEAT (P3) as potential ligands. The three selected peptides P1, P2, and P3 were synthesized using microwave-assisted solid-phase peptide synthesis, purified using HPLC, and conjugated to MBAuNPs

via Michael´s addition reaction. Further studies include the evaluation of the internalization kinetics and uptake capacity of each MBAuNPs@Pep12 system using HeLa and MDA cells.

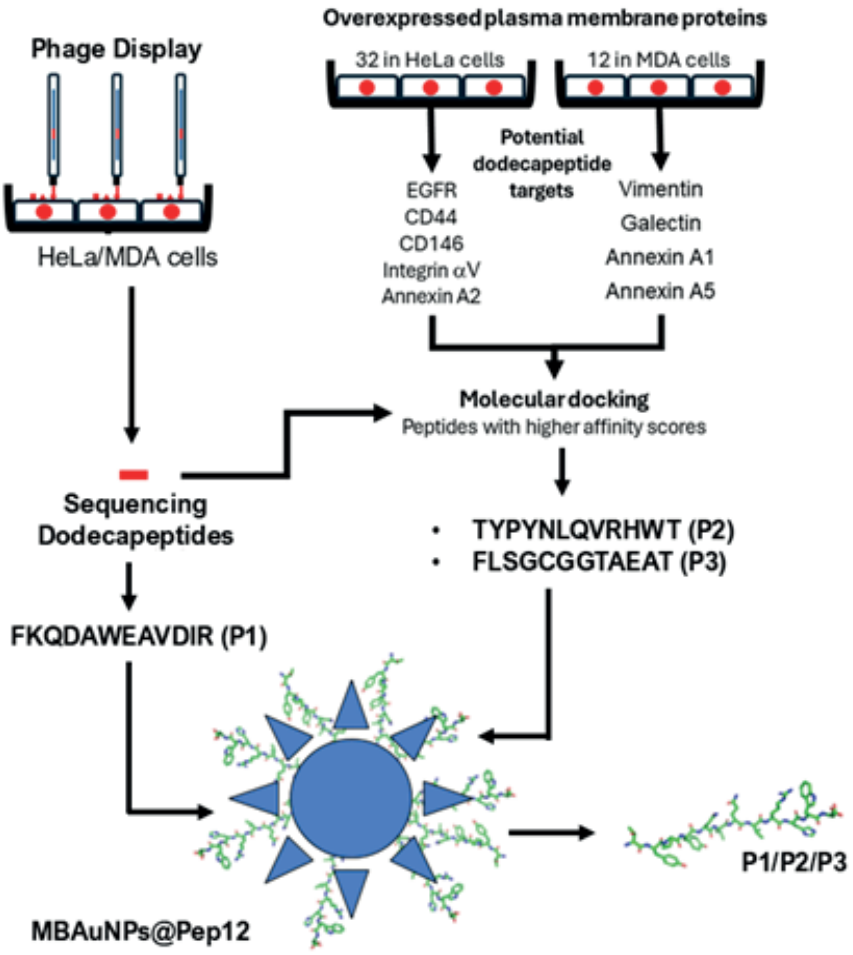


Figure 1. Systematic design of the MBAuNPs@Pep12 system

d) Impact of Calcination Temperature on the Formation of CuO Nanofibers

Authors: Nathaly Osorio[1], Rosa Almache[1]

Affiliation: [1]School of Physical Science and Nanotechnology, Yachay Experimental Technology Research University, Urcuquí-Ecuador

Corresponding author's email: nathaly.osorio@yachaytech.edu.ec

Abstract: Transition metal oxides stand out as some of the most promising materials, and are recognized for their low environmental impact, low toxicity, and good semiconducting properties. These characteristics make them ideal candidates for applications in sensors or devices, enabling the replacement of toxic and scarce materials. Indeed, metal oxide nanostructures became a novel technology and CuO nanostructures have gained significant attention for applications in multiple fields. In this context, this research explores the effect of calcination temperature on the formation of copper oxide (CuO) nanofibers. The synthesis of the nanofibers was carried out using PVP and copper acetate as precursors, employing the electrospinning technique under specific conditions (voltage: 5,84kV; flow rate: 0,5 ml/hr). During the process, good stability was achieved in the formation of the nanofibers, which were subsequently calcined at different temperatures (400 °C, 500 °C, 600 °C, and 700 °C). Raman analysis confirmed the formation of CuO starting at 400 °C, with three principals peaks around at 285cm-1, 600 cm-1 and 635 cm-1 respectively; with these results further supported by thermogravimetric analysis (TGA) in order to compare the weight loss of nanofibers, where was observed the total decomposition of the polymer at about 450°. The morphology of the calcined nanofibers was evaluated using atomic force microscopy (AFM), revealing that at temperatures below 500 °C, CuO grains do not adequately cluster, resulting in a non-uniform distribution. In contrast, at 600 °C, a more homogeneous distribution of CuO grains along the nanofibers was observed, in conclusion, it can be considered as optimal temperature for the CuO nanofibers formation. Additionally, a reduction in fiber diameter after calcination was detected, attributed to the evaporation of PVP, estimated to be approximately 1770 nm. Results obtained through FTIR and XRD analyses will be discussed in detail during the poster presentation.

e) Modelamiento de la Interacción Argonauta 2-miR33a-oligonucleótido Mediante Herramientas de Química Computacional

Authors: Oswaldo Ramírez[1,2], Miguel Ángel Méndez[2,3], Marcelo Grijalva[4], Tatiana Lara[4], Evelyn Pulles[1], Amy Heredia[5], Nathalia Solís[1]

Affiliation:
[1]Departamento de Ciencias de la vida y Agricultura, Universidad de Las Fuerzas Armadas ESPE, Av. Gral. Rumiñahui S/N, Sangolquí 171103, Ecuador.
[2]Grupo de Química Computacional y teoríca Campus Cumbayá, Diego de Robles s/n, Quito 170901, Ecuador.
[3]Departamento de ingeniería Química, Universidad San Francisco de Quito Campus Cumbayá, Diego de Robles s/n, Quito 170901, Ecuador.
[4]Centro de Nanociencia y Nanotecnología, Universidad de Las Fuerzas Armadas ESPE, Sangolquí 171103, Ecuador

Corresponding author's email: nathaly.osorio@yachaytech.edu.ec

Abstract: Atherosclerosis is an inflammatory disease that begins with damage or inflammation in the inner lining of the arteries, where the gradual accumulation of plaque on the arterial walls is crucial. This plaque is composed of a mixture of substances including fats, cholesterol, cellular waste, calcium, and fibrin. Over time, this plaque accumulation can increase and harden the arteries, thereby reducing blood flow and oxygen supply to organs and tissues. This decreased blood flow can lead to a range of serious complications such as cardiovascular disease (CVD), including heart attacks, strokes, or peripheral circulatory problems. It is the cause of 33% of global deaths.

Therefore, our research took on the challenge of designing a nucleic acid-based therapy to promote reverse cholesterol transport. In this regard, an AGO2-miR33a ribonucleoprotein complex, responsible for silencing key genes in cholesterol metabolism and reverse transport, was modeled using deep learning and molecular dynamics (MD) tools. Four antisense DNA molecules were designed based on minimum free energy (MFE) and template, aimed at inhibiting the ribonucleoprotein.

MD results of the ribonucleoprotein indicate conformational changes that make the initial model resemble other experimental AGO2-miRNA complexes. MD of the DNAs shows that structures capable of inhibiting AGO2-miR33a have been obtained.

Concluding that the candidate DNA structures could be a possible therapy for the early treatment of atherosclerosis.

f) Functionalization of hybrid cells in Lactuca sativa L. cultures at the laboratory level for application in agriculture

Authors: Coraima Edith Torres Guerrero[1,2], Yolanda del Rocío Angulo Paredes[1], Andrés Izquierdo[1,2]

Affiliation:
[1]Departamento de Ciencias de la Vida de la Universidad de las Fuerzas Armadas ESPE, Sangolquí.
[2]Centro de Nanociencia y Nanotecnología de la Universidad de las Fuerzas Armadas ESPE, Sangolquí.

Abstract: The use of bioproducts in agriculture has increased in recent years due to the harmful effects of agrochemicals on living beings and the environment. Bioproducts based on microorganisms have attracted the attention of farmers, due to the low cost of obtaining them, the improvement of the nutritional composition of the soil, as well as their biostimulant, biofertilizer and/or biopesticide effect. Similarly, within the industry, cells hybridized with nanoparticles have attracted attention in various fields due to the acquisition of new metabolic characteristics that could improve various industrial and agricultural processes. The objective of this study was to functionalize hybrid cells in cultures of Lactuca sativa L. at laboratory level for their application in agriculture. The irrigation times and volumes of lettuce in liquid and soil cultures were standardized. The hybridized cells were then functionalized at a concentration of 0.2x106 cell mL-1 (AgNPs-FJ, AuNPs-FJ, AuNPs-G) in lettuce cultures in liquid medium and soil with 1, 2, 3, and 4 dosages of 200uL per hybridized cell. After 30 days, morphological characterization was performed by structure measurement, weight determination and SEM; and physicochemical characterization by cyclic voltammetry and infrared spectroscopy (FTIR). It was determined that in the liquid medium culture, irrigation with 0.6 cell mL-1 of the AgNPs-FJ hybridization showed an increase of 38.6% in fresh weight, while in the soil culture, irrigation with 0.6 cell mL-1 of the AuNPs-FJ hybridization showed an increase of 51.1% in fresh weight. In addition, it was determined that plants irrigated with AuNPs-FJ hybridization and AuNPs-G hybridization have higher oxidation potential. There were no differences in the transmission spectra in the attenuated total reflection sampling infrared spectroscopy (ATR-FTIR) technique.

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