Contact dermatitis and microbial biofilms

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Contact dermatitis is caused by external exposure of the skin to an allergen. Metal allergies can lead to allergic contact dermatitis. Electrophilic metals have the ability to ionize and react with proteins, thus forming complexes that can be recognized by dendritic cells, which enables sensitization. Cases of contact dermatitis caused by skin exposure to cosmetics and jewelry containing nickel, zirconium, and titanium have been reported. Thinning of the stratum corneum and intermittent exposure to perspiration on the eyelids have been associated with increased absorption of nickel through the skin from cosmetics, allowing lower concentrations of nickel to cause an allergic reaction.

People with allergic contact dermatitis where there are immune cells that recognize a certain chemical, such as a metal, so they react to exposure to that chemical on their skin. The biofilm is constituted by a complex microbiota and the dynamics of strains that adhere to surfaces, which are encapsulated in a matrix of extracellular polymeric substances (EPS). Biofilms can form on a suite of surfaces, including natural substrates such as rocks and plant surfaces, as well as man-made surfaces such as medical implants, industrial equipment and food processing equipment. In biofilms, microbial cells can metabolize organic matter and nutrients from the environment, contributing to nutrient cycling and biogeochemical processes.

Understanding the structure and function of biofilms is essential for developing effective strategies to control microbial biofilm formation, mitigate biofilm-related risks, and harness the beneficial properties of biofilms for various applications. Biofilms play an essential role in microbial ecology, ecosystem functioning and human health, with implications for diverse fields including environmental science, medicine, biotechnology and food safety.

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Risk assessment of exposition to nitrite and nitrate ingestion by meals at a social canteen

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The ingestion of nitrate and nitrite is still a concern because of its growing use in food and agriculture industries as preservatives and fertilisers, despite being precursors for potential carcinogenic molecules such as *N*-nitrosamines. Usually, ingestion of nitrite and nitrate is estimated by the sum of the concentrations of these analytes in the different components of a meal, without consideration for the interactions between them or the variation in concentration for the same component. In this work, the risk of nitrite and nitrate ingestion was assessed in samples that reflect human consumption, considering a Mediterranean diet. The extraction of these analytes from meals sourced from a school canteen was done using hot water and magnetic agitation. Concentration of analytes was determined by ionic exchange chromatography with UV-Vis detection at 205 nm. These concentrations, the weight of the consumer as well as the meal weight were all simulated considering measurements uncertainty and composition diversity, by application of the Monte Carlo method on an MS-Excel spreadsheet. Through the analysis of 50 meals and thousands of simulations, it was concluded that there is a 0.16% chance of consuming over the acceptable daily intake stipulated for nitrate consumption by exclusive consumption of two canteen meals a day. It was not possible to confirm the presence of nitrite.

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Development of a Rapid and Green Method for Determination of Aviation Fuel in Soil Using GC-MS and SPME

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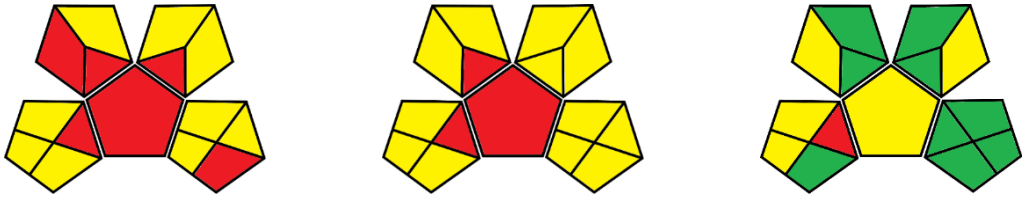
The increasing frequency of aircraft accidents and the intensification of aerospace activities highlight a growing environmental concern: contamination of soil with aviation and rocket fuel components. These fuels contain a complex mixture of volatile hydrocarbons that can pose serious risks to ecosystems and human health. Effective environmental and forensic monitoring in such scenarios demands fast, accurate, and environmentally sustainable analytical methods capable of detecting low concentrations of petroleum-based pollutants in soil matrices.

Traditional analytical approaches, including gravimetric and IR-based techniques, although reliable, often require time-consuming sample preparation steps involving large volumes of toxic solvents. These factors limit their use in urgent or field-based contexts and conflict with the concept of green analytical chemistry. This study addresses these challenges by developing a rapid and green analytical method for the determination of aviation fuel in soil using gas chromatography–mass spectrometry (GC-MS) combined with solid-phase microextraction (SPME). The method integrates the high selectivity and sensitivity of GC-MS with solvent-free sample preparation via SPME, making it suitable for both laboratory and potential in-field applications. PDMS fibers (100 µm) were used under optimized extraction conditions (90°C, 10-minute), enabling efficient isolation of volatile hydrocarbons from the sample headspace. The procedure avoids chemical solvents and completes the extraction in just 10 minutes. Key performance metrics include a concentration range of 0.01–1.0 g/kg, repeatability (RSD) of 2.21 %, limit of detection (LOD) of 1.27 mg/kg, and limit of quantification (LOQ) of 4.24 mg/kg.

The method's precision and accuracy were validated through compliance with national metrological standards, while calibration showed excellent linearity (R = 0.999). A Green Analytical Procedure Index (GAPI) evaluation confirmed its ecological advantages over conventional methods (Figure 1).



Gravimetric analysis with Solvent extraction [1] | GC-FID with Ultrasonic extraction [2] | GC-MS with SPME [3]

Figure 1. Greenness evaluation of hydrocarbons determination in soil methods with GAPI

Successfully tested on simulated contaminated soil samples, the method demonstrates high potential for application in environmental monitoring, emergency spill response, and forensic environmental investigations. This work contributes to the advancement of green, efficient, and accurate methodologies, offering a valuable tool for assessing fuel-related contamination in vulnerable terrestrial ecosystems.

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Synthesis, Characterization, and Application of Polymeric Membranes Enriched with Titanium Dioxide Nanoparticles for Removal of Nickel Ions from Synthetic Wastewater

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Recently, concerns about drinking water sources have become increasingly important worldwide due to population growth, industrialization, and wastewater pollution from various industries (e.g., mining, electroplating, tannery, chemical, textile, medical, pharmaceutical, and paper industries) [1] (e.g., heavy metals, dyes, suspended solids, alkaline earth, pesticides) [2]. Electrodialysis, a membrane separation process in which ions migrate from a concentrated solution to a dilute solution through ion-selective or ion-exchange membranes under the action of an electric field, has been successfully applied for heavy metal treatment from different wastewaters.

The current study focused on the fabrication, characterization, and application of polymeric membranes enriched with titanium dioxide (TiO_2) nanoparticles. Fabricated polymer membranes were used to remove nickel ions from synthetic wastewater using a laboratory system, called electrodialysis in concentration. Physico-chemical, structural, mechanical, and proton conductivity properties of prepared polymeric membranes have been investigated by FT-IR, SEM, TGA, and a.c. impedance spectroscopy. FT-IR and SEM analysis indicated that the TiO_2 nanoparticles were successfully incorporated into the polymeric membrane matrix by phase inversion technique. The structure of the polymeric membrane became more compact and uniform after the TiO_2 nanoparticles were incorporated into the membrane matrix. TGA analysis showed greater thermal stability of the polymeric membrane which started to decompose at around 355^0C. The impedance measurements revealed that the proton conductivity was around $14 \cdot 10^{-3}$ S/cm, and the charge transfer resistance was around $390 \cdot 10^3$ Ω at ambient temperature. The system performance and the efficiency of the polymeric membranes were evaluated by determining the removal rate of the nickel ions (RR_{Ni}^{2+} (%)), the current efficiency (CE (%)), and the specific energy consumption (SEC, kWh/cm^3). The results showed the following values: RR_{Ni}^{2+} = 87%, CE = 13.07%, and SEC = 235 kWh/cm^3 after 1.5 h of treatment. Based on the obtained results, the prepared polymeric membranes can be considered effective and promising multifunctional material for removing metallic ions from different waters and wastewaters.

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Defining valid criteria for the automatic identification of microplastics by micro-Raman using various spectrometers

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The characteristics of plastic materials that motivate their commercial success, namely low cost and high chemical and physical resistance, and the inadequate disposal of these cheap materials, are responsible for the ubiquitous presence of lasting plastic particles in the environment. Plastic materials' type, size and shape affect their impact on the environment, where smaller particles can even travel inside living organisms with unknown impacts in these systems. Plastic particles can be classified according to their size as Macroplastics (> 25 mm), Mesoplastics (5 mm to 25 mm), Microplastics (1 µm to 5 mm) and Nanoplastics (< 1 µm) [1].

Parallel to determining the toxicological impact of these particulates, it is necessary to determine their abundance values and respective trends and the most relevant sources of these materials. This information should support setting up and monitoring the policies to reduce the impact of plastics on the environment and human health.

The harmonisation of procedures for monitoring plastic contamination in food products and environmental matrices is still lacking. Additionally, development on how to assess the performance and evaluate the uncertainty of these monitoring is also needed [2,3].

Before counting plastic particles in a food or environmental sample, it is necessary to identify them. Micro-FTIR and micro-Raman are the most popular tools for plastic particle identification before characterising their size and shape. Reference and particle spectra are compared manually or automatically, where manual identifications are time-consuming and must be performed by qualified analysts, while automatic identifications are fast and do not require so much analyst expertise. Given the number of plastic particles observed in some samples, automatic identifications are thus advised.

The automatic identification of particles requires quantifying the correlation or match between reference and particle spectra and defining a minimum match above which identification has an adequately high and low true and false positive results rate, respectively. The match threshold can be defined for reference and particle spectra collected using the same or different equipment, the diversity of equipment being an additional challenge for the analyst.

This communication describes the development and validation of a procedure for the automatic identification of polyethylene terephthalate (PET) microplastics by micro-Raman fit for identifications supported by reference and particle spectra collected in different spectrometers. Identifications are considered valid if associated with a true positive rate not lower than 95% and false positive rates not larger than 5%.

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Antioxidants, essential oils, and natural protein fibers

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Natural plants have played an important role in the discovery of new antimicrobial agents without toxic effects on humans. Garlic extract used in therapeutic treatments includes beneficial effects on the cardiovascular system, antibiotic properties, anticancer effects, anti-inflammatory actions, and hypoglycemic effects similar to hormones. All synthetic food preservatives show adaptation to the substrate, meaning they eventually lead to bacterial resistance over time.

Raw garlic (Allium sativum) is a powerful natural antibiotic that works differently from modern antibiotics and kills certain bacterial strains, such as *Staphylococcus aureus*, which have become immune or resistant to modern antibiotics and consequently show increased incidence in food due to horizontal contamination by healthy carriers. Fermentation is a biotechnology that promotes and controls the growth of microorganisms and their metabolic activities for the preservation and transformation of raw food materials.

Lupin seeds contain a higher amount of available soluble sugars and high levels of non-starch soluble polysaccharides (30–40%). The lupin content of these dietary fibers, such as soluble sugars and polysaccharides, plays an important role in yogurt products for their textural properties and in maintaining a firm coagulum without syneresis (wheying-off).

The use of probiotic bacteria or other antagonistic microorganisms can be an effective method to prevent the proliferation of yeasts. These microbes can inhibit the growth of pathogenic yeasts through competition for nutrients and by secreting antimicrobial substances. The type of fruit plays a significant role in yeast development and in choosing appropriate control methods. To effectively combat yeast contamination, it is essential to apply a suitable method based on the type of fruit and the specific storage conditions.

Microorganisms are introduced into wine, and new environments are created that may favor the development of spoilage microorganisms. The interaction of microorganisms in wine and juice has shown that competition for nutrients—energy sources and especially essential nutrients—is a key factor in the succession and dominance of wine microorganisms.

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Complex Matrices in Drinking Water Quality and Interactions with the Distribution Network

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Drinking water in Cyprus has been exposed to severe fluctuations during the past few decades. This is the result of prolonged droughts and the water management strategies that are still undergoing major reforms. The island has been traditionally relying on rainwater as the main contributor to the water balance. Rainwater is being collected and stored in dams and reservoirs from where it is channelled into the mains distribution network, after undergoing basic refining. This water is significantly affected by the baseline geochemistry of the island, which is strongly alkaline and calcareous. As such, it has a very strong limescale depositing tendency in the storage and distribution network and in residences alike.

This water stress has inevitably created the need for additional water supplies, especially in the light of increasing tourist arrivals, mainly during the summer months, and foreign investments that have attracted additional population. This increasing water demand is being satisfied by numerous seawater reverse osmosis desalination plants (SWRO's). Today, five plants are operational on the island, producing over 200Km^3 per day.

SWRO product water exhibits a specific chemical footprint, that clearly differentiates this from surface water and rainwater stored in dams. Its chemical composition is optimised through the post-treatment remineralisation process, providing neutral to slightly positive scale depositing tendency. This is strictly monitored through the Langelier Saturation Index (LSI) and forms part of a series of stringent contractual conformity criteria.

Our experience during the past 25 years has demonstrated that extreme caution must be exercised when SWRO water is being channelled through distribution networks that have traditionally been exposed to surface waters. This presentation will focus on this issue by citing specific examples relating to anomalies observed at consumers' taps, and providing appropriate documentation through extensive laboratory testing.

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Asepsis in food processing areas and the incidence of pathogenic germs in food

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The areas that require the most attention are those where the risk of microbiological contamination is most likely to occur—specifically, areas intended to come into contact with the product or where the batch comes into contact with it. The microaeroflora analyzed within the food processing unit before and after the disinfection process meets the bacteriological indicators in the critical points of the food preparation area.

The spread and growth of fast-food restaurants are continuously increasing in all parts of the world. A crucial subset of ingredients for fast-food restaurants includes fresh vegetables such as tomatoes, cucumbers, lettuce, watercress, parsley, carrots, arugula, broccoli, and green peppers. Vegetables consumed raw are increasingly recognized as vectors for the transmission of human pathogens. The rise in consumption of fresh vegetables is threatened by an increase in microbial contamination.

Numerous studies have confirmed that foodborne illnesses are strongly associated with microbial contamination of raw foods consumed by humans. The growing number of etiological agents is leading to an epidemic of diseases that poses a major threat to human health and to global well-being. Prioritizing vigilance over high-risk food types and key processing areas is imperative in order to minimize the downstream incidence of foodborne illnesses and to provide consumers with safe and healthy food.

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Assessment of heavy metals in human hair

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The concentrations of heavy metals in human hair can be a bioindicator of environmental pollution. The prolonged accumulation of pollutants in hair increases the potential for a comprehensive assessment of occupational and environmental exposures [1, 2]. This study investigates the accumulation of selected metals (Mn, Cr, Cd, Pb, Ni, Co) in hair from adolescents and adults between 12 and 75 years of age. Determination of the content of metals was carried out with graphite furnace atomic absorption spectrophotometry (GFAAS) after a microwave digestion. The relationships among age, sex, and hair type (dyed or not) of Mn, Cr, Cd, Pb, Ni, and Co content were investigated in normal subjects. The findings revealed that the mean of concentration of Cr and Co were higher in female hair (1.89µg/g; 0.35µg/g) than in male hair (0.63µg/g; 0.25µg/g). The mean concentrations of manganese, cadmium, lead, and nickel are significantly higher in male subject's (7.01µg/g; 0.44 µg/g; 12.03 µg/g; 4.76 µg/g) than in female subject's (3.94µg/g, 0.35 µg/g; 8.58 µg/g; 1.47 µg/g). One-way ANOVA test was done for statistical analysis.

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Nut Shell-Derived Biochar for Pb(II) Removal from Aqueous Solutions

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Circular bioeconomy focuses on the valorization of residues and waste to optimize the value cascade of biomass in a multi-generational and broad production chain [1]. In this context, biochar recognized for its wide range of commercial applications (fuel and energy production, energy storage, soil improvement and conditioner, animal farming, building sector, drinking and wastewater treatments, biogas production, industrial materials, exhaust filters, paints and coloring, cosmetics, and medicines) can be produced from various biomass sources [2]. The characteristics and applications of the biochar are influenced by the type of feedstock, and by the pyrolysis conditions (temperature, time, atmosphere) [1]. The total content of cellulose, hemicellulose, and acid insoluble lignin in pistachio, peanut, and macadamia shells is more than 73% [3,4] making them suitable for biochar production.

The objective of this research is to prepare biochar from agricultural waste by a cost-effective double crucible method [5]. The feedstocks consist of shells of various nuts (peanuts, pistachio nuts, macadamia nuts) which were preliminarily ground and fractioned using sieves, with a mesh size of less than 1 mm. The thermal decomposition of agricultural waste was performed in absence of O_2 at 700 °C for 2 hours. The resulting biochar was treated with 1M HCl and 1M NaOH, then washed and dried in air.

The biochar samples were characterized by Fourier transform infrared spectroscopy (FTIR) and specific surface area and porosity analysis. Bio_PIST sample shows the highest specific surface area (584.8 m^2/g) and the largest total pore volume (0.272 cm^3/g), indicating a more developed pore network. Bio_MAC exhibits the highest proportion of micropores relative to its total surface area (88.5%), despite having the lowest BET surface area (532.2 m^2/g). This suggests that Bio_MAC's porosity is more concentrated in the micropore range, possibly due to the intrinsic structure of the biomass used. Bio_PEA presents intermediate values in all parameters, with a surface area of 552.6 m^2/g, a micropore surface of 457.1 m^2/g, and a total pore volume of 0.258 cm^3/g.

The Pb(II) adsorption performance of the biochar samples was evaluated in batch tests. The experimental results were modeled using isotherm and kinetic models. The maximum adsorption capacity determined from the Langmuir equation was highest for Bio_PIST (219.23 ± 9.82 mg/g) followed by Bio_PEA (158.73 ± 7.68 mg/g) and Bio_MAC (152.70 ± 4.22 mg/g). These values are consistent with the the BET surface areas and comparable to those reported in the literature [6]. The Pb(II) removal mechanism involves chemical reactions, as indicated by the good correlation with pseudo-second-order kinetic model. This suggests that Pb(II) ions interact with functional groups on the biochar surface through complexation with oxygen-containing functional groups, surface precipitation, and cation exchange processes). The results showed that biochar derived from peanuts, pistachio nuts, macadamia nuts shells is a green, cost-effective, and high-performance sorbent for Pb(II) remediation.

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Upcycling banana peels into magnetic biochar for Pb(II) removal from aqueous solutions

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Biochar (Bio) is a high porous material with a large internal surface area prepared from different agricultural waste considered one environment-friendly, available as well as green adsorbent for heavy metals. However, the removing performance of the pristine Bio is limited [1] and its modification has seen huge interest in recent years to improve pollutant adsorption performance [2]. Several papers present the results regarding the increasing of the adsorption capacity by loading metallic nanoparticles (Mg, Zn, and Fe) on the biochar's surface [3].

The aim of the research is to use one alternative cost-effective process named double crucible method to prepare biochar from banana peels and further modification with magnetite. One small crucible containing banana peels (washed and crushed) is placed inside a bigger porcelain crucible filled with raw husk to create a reduced oxygen environment inside the crucible. Both crucibles were covered with a lid and heated at 700 °C for 2 hours [4]. After treatment with 5M HCl and washing, the biochar was dried in air. Three biochar-magnetite (Bio@MAG) composite have been prepared by using different mass ratio between Bio and MAG (1:1; 1:2, and 2:1). MAG was prepared *in-situ* by co-precipitation using 0.18M $FeSO_4$ and 0.5M $FeCl_3$ solutions. The prepared composite have been denoted as Bio@MAG-1 corresponding to the Bio:MAG mass ratio 1:1, Bio@MAG-2 corresponding to the Bio:MAG mass ratio 1:2, and Bio@MAG-3 for Bio:MAG mass ratio 2:1. After preparation, the biochar and Bio-MAG composites were characterized by Fourier transform infrared spectroscopy (FTIR) and determination of specific surface area with the Brunauer–Emmett–Teller (BET) equation using N_2 adsorption-desorption isotherms recorded at 77 K (Micromeritics ASAP 2020). The BET surface area of Bio (878.0 m^2/g) decreased to 649.3 m^2/g for Bio@MAG-3, to 501.3 m^2/g for Bio@MAG-1 and 382.5 m^2/g for Bio@MAG-2. The highest decrease of the BET surface area was recorded for the composite with the highest amount of MAG. Although the BET surface area of Bio@MAG was reduced compared to Bio, the Fe_3O_4 load provided more active sites for the adsorption of Pb(II).

The sorption of Pb(II) ions onto Bio and Bio@MAG composites were performed in batch tests. The adsorption kinetics and isotherm modeling were investigated to suggest the adsorption mechanism. The maximum adsorption capacity recorded for Bio@MAG-2 (232.67 mg/g) determined from the Langmuir isotherm is higher than values presented in the literature [5]. The adsorption mechanism for Pb(II) adsorption onto Bio and Bio@MAG composite is controlled by a chemical process, as evidenced by the good correlation with pseudo-second-order kinetic. The high maximum adsorption capacity and the easiness of recovery after wastewater treatment using a magnetic field revealed that Bio@MAG composites could be suitable alternatives to various adsorbents for the remediation of heavy metal-polluted waters. However, further studies should be performed to determine the proper regeneration agent for recycling metal-loaded Bio@MAG composites to prove their reusability.

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Innovative hybrid mesoporous materials as adsorbents for heavy metal ions removal from aqueous solutions

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Water contamination with persistent organic and inorganic pollutants poses a significant threat to living organisms, particularly human life [1]. Therefore, numerous strategies have been developed to remove and remediate organic and hazardous pollutants. Adsorption is one of the most efficient and cost-effective strategies for achieving this goal. Porous materials are widely regarded as suitable adsorbents for water purification. Numerous researches have been carried out to design new and improved functionalized mesoporous materials with high ability to adsorb heavy metal ion inside the pores [2].

The aim of the research was to prepare new periodic mesoporous organosilica (PMOs) of MCM-41 type with a bridged fluorescent organosilane precursor with diimine moiety inside the pore wall. We synthesized a Schiff base (2,6-bis((3-(triethoxysilyl)propylimino)methyl)-4-methylphenol) starting from 2,6-diformyl-4-methylphenol and 3-(triethoxysilyl)propan-1-amine (1:2 molar ratio) and, subsequently, the isolated compound was used to prepare a PMO through a co-condensation template synthesis approach with tetraethyl orthosilicate (TEOS) and cetyltrimethylammonium bromide (CTAB), in alkaline medium (MCM-41@Schiff base).

To perform a comparative study, MCM-41 APTES (silica functionalized with 3-(triethoxysilyl)propan-1-amine) and MCM-41 were also synthesized, following the same procedure.

The silica adsorbents were analyzed by Fourier transform infrared spectroscopy (FTIR), nitrogen adsorption-desorption technique and scanning electron microscopy–energy dispersive X-ray spectroscopy (SEM-EDX), high-resolution transmission electron microscopy (HRTEM), and thermogravimetric analyses.

Batch isotherm and kinetic experiments were carried out to propose the mechanism of Cd(II) retention. The kinetic study highlighted the chemical nature of the Cd(II) ion retention process, and the adsorption isotherm study revealed a monolayer adsorption process on the homogeneous surface of the tested adsorbents. A maximum removal capacity (Q_{max}) of 53.6 mg/g was determined for a contact time of 4 h and a pH value of 5.38. The data obtained show that the remediation process of aqueous effluents containing Cd(II) by adsorption on MCM-41, MCM-41 APTES and MCM-41@Schiff base is a three-step process, and the time required to reach equilibrium is 4 hours.

Comparing the three PMOs, the best results were given by MCM-41@Schiff base, followed by MCM-41 APTES. This fact proves that functionalization MCM-41 with diamine organosilane precursor is an efficient method to increase the performance of adsorbent materials.

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β-Cyclodextrin/Hydroxyapatite Composites as a New Green Additive for Enhancing Leather Properties

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The leather industry faces a significant challenge in developing environmentally sustainable processes because it currently relies heavily on energy, chemicals, and water, which pose a threat to the ecosystem. [1-2] The reduction of noxious chemicals in the production of leather must be coupled with the implementation of environmentally friendly technologies, such as ultrasound and microwaves.[1-3] Our research focuses on developing non-toxic, biodegradable additives that provide key leather properties, such as antimicrobial activity, flame retardancy ability to encapsulate small molecules such as dyes, fragrances, and breathability, using ultrasound (US), a clean and sustainable technology that minimizes environmental and health impacts. The properties of hydroxyapatite and beta-cyclodextrin make them particularly suitable for this purpose due to their specific properties, such as fire and mechanical resistance, antimicrobial activity, and biocompatibility of HAp. Cyclodextrins (CDs) enhance tanning efficiency by improving the diffusion of target molecules and the solubility and binding of hydroxyapatite (HAp) to the collagen matrix, making them a practical choice for sustainable leather processing. In this study, HAp/β-CD composites were synthesized using ultrasound (US), by varying the US amplitude, treatment time, and HAp/β-CD ratio to optimize the size and stability of the composites. The average size of the composites was measured by Dynamic Light Scattering (DLS), and their stability was evaluated by the Z-potential. The molecular profile, composition, thermal stability, and morphology of composites were investigated by FTIR-ATR spectroscopy, XRD, TG/DTG, and SEM. All the composites show antimicrobial activity with no cytotoxicity.

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Development of a Hybrid Nylon 11/HA/MLT bionanocomposite for Accelerated and Reliable Dental Tissue Regeneration

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The increasing demand for advanced wound care materials, particularly in the oral cavity where healing is complex due to high microbial activity and mechanical stress, necessitates the development of innovative bioplatforms. In this work, we present a novel wound healing system composed of Nylon 11 nanofibres integrated with a mixed matrix of hyaluronic acid (HA) and melatonin (MLT), aiming to accelerate and improve the reliability of tissue regeneration in dental applications. Nylon 11, a biocompatible and sustainable polyamide, was obtained using aluminium oxide template. The synthetized nanofibers were subsequently infused within a biocomposite mixture of HA for its intrinsic bioadhesive, anti-inflammatory, and hydrating properties, and MLT for its potent antioxidant and pro-healing effects [1].
The Nylon 11 nanofibers were characterized through scanning electron microscopy, and XRD analysis, while the HA and MEL mixtures were studied using FTIR and SEM analysis, and for the stability in time against the pH the fluorescence spectroscopy was applied.
The hybrid matrices were characterized for stability using electrochemical determination for Zeta potential, recording a value of -31 mV. Preliminary antimicrobial tests showed reduced bacterial colonization, particularly against *Streptococcus mutans*, a common oral pathogen. The release kinetics of melatonin were found to be sustained over 72 hours, supporting prolonged therapeutic action. Together, these findings underscore the potential of Nylon 11-based nanofibre bioplatforms combined with HA and MLT as a promising strategy for oral wound healing. Future in vivo studies will further elucidate their performance in clinical settings.

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Bionanomaterials with therapeutic properties on biogel substrate

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Abstracts: This paper presents a method for the preparation and characterization of Carbopol hydrogels coupled with essential oil useful in biomedical aplications.
Nanostructured bionanomaterials based on polymers coupled with active principles of natural origin have become very useful in medical practice. The present study focuses on obtaining a hydrogel coupled with *Bergamot* essential oil in order to obtain hydrogels with remarkable therapeutic properties.
Carbopol is a synthetic polymer made of carbomers. Carbomer polymers are cross linked together and form a microgel structure that is useful in biomedical aplications [1]. ***Bergamote*** essential oil are anti-inflammatory effect, antibacterial, antidepressant, analgesic, antibiotic, healing, due to the content of linalool, linalyl, limenene and other biologically active substances.
Preparation of gels have earned great popularity owing to their ability to provide effective dispersion performance. This study involved the use of direct method for preparing gels:
For the preparation of hydrogels, polymer Carbopol (Synthalen K) was dispersed gently into known quantity of water with constant stirring by using magnetic stirrer (Heidolph MR Hei-Tec). Then the *Bergamote* essential oil was added to the mixture with constant stirring, so homogeneous dispersion was obtained. In order to adjust the pH of gel formulation, triethanolamine was used [2].
Hydrogels P1-P5, were analyzed for pH evaluation The pH of the gels was recorded using digital pH meter (Mettler Toledo). Antioxidant activity [3,4] and biocompatibility, the indirect contact method was used at 24 and 48 h using the Neutral Red technique with human keratinocytes line HaCaT. The results showed that all samples were biocompatible.
Concluzions: The results showed that biomaterials can be considered as promising candidates for biomedical/biotechnological applications.

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