Annual International Congress On Chemistry

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Table Content:

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Rhamnose, a safe chemical compound for the manufacture of immunostimulating pharmaceuticals

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Abstract

Introduction: Microorganisms such as bacteria, fungi, protozoa and viruses often cause irreparable damage to humanity. This is the case for diseases like black death, flu, AIDS, Ebola, Cholera, Mpox which have caused millions of deaths in the world. Plants and microorganisms contain carbohydrates like rhamnose which help boost the immune system. Some polysaccharide conjugate vaccines were manufactured to treat some pathogenic affections.
Aim: The aim of this research is to use the literature to reassure scientists about the role that rhamnose could have in combating pathogenic diseases like immunology disorders.
Methods: Electronic database engines such as Google Scholar, ScienceDirect, PubMed, Scopus, Biomed were used to carried out the work.
Results: According to the researches, rhamnose (Rha or Rham) is mainly in nature in L form: L-rhamnose. It can be found as disaccharides, heteropolysaccharides and polysaccharides. It can combine with other chemical compounds. This could make the pharmacological activities of rhamnose more interesting and useful to the human organism in the case of immunological dysfunction. Its action repairs the damage caused by pathogens to the body and have used as active product for several studies. Rhamnose has highly an anti-inflammatory and antioxidant properties. Some vaccines have even been manufactured from L-rhamnose.
Conclusion: Using rhamnose from any sources especially natural would be very beneficial for the search for effective vaccines, different from those already existing on the market and especially to undesirable effects tolerable for many people. Polysaccharides particularly rhamnose might be use for the manufacture of effective drugs and vaccines to prevent or cure immunodeficiency diseases.

Keywords: Rhamnose, Chemical characteristics, Vaccine; Immunostimulant

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A new green protocol for the identification of Microplastics and Microfibers in marine environment, a case study from the Vesuvian Coast, southern Italy

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Abstract

Microplastics (MPs; 1 µm–5 mm) and microfibers (MFs; thin, elongated particles with a high length-to-width ratio) have emerged as a major global environmental concern due to their widespread presence in the oceans. Their complex physicochemical properties affect their mobility, bioavailability, toxicity to organisms, and interactions with surrounding pollutants. Despite their environmental significance, the development of reliable and automated methodologies for monitoring MPs remains a significant challenge. To address the need for practical and standardized approaches, we have developed an innovative analytical protocol based on optical microscopy for counting and performing the morphological characterization of MPs and MFs in the marine environment (sediments and seawater). This method addresses the limitations of existing techniques, which often lack standardization and practicality. Unlike many conventional methods, it eliminates the need for sieving (for sediments), washing, heating, density separation, or digestion processes. Our environmentally friendly approach requires minimal sediment quantities (e.g., 1.5 g) and significantly reduces processing time. Specifically, the protocol includes: (1) sampling based on the morphological features of the coastline and prevailing marine currents, (2) stereomicroscopy for counting and morphological analysis, (3) scanning electron microscopy (SEM) for detailed morphological data, (4) energy-dispersive X-ray spectroscopy (EDS) and micro-Raman spectroscopy for chemical characterization, and (5) additional investigations. This protocol has been successfully applied, for the first time, to analyze marine and terrestrial sediments, as well as seawater, in the Vesuvian area of the Gulf of Naples (Italy).

Keywords: Microplastocs and microfibers, marine environments, high-definition optical microscopy, Micro-Raman, Vesuvius coastal zone dynamics.

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NMR-based-Metabolomics Evaluation in Dogs Infected with Canine Parvovirus: A New Approach for Biomarker/s

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Abstract

Despite aggressive treatment, canine parvovirus (CPV) enteritis remains a major cause of morbidity and mortality in puppies. Identifying reliable biomarkers of CPV enteritis is important for determining severity, length of hospital stay, and predicting clinical outcomes. This first study aimed to reveal the new potential biomarkers for CPV enteritis by Nuclear Magnetic Resonance (NMR)-based quantitative metabolomics. Forty-three (43) CPV-infected dogs were diagnosed by a rapid antigen test kit and subsequent PCR, and 10 healthy dogs were enrolled. In this prospective study, metabolomics and cardiac troponin were measured by NMR and ELISA, respectively. The diseased dogs showed statistically significant lower levels of fructose, glucose, citrate, glycerate, glutamate, carnitine, glycine, formate, and higher levels of isoleucine, isovalerate, glycolate, and creatine compared with healthy dogs. The same analysis performed on lipid parameters showed statistically significant higher levels of cholesterol variants, fatty acyl variants, free cholesterol, glycerol backbone, and sphingomyelin and lower levels of phosphoglycerates and esterified cholesterol in the diseased groups. The changes in metabolomics could be attributed to energy deficit, fat mobilization, gluconeogenesis **tricarboxylic acid** cycle deficiency, and multiple organ failure. Decreased citrate, and increased fatty acyl chain-CH_2CO and sphingomyelin levels will serve as the most useful biomarkers in the prognosis of dogs suffering from CPV infection.

Keywords: biomarker; metabolomics; NMR; canine parvovirus

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Methylene Blue Adsorption and Desorption Performance of Silane Treated Pine Cone in a Short Time

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Abstract

Dye discharge into the aqueous solutions from various industries such as textile, dye production, plastics, leather, and food significantly contribute environmental pollution. This study focused on evaluation of the silane treated pine cone for methylene blue (MB) adsorption. Following to surface treatment of pine cone, structural, textural and surface properties of the treated pine cone were investigated in detail. Adsorption kinetic, equilibrium and thermodynamic of MB were studied in a batch system. The adsorption kinetic experiments revealed that MB adsorption was conducted by both physical and chemical interactions. The maximum adsorption capacity based on Langmuir isotherm model was determined as 39.52 mg g^{-1}. The adsorption thermodynamic parameters indicated that MB adsorption was endothermic and spontaneous. MB desorption was carried out in different eluents. MB desorption increased in the order: water < NaOH < ethanol < NaCl < HCl < acetone. In the case of MB desorption in acetone for 15 min, MB adsorption-desorption experiments showed that the silane treated pine cone can be used as a potential and reusable adsorbent. The results showed that the silane treated pine cone can be used as a promising adsorbent for MB removal with time, cost and environment saving.

Keywords: Pine cone; silane treatment; methylene blue adsorption; regeneration

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In Vivo, Evaluation of the Effects of Levan and Inulin on Wound Healing in Type 2 Diabetic Animal Models

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National research centere

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Abstract

Diabetes mellitus is a metabolic disease that commonly leads to chronic wounds due to abnormal blood glucose accumulation. It also causes neuropathy and arterial damage, which can affect various tissues and organs. Poor circulation, limited nutrients, and inflammation usually cause infections such as diabetic foot ulcers. Although antibiotics could be used to treat diabetic wounds, drug resistance is a common serious issue. Therefore, it is important to develop therapies from animal models to clinical trials to overcome those symptoms and shorten the diabetic wound healing process. Accordingly, fourteen probiotic honey isolates were isolated from mountain honey, and their polysaccharides were identified as levan based on TLC, FTIR, and NMR. The cytotoxicity of the fourteen levans and the inulin extract was negative. Five levans and inulin were selected based on the lowest cytotoxicity for the in vitro wound healing test. The isolates No11 and inulin that achieved the highest wound healing activities were chosen for the rat model. Effect of oral and topical inulin (50 mg/kg) or levan treatment (50 mg/kg) on wound contraction (%) measured on days 1, 4, and 8 in diabetic rats. Inulin treatment (50 mg/kg, p.o.) for one week significantly ($p< 0.05$) reduced blood glucose level as compared to the positive control group. However, there is no significant difference in the glucose level between the other levans treatment groups and the positive control group. The treatment groups except the group with topical application of the plain formula (pectin) showed significant ($p < 0.05$) reduction in the wound area as compared to the positive control group. Oral inulin, oral levan, topical inulin, topical levan, and dex-panthenol showed 87.85%, 87.05%, 90.70%, 90.75%, and 80.47%, respectively, of wound contraction, as compared to the positive control group (which showed 63.27% wound shrinkage). Treatment of animals with inulin (p.o.), levan (p.o.), inulin (topical), and levan (topical) showed a significant depression in the skin content of MDA by about 30%, 33%, 36%, and 38%, respectively, as compared to the positive control group. Application of topical inulin or levan showed a comparable reduction in MDA content as that of the standard drug, dex-panthenol, which showed a 42% reduction in MDA

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Raman spectroscopy in infectious and oncology precision medicine

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Abstract

Rapid and accurate identification of infection-causing pathogens, such as early detection of cancer diseases, are among the greatest challenges in medicine. Early identification of causative agents and their antimicrobial resistance profile can significantly improve infection management, reduce health care costs, mitigate ever-increasing antimicrobial resistance, and, in many cases, save lives.

On the other hand, early detection in oncology allows the best available treatment and intervention options to be presented. Unfortunately, existing methods for both the most common infectious diseases and cancer diagnosis, while very advanced, can be expensive, invasive, often inconclusive or inaccurate, and are not always performed or can be performed during the early stages of disease. For this reason, there is a crucial and currently unmet need to develop a single universal method that is reliable, inexpensive, and noninvasive and can diagnose all infectious diseases and all forms of cancer early.

Raman spectroscopy has been shown to be a useful-quick, noninvasive, and nondestructive tool for identifying microbes from solid and liquid media and, in combination with advanced statistical analysis, is proposed here as a potential solution to the indispensable need for early diagnosis, both infectious and oncological. The advantages and risks of the methodology will be presented, demonstrating how all currently available evidence suggests that Raman spectroscopy is highly suitable to become the first universal method to be used for early diagnosis and thus for even more precision medicine.

Keywords: Raman spectroscopy, molecular fingerprint, cancer, infectious diseases, early diagnosis, precision medicine, advanced statistical analysis

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Bifunctional organosilicon compounds and their potential application

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Abstract

Biological corrosion is the term referring to undesirable deposition and growth of all kinds of microorganisms, mainly fungi, bacteria and algae. It is a multistage and complex process leading to destruction of materials on which this deposition and growth, in the form of a biofilm, took place. The phenomenon leads not only to technological problems but can have harmful effects on human health. Most often this phenomenon is discussed in the context of construction materials such as bricks, concrete, roof tiles, glass and wood. This publication presents the synthesis of functionalized organosilicon compounds and their selected surface properties.

Keywords: organofunctional siloxane, microbiological colonization, protective coatings

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Visual Examinations in Cultural Heritage: Insights and Perspectives

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Abstract

Visual examinations in the field of cultural heritage are essential for continuous monitoring of the condition and for achieving effective preservation outcomes for cultural heritage items. The present paper explores the role of these methods in the conservation of cultural heritage, highlighting key insights and perspectives. It discusses the practical application and benefits of various light imaging techniques in detail, including visible light imaging, optical microscopy, colorimetric analysis, infrared (IR) radiation, ultraviolet (UV) fluorescence, and radiography (X-rays). Each technique's principles and approaches are outlined, emphasizing their unique contributions to diagnosing, documenting, and preserving artefacts. Visible light imaging captures detailed surface features, while optical microscopy provides high-resolution magnification for the detailed examination of fibres, surfaces, and ink compositions. Colorimetric analysis quantifies the intensity of colours in pigments, providing critical information on the composition and degradation of these materials. Infrared radiation reveals under-drawings and material differences beneath the surface. Ultraviolet fluorescence highlights surface treatments and previous restorations through fluorescence, whereas radiography offers insights into internal structures and the condition of hidden elements. The integrated use of these techniques allows for comprehensive analysis and informed conservation decisions, ensuring the long-term preservation of cultural heritage artefacts. Future perspectives on visual examination methods are also discussed, highlighting emerging trends and the importance of interdisciplinary collaboration among chemists, conservators, and art historians in advancing the field of cultural heritage preservation.

Keywords: Visual Examination; Cultural Heritage; Preservation Strategies; Chemical Analysis; Interdisciplinary Knowledge

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Versatile role of cytostatic, antineoplastic and chemotherapeutic drug compounds on human health and aquatic ecosystems

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Abstract

Anticancer or chemotherapeutic drugs frequently used to treat cancer represent a real source of environmental pollution.

In order to assess the progressive human and environmental risk of antineoplastic drugs in the environment, it is important to collect as much information as possible on their toxicity, presence, bioaccumulation and persistence. In addition, the efficiency of their elimination in conventional wastewater treatment plants and in alternative treatments requires additional research efforts. The structure and functioning of freshwater communities are profoundly affected, among others, by cyclophosphamide. These important molecules have become a real concern in the face of water treatment processes in aqueous media. Cytostatics such as alkylating and non-alkylating agents, topoisomerase inhibitors are classified as contaminants of concern for the degradation of environmental health. Frequently used compounds, especially 5-fluorouracil, morphine and codeine, in hospital effluents have high contamination risk quotients. However, at present, the effects of chemotherapeutics on aquatic organisms and ecosystems are poorly understood. The work presented here includes three main objectives: i) to discuss the hypothesis that the distribution, elimination aspects of chemotherapeutic agents and environmental fate depend largely on the structural orientation, degree of ionization and environmental (and genetic) factors; ii) to evaluate the elimination method, transformation and risk assessment in environmentally friendly and advanced technologies for the treatment of effluents particularly contaminated by chemotherapeutic drugs and related compounds in aquatic environments. (iii) Compare the effect of cytostatic oxidative degradation, a cost- effective process that eliminates the mutagenicity of anthracyclines, to photolysis which reduces detected environmental concentrations, thereby decreasing the estimated environmental risks of targeted drugs to human health.

Keywords: oxidative degradation, photolysis, Chemotherapeutics , , cytostatic, aquatic ecosystem, public health.

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Towards heavy metal bioremediation using Chlorella vulgaris: The influence of advanced aeriation systems

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Abstract

Towards the bioremediation of toxic compounds from aquatic environments using living microalgae, *Chlorella vulgaris* has emerged as a promising candidate for the removal of mono heavy metal-treated (MT) systems. The present study investigates the microalga's removal efficiency in multi-MT systems (Cu, Cd, Ni, Pb and Zn at 1 ppm each) under two aeriation conditions: standard aeriation (SA) and micro-bubble aeriation (MBA). The MBA system, designed using a custom-built apparatus, increases the residence time of CO_2 required for photosynthesis thus, the contact area between the two phases influencing the culture's conditions (e.g. pH) and efficiency. The cultures were monitored over a cultivation period of 7 days in a 30-liter photo-bioreactor. The heavy metal removal efficiency was evaluated by means of atomic absorption spectroscopy (AAS) on Days 3 and 7 of cultivation, assessing cell population growth and pigment content. The comparative results indicate that the MBA culture achieved higher removal efficiency and exhibited superior growth and pigment content compared to the SA culture. The findings demonstrate the microalga's efficiency in removing heavy metals from multi-MT systems and highlight the potential of advanced aeriation systems to enhance remediation processes in such aquatic environments.

Keywords: Microalgae; AAS; UV-Vis; Chlorophyll; Biomass growth.

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Microplastic in water from Alto Paraná River, Argentina

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Abstract

We are currently in a Plastic Era, when 90% of plastic is being wasted, leading to the proliferation of microplastics (MP: plastic particles <5 mm), which can be either manufactured or generated from the fracture of larger plastic debris and interact with biota in the environment. Along the Alto Paraná and its tributaries, there is a high flux of river transport, fishing, and tourism activity, in addition to the anthropogenic activity linked to urban conglomerates from three countries: Brazil, Paraguay and Argentina. During October 2023 (spring) and February 2024 (summer), water samples were collected from 9 sites along the coast of Parana River, and in tributaries in Misiones, Argentina. Five sites in Posadas city: Costa Sur (CS), Monte Kolping (MK), Reserve Itá (RI), Carpincho Creek (CC) and Zaiman (ZC); two in Candelaria: Paraiso Beach (PB) and Santa Cecilia (SC); one in Garupa (Ga) and one in Corpus (Co). Sampling was done by collecting 100 L of subsurface water in triplicate, and filtered with 25 µm plankton nets. Samples were treated with H_2O_2, and filtered through a cellulose nitrate filter (47 mm, 0.45 µm pore). The filters were examined with a 5.6x stereomicroscope. MP were found in all samples, with highest count in Kolping in spring (383 ± 97) MP m^{-3}, and lowest in Garupa in summer (97 ± 30) MP m^{-3} and fiber was present above 70% in all samples, being the predominant MP found. Pellets were found in more anthropogenic sites (MK, RI, ZC, CS), but only between 1-4 pellets per filter. Black and blue colors were predominant in all samples, and particle sizes between 100 and 1000 µm. These results are a first baseline helping to contribute to the related management organizations to establish guide levels for the protection of aquatic life.

Keywords: emerging contaminants; water, microfiber, anthropogenic

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Medicinal Plants: The Untapped Lifeline for Oncology

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Abstract

Medicinal plants have long served as the foundation for groundbreaking medical advancements. However, in recent decades, pharmaceutical research has shifted toward combinatorial chemistry and high-throughput screening, leading to a decline in natural product-based drug discovery. This strategic shift has significantly reduced the number of new drug approvals, necessitating a renewed focus on bioactive compounds derived from nature.

Medicinal plants, especially those from the pristine Himalayan ranges, represent a vast yet largely untapped source of oncologically significant molecules. Despite their well-documented therapeutic properties in traditional medicine, many remain underutilized due to the lack of systematic scientific exploration and advancements in biomolecule isolation. This gap is particularly evident in the structural elucidation and synthesis of stereo active medicinal compounds, which possess multiple therapeutic properties and hold immense potential for targeted cancer treatments. This paper examines key medicinal plants with potential anticancer properties, elucidating their target pathways and pharmacological significance. By integrating modern scientific methodologies with nature's biochemical wealth, this research advocates for a paradigm shift toward harnessing medicinal plants as a pivotal resource in oncology.

Keywords: Medicinal Plants, Oncology, Cell Pathways, Drug Discovery, Nature

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Evaluation of serum Interleukin-17 as Diagnostic Markers in Asthma severity

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Abstract

Background: Asthma continues to be a major health issue worldwide, with an increasing prevalence impacting over 300 million people and contributing significantly to morbidity and mortality. This study investigates the role of interleukin-17 (IL-17) in different asthma phenotypes, focusing on its potential as a biomarker for disease severity and control. Objective: The primary aim was to measure and compare the serum levels of IL-17 in asthmatic patients with those of healthy controls, and to explore the correlation of IL-17 levels with other inflammatory markers such as IgE, C-reactive protein (CRP), and eosinophil count. Additionally, the study sought to determine the relationship between IL-17 levels and asthma control status. Results: The study encompassed 140 participants, divided equally between asthmatic cases and healthy controls, showing that IL-17 levels were elevated in asthma patients though not reaching statistical significance. However, a clear association was observed between elevated IL- 17 levels and other biomarkers with deteriorating control of asthma symptoms. These findings suggest that IL-17 might be involved in the pathophysiology of severe asthma phenotypes and could serve as a marker of disease exacerbation.

Conclusion: While the direct correlation between serum IL-17 levels and asthma severity was not statistically significant, the study indicates the potential of IL-17 to be a contributing factor in severe asthma cases. Further studies are needed to confirm these findings and assess IL-17's utility in clinical practice for asthma diagnosis and treatment.

Keywords: Asthma; IL-17; Biomarkers; Asthma Control; Inflammation; Phenotypes

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Preparation, Characterization of Polymer Enterosorbents for Effective Removal of Heavy Metal Ions

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Abstract

Nowadays, industrial facilities are powerful sources of pollution and as a result of their activities, a huge amount of toxic substances are emitted into the atmosphere. Against this background, flora and fauna die, epidemics and serious diseases develop. Heavy metals are one of the persistent pollutants of nature. Accumulating in living organism, they cause various changes and pathologies, leading to certain diseases. Immediate measures are needed to reduce environmental pollution, thereby decreasing the impact of these pollutants on living organisms. *This requires* reducing the toxicity of these metals in the atmosphere, water and soil by creating effective sorbents to remove heavy metal ions from the environment. Enterosorption method, due to its simplicity, safety and cost-effectiveness, has recently attracted particular interest as a way to extract toxic substances from the internal environment in the digestive tract of the human body. The aim of the presented research is to create new "smart" enterosorbents with a "memory effect" based on modified, crosslinked samples of chitosan (natural) and poly-N-vinylpyrrolidone (synthetic) polymers, widely used in medical practice, for selective sorption of excess amounts of heavy metal ions from the human organism. Samples of chitosan modified with the corresponding aldehydes were synthesized via alkylation, reduction, quaternization reactions, and the crosslinking of the indicated polymers with N,N'-methylene-bis-acrylamide was carried out. Structures of the synthesized samples were determined using FTIR, XRD, SEM, thermal analyses. Based on the analyses results of initial substances and final products it was established that the modification of chitosan and the crosslinking of chitosan with poly-N-vinylpyrrolidone, as well as the cross-linking of each polymer separately with N,N'-methylene-bis-acrylamide, were successfully carried out.

Keywords: Polymer; Enterosorbents; Characterization; Removal; Heavy metal ions

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Metal Compounds in the Phase of Cross-linked Ionic Polymers

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Abstract

Cross-linked ionic polymers are used in the largest volumes as ion exchangers in water treatment in the energy industry. Ion exchange is a reversible and practically non-selective process. However, anion exchangers containing weakly basic groups in their composition, in addition to the main process, are capable of retaining metal cations from solution as a result of coordination. Cation exchangers containing electron donor atoms can also retain cations from solution by complexation.

But can strongly basic anion exchangers, which contain only positively charged groups in their matrix, such as R_4N^+, and do not contain electron-donating atoms, retain metal cations from solutions? Theoretically not, but under certain conditions such polymers can retain some metal cations from solutions. Our work shows that commercial polymers AV-17 and Purolite A-400, containing $[-N(CH_3)_3]^+$ functional groups, retain Fe^{3+} cations from sulfate solutions. Using Mössbauer spectroscopy and SEM-EDS, it was shown that the retention of Fe3+ cations occurs as a result of the formation in the polymer phase of ultra-dispersed particles in state of superparamagnetic form of compounds such as the mineral jarosite with the composition $R_4N[Fe_3(OH)_6(SO_4)_2]$, where R_4N^+ is the functional group of the polymer. Jarosite is formed in an acidic aqueous environment.
using Mossbauer spectroscopy, in2004, Jarosite was discovered on Mars by Opportunity, one of the Mars exploration rovers of National Aeronautics and Space Administration(NASA). . For scientists, it was an argument that, on Mars, water once existed. It has been shown that when heated in water, Fe-jarosite in the polymer phase is transformed into ultra-dispersed β-FeooH particles. We have extended the formation of compounds of the type $R_4N(M_3(OH)_6(SO_4)_2$ in the polymer phase, where M^{3+} is Cr^{3+}, Ga^{3+}, In^{3+}, lanthanide (III), and R_4N^+ is the functional group of the polymer. Metal - Polymer composites have selective sorption and/or catalysis properties. The Cr-polymer composite was investigated in more detail, taking into account that chromium compounds are kinetically more stable than the investigated composites of other metals.

Keywords: Cross-linked ionic polymer; ion exchanger; jarosite; composite; iron; chromium

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Liquid Chromatographic Determination of Cefuroxime Axetil: A Preliminary Analytical QbD-Based Approach

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Abstract

Cefuroxime axetil (CEFax) is a racemic mixture and potent second-generation cephalosporin antibiotic prescribed for the treatment of bacterial infections of the kidney, urinary tract, meningitis and respiratory tract. It is effective against Gram-positive and Gram-negative bacteria, excreted from the body as intact. In the proposed preliminary study, it was aimed to perform the high performance liquid chromatographic (HPLC) analysis of CEFax using analytical quality by design (QbD) approach. The parameters such as flow rate, pH and methanol percentage of the mobile phase were selected as independent variables to obtain optimum resolution and retention time using response surface methodology. Chromatographic separation was carried out by a C18 column (150 x 4.6 mm, 2.7 µm) using methanol: aqueous o-phosphoric acid solution (10 mM) (v/v) (45:55) as the mobile phase at 280 nm UV detection wavelength. The designed parameters were successfully applied to the determination of CEFax in tablet formulations using QbD principles for the first time. The developed method will further be validated in compliance with ICH Q2 R1guidelines.

Keywords: Cefuroxime axetil; experimental design; HPLC; QbD; formulation, RSM

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Advanced nanomaterials for textile industry wastewater solutions

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Abstract

The textile industry is one of the leading contributors to global water pollution, discharging wastewater rich in dyes and hazardous chemicals that pose serious environmental threats. To tackle this challenge, advanced nanomaterials have emerged as promising solutions for the effective treatment of textile effluents. Among these, graphene-based nanocomposites have gained considerable attention due to their outstanding adsorption capacity, environmental sustainability, and cost-effectiveness. This study investigates the performance of graphene-based nanocomposites in the removal of cationic dyes, with a particular focus on methylene blue. The materials demonstrated a high adsorption capacity of 260.45 mg/g, utilizing mechanisms such as electrostatic interactions, π–π stacking, and hydrogen bonding to achieve efficient dye removal. Thermodynamic studies confirmed that the adsorption process is spontaneous and exothermic, highlighting its suitability for real-world industrial applications. Additionally, the nanocomposites exhibited excellent reusability, maintaining their performance over multiple regeneration cycles. Critical parameters affecting adsorption—such as solution pH, contact time, and adsorbent dosage—were systematically studied. The results emphasize the potential of graphene-based materials as a scalable, eco-friendly, and sustainable solution for treating textile wastewater, offering both environmental and economic advantages. These findings reinforce the pivotal role of advanced nanomaterials in addressing pressing global water pollution issues through innovative and sustainable technologies.

Keywords: Advanced nanomaterials; Textile wastewater; Adsorption capacity; Reusability.

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Thermal Properties of PLA Nanofibers Surfaces Containing HA/TiO2 Additives Produced by Electrospinning Method

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Abstract

In this study, the electrospinning method was used to create nanofiber surfaces using titanium dioxide (TiO2), hydroxyapatite (HA), and polylactic acid (PLA) in varying concentrations and mixing ratios. Thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and Fourier transform infrared spectroscopy (FT-IR) tests were used to identify the distinctive characteristics of the generated nanofibers surfaces. The results of the FT-IR analysis showed that the functional groups in the composition of the generated composite nanofibers remained unchanged. In the DSC analysis, adding 2% HA and 2% TiO2 to PLA decreased the glass transition (Tg) temperature, but it had no discernible effect on the melting or Tg temperatures of any of the samples. The generated composite nanofibers started to break down at 300 °C, per the TGA analysis. It was seen that the composite nanofibers have sufficient thermal properties to be used in living tissues.

Keywords: Electrospinning, Nanofiber, Polylactic acid, Hydroxyapatite, Titanium dioxide