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Inulin as a novel biocompatible coating: Evaluation of surface affinities toward CaHPO_4 , $\alpha\text{-Fe}_2\text{O}_3$, ZnO, $\text{CaHPO}_4@\text{ZnO}$ and $\alpha\text{-Fe}_2\text{O}_3@\text{ZnO}$ nanoparticles



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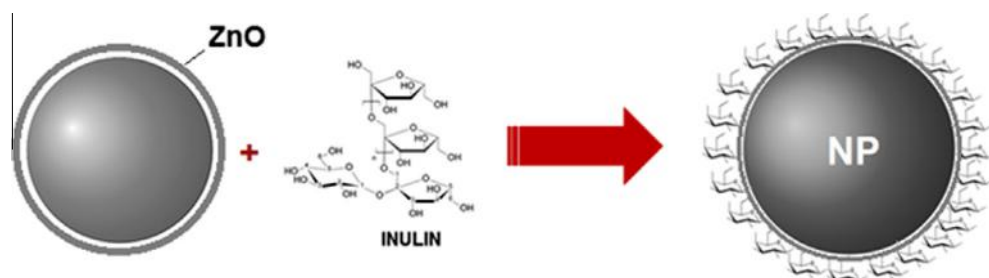
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ABSTRACT

The introduction of biocompatible coatings onto nanoparticle surfaces can be synthetically challenging. In this work, calcium phosphate (brushite, $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$), iron oxide (hematite, $\alpha\text{-Fe}_2\text{O}_3$), zinc oxide (ZnO), and $\text{CaHPO}_4@\text{ZnO}$ and $\alpha\text{-Fe}_2\text{O}_3@\text{ZnO}$ nanoparticles were synthesized and treated with the biocompatible, biodegradable, polysaccharide inulin [(2R,3S,4S,5R)-2-[[[(2R,3S,4S,5R)-3,4-dihydroxy-2,5-bis-(hydroxymethyl)oxolan-2-yl]oxymethyl]-5-(hydroxymethyl)oxolane-2,3,4-triol] under mild conditions. The products were fully characterized by Fourier transforms infrared (FTIR) spectroscopy, energy dispersive spectroscopy (EDS), dynamic light scattering (DLS), differential thermogravimetric/differential thermal analysis (TGA/DTA), transmission electron microscopy (TEM) and powder X-ray diffraction (XRD). Surface interactions among hematite and brushite with inulin are weak, but coating the nanoparticle surface with ZnO increased the affinity toward the polysaccharide. Inulin adsorption on the nanoparticle surface was confirmed by thermal and spectroscopic analyses. The nanoparticles had diameters ranging from 50 to 80 nm, with nearly spherical morphology. The nanoparticles sizes, stability and solubility in water could make them useful as components for enriched foods.

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1. Introduction

The development of novel delivery systems for food enrichment and pharmaceutical use is a promising application for nanomaterials

Assessment of Biomass of Leaves of Water Hyacinth (*Eichhornia crassipes*) as Reducing Agents for the Synthesis of Nanoparticles of Gold and Silver

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Abstract— Green chemistry methods for nanoparticles synthesis have implemented the valorization of renewable waste that reduces the use of chemicals and sub-products to minimize the environmental impact. Herein, we report a method to synthesize Ag and Au nanoparticles (AgNPs, AuNPs) using one of the world's worst aquatic weeds, water hyacinth. From a reaction between a solution of AgNO₃ or HAuCl₄ and controlling the pH, the nanoparticles were synthesized. The optimum pH value to obtain uniform quantum dots was found to be acidic for AgNPs and neutral for AuNPs. The size was highly dependent on pH for AgNPs, a smaller size was for acidic pH, and the larger size was for basic pH, and cubic and hexagonal are the predominant structures, no dependent was observed in AuNPs, and orthorhombic is the most common form. This method was sustainable because water hyacinth is a renewable resource in all world, and their use is not being exploited in any process. The bioreduction process using water hyacinth promotes the metallic nanoparticles formation and applied standard conditions for temperature and pressure. Also, the rate of synthesis is fast.

Keywords— Assessment of water hyacinth, green synthesis, gold nanoparticles, leaf biomass, silver nanoparticles.

I. INTRODUCTION

The study of the metal bioaccumulation/phytoremediation process in plants has revealed that metals are deposited as nanoparticles in various organs and tissues (Makarov et al., 2014). A nanoparticle is defined as a discrete particle that has a structure in the nanometer size range, usually from 1 to 100 nm. The high surface area due to volume ratio of nanoparticles makes their physicochemical properties quite different from those of the bulk material

(Hebeish, El-Rafie, El-Sheikh & El-Naggar, 2013; Ahmad, 2014). Many researchers have been focused on silver and gold nanoparticles (AgNPs, AuNPs) in various fields of applications. Metal ion adsorption Bahadar et al., 2014; antimicrobial activity Muhammad et al., 2014; photocatalytic activity Wei et al., 2014; chemical sensors Rahman, Khan, Jamal, Faisal & Asiri, 2012 and, labeling Urusov et al., 2015.

Generally, AgNPs and AuNPs are synthesized by several methods whether physical or chemical. Thermal decomposition Hosseinpour & Ramezani, 2014; sonochemical Mohd & Ashokkumar, 2015; Darroudi, Zak, Muhamad, Huang & Hakimi, 2011; solvothermal Choi et al., 2013; microemulsion Ahmad, Wani, Al-Hartomy, Al-Shihri & Kalam, 2015; Jurkin, Guliš, Dražić, & Gotić, 2016; and laser ablation Urusov et al., 2015. The most of these methods need controlled environments and involve the use of hazardous chemical reagents like sodium borohydride and hydrazine hydrate (Hebeish et al., 2013). The request for an environmentally sustainable synthesis method has led to green chemistry techniques (Shameli et al., 2012). This approach could have a reduction/elimination of toxic and hazardous substances in the synthesis processes of metallic nanoparticles. Green chemistry uses microorganisms, enzymes, algae, plants (Majeed et al., 2016) and biomolecules (Hebeish et al., 2013).

The water hyacinth plants were considered as a good source in metal nanoparticles synthesis; it is contemplated as a weed because of growth in rivers and streams. It has been recognized as a hyperaccumulator organism in which high concentration of tannins makes it an excellent tool for heavy metals removal and metal nanoparticles synthesis (Rosano-Ortega et al., 2007).

La renovación curricular desde el diagnóstico social participativo: una experiencia académica de la Maestría en Mecatrónica de UPAEP

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Resumen

Se presenta el diagnóstico social, resultado de un estudio de las tendencias nacionales y demandas que emergieron de entrevistas aplicadas a egresados, empleadores y académicos. Tiene por objetivo indagar sobre las competencias que dan respuesta al contexto social histórico en opinión de los actores estratégicos. El propósito es investigar los parámetros que potencian el diseño curricular de la Maestría en Ingeniería

ANALYSIS OF THE INTERACTIONS OF N-(L-A-ASPARTIL)-L-PHENYLALANINE, 1-METIL ESTER (ASPARTAME) AND THE NITROGEN BASES OF DNA AND RNA USING QUANTUM METHODS.

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ABSTRACT

There is much research going on around the ASP. Some of these studies claim that ASP is a potential carcinogen, while others claim otherwise. In this research, we determine the power to exchange electrons of the ASP through the calculation of their Electron Transfer Coefficient (ETC). The quantum methodology was used with the Hyperchem simulator and the Semi-empirical Parametric Method 3 (SE-PM3) with its specific parameters. The results show that the ASP has an ETC capable of interchanging its electrons as an oxidizing agent or reducing agent in a probable interaction zone. It is concluded that for this reason of average probability the results of this investigation

sometimes show if and sometimes not their cancerous power. It is then said that its carcinogenic power depends on the conditions under which the laboratory test is performed.

KEYWORDS: Cancer, Aspartame, SE-PM3.

MOLECULAR INTERACTIONS OF NICOTINE AND THE NITROGENOUS BASES OF DNA AND RNA CALCULATED BY IMPROVED QUANTUM METHODS

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ABSTRACT

Nicotine (Nic o N) has caused much damage to humans. Exposure to Nic during the development stage of the fetus can lead to several disorders. The objective of this work was to calculate all possible interactions of Nic vs. Nitrogen Bases (NB) for DNA and RNA using Semi-Empirical Parameterized Method 3 (SE-PM3). These calculations were performed using the molecular simulator Hyper Chem (HC). The improved calculations were based on the novel Electron Transfer Coefficient (ETC) theory posited by the authors in previous work. This theory is the calculus of the ratio of dividing Band Gap (BG) / Electrostatic Potential (EP). This ratio indicates the number of multiples of its EP that the electron needs to jump its BG. As the result, we calculated 36 Interactions Cross Band (ICB) of NB and 13

ICB of Nic vs. NB. We conclude that N can be confused with the A in the genesis of RNA because the similar value of ETC (24.092 and 24.240) for the pairs pair A:U and N:U. It is noted that the N gives an electron cloud in the same way that A does.

KEYWORDS: Nicotine, Nitrogenous bases, DNA and RNA, Quantum methods, SE-PM3

I. INTRODUCTION

a. The harm caused by Nic

Nic has caused much damage to humans. Many studies show that Nic may affect pluripotent cell differentiation in fibroblasts and, in particular, the differentiation of embryonic stem cells.^[1] The reduced fertility and increased follicular atresia in animals exposed to Nic may

Análisis de elemento finito en la formación de la columna de giro para volante automotriz

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Palabras clave: elemento finito, discretización, nodos.

Resumen

El análisis del funcionamiento mecánico de una pieza automotriz independientemente de su diseño o función, requiere para su liberación, la aplicación de un conjunto de ensayos que deben ajustarse a especificaciones normalizadas con el fin de verificar y confirmar que los datos obtenidos coinciden con los parámetros establecidos, para así validar su funcionalidad de acuerdo a los estándares y la aplicación para lo que fue diseñada. Una alternativa para reducir los tiempos de desarrollo y ejecución de ensayos se basa en el desarrollo de procesos de simulación y ensayos virtuales a través de diferentes herramientas de software como Abaqus, Nastran, Algor, Ansys, entre otros. Con la aplicación de estas herramientas de software se alcanza una aproximación certera sobre el comportamiento y funcionalidad de la pieza, en donde los resultados pueden ser utilizados para establecer un buen margen en el avance de pruebas de laboratorio y basados en la experiencia desarrollada en CAE, los resultados llegan a ser confiables como una primera aproximación en la caracterización de la pieza, en el cual reduce los tiempos de desarrollo y costos de prueba, para su validación.

Abstract

The analysis of the mechanical operation of an automotive part regardless of design or function, required for his release, the application of a set of tests to be fit with standard specifications in order to verify and confirm that the data are consistent with the parameters set in order to validate its functionality according to the standards and the application for which it was designed. An alternative to reduce development time and execution of tests is based on the development of simulation processes and virtual testing through different software tools such as Abaqus, Nastran, Algor, Ansys, among others. By applying these software tools an accurate approximation of the behavior and functionality of the piece, where the results can be used to establish a good margin in the advancement of laboratory tests and based on the experience developed in CAE, is reached, the results become reliable as a first approach in the characterization of the piece, which reduces development time and testing costs for validation.

Introducción

El método de elementos finitos por novedoso que parezca, tiene ya varios años en su forma conceptual, ya que en ello podemos recordar las bases de cálculo diferencial e integral, sin embargo el desarrollo moderno de esta técnica comienza en 1940, específicamente en el campo de ingeniería estructural, con los trabajos de Hremikoff en 1941 y McHenry en 1943, quienes propusieron el uso de dos líneas en una dimensión para representar elementos como barras o vigas para el cálculo de esfuerzos en sólidos con sección transversal continua [Hortig y Kayser 2008]. El análisis de elementos finitos desde su enfoque matemático fue desarrollado en 1943 por