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Synergetic effect of sonication and solar light-a new methodology for the synthesis of bimetallic nano-TiO_2; Nanophotocatalysts for oxidation processes

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An improvement of properties of photocatalytic materials is currently one of the most urgent matter. These drawbacks severely limit a practical application of titanium dioxide photocatalysts as such to degrade organic pollutants in gas or liquid phase. Therefore, new synthesis methods are intensively searched.

Sonication is currently considered one of the most powerful tools in the synthesis of nanomaterials. In comparison with traditional sources of energy, ultrasounds ensure unusual reaction conditions in liquid phase reactions due to the cavitation phenomenon. Photodeposition is a way of deposition of metal particles from its salt solution on the surface of semiconductor with the use of light. Such photodeposition as well as sonication method are well known and used independently in the synthesis of nanomaterials. A new metal nanoparticles sonophotodeposition method, which combines in situ sonication with photocatalytic reduction of metal, has been proposed earlier. Herein, reducing agents are electrons produced by the ultraviolet absorption by semiconductor materials. Ultrasounds assure dispersion of nanoparticles in the solution, enhanced mass transfer between reagents and help in the metal reduction.

Four different photocatalytic systems have been prepared by this methodology. Couple of two metals, Fe-Pt and Fe-Pd, have been grafted on TiO_2/zeolite surface by two different ways: simultaneously or by consecutive doping of already prepared Fe-TiO_2/zeolite photocatalyst with noble metals. Such prepared materials have been characterized by different techniques to determine their structural, textural and optical properties. They have been also tested in phenol photo-oxidation reaction to proof their photocatalytic activity and perspective use in wastewater treatment.

Biography

Juan Carlos Colmenares Q graduated from Warsaw University of Technology (Chem.Eng.1995) and obtained his M.Sc. (1997) in Catalysis for Organic Technology and Ph.D. (2004) in Chemical and Material Sciences from the same university. His interests range from materials science, nanotechnology and heterogeneous catalysis to biomass and CO2 valorization, biofuels, photocatalysis and water/air purification. After his Ph.D., he worked at the University of Cordoba, Spain (2005-2006) in Prof. Marinas group as a post-doctoral fellow and at the University of Southern California, Los Angeles (USA) (2006-2009) in Prof. G.A. Olah (Nobel Prize in Chemistry) as a post-doctoral research associate. He is a Marie Sklodowska-Curie Fellow and has participated in many research projects as a main investigator and co-leader. He has co-authored more than 35 works in international specialized journals/books.

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Preparation, characterization and modification of hyperbranched polyester (HBPE) and its application in nanosilver preparation

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A novel hyperbranched polyester with aromatic/aliphatic structure was synthesized in three different monomer mole ratio by polycondensation method. The reaction was carried out via A_2+B_3 approach using 2,2',2" nitrilotriethanol as a core molecule, benzene 1,3 dicarboxylic acid as a chain extender and p-Toluene sulfonic acid (p-TSA) as an acid catalyst. The chosen molar ratio of 2,2,'2" nitrilotriethanol to benzene 1,3 dicarboxylic acid were 1:1, 0.9:1, 0.6:1. The resulting polyester molecules were characterized using ^{1}H'NMR, ^{13}CNMR, FT-IR spectroscopy, GPC and TGA. Silver nanoparticles were prepared by reductive technique using HBPE of 1:1 molar ratio as matrix. XRD, UV visible and TEM analysis indicated the formation of highly spherical and stable nanosilver in HBPE matrix. The antibacterial activity of nanosilver/HBPE was evaluated against *Staphylococcus aureus (S.aureus)* and *Escherichia coli* bacterium (*E.coli*).

Biography

K. Priya Dasan has completed her Ph.D. from University of Calicut, India in 2007. After 2 years of industrial R& D experience she moved to academics. She joined VIT University as Assistant Professor in material chemistry division and is associated with the university for the last four years. She has published more than 15 papers in reputed journals and is completed the doctoral work of two research students. Her main area of work is polymer composites, biocomposites, hyperbranched polymers and polymer based coatings.

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