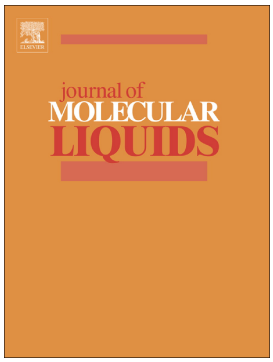

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Optical and Structural Properties of Oxidation Resistant Colloidal Bismuth/Gold Nanocomposite: An Efficient Nanoparticles Based Contrast Agent for X-ray Computed Tomography

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Abstract

Optical and biomedical applications of bismuth-based nanostructures could be limited due to the particle oxidation in aqueous media. To overcome this limitation, a two-step process including Nd:YAG pulsed laser ablation of bismuth and chemical reaction for shell formation have been developed to fabricate Bi/Au nanoparticles. The nanoparticles have been extensively characterized by various method including transmission electron microscopy, scanning electron microscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction, optical extinction and MNPBEM simulation package using boundary element method. The prepared bismuth nanoparticles by laser ablation in toluene demonstrate a narrow size distribution with mean size of 40 nm and gold shell were synthesized on Bi core with 7 nm thickness. In optical transmission, the wavelength of maximum absorption peak due to surface plasmon resonance was at 562 nm for gold thickness between 5 to 7 nm. MNPBEM simulation results predict the trends of the experimental observation including the spherical shape and shell thickness. Oxidation resistance of nanoparticles was studied via optical extinction spectroscopy. Oxidation resistance is one of the important factors in efficiency of nanoparticles in aqueous solution as CT contrast agents Finally, Bi/Au composite nanoparticles demonstrated higher x-ray attenuation in comparison with commercial iodine molecule.

Keywords: Bi/Au composite; optical properties; oxidation resistant; CT contrast agent.