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Research Article

Stabilization of Silver Nanoparticles with a Dithiocarbamate Ligand and Formation of Nanocomposites by Combination with Polythiophene Derivative Nanoparticles

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Spherical morphology for silver nanoparticles (Ag NPs) stabilized with dithiocarbamate (DTC) by reducing silver nitrate with sodium borohydride was obtained, while the addition of sodium citrate and hydrogen peroxide allowed the formation of silver nanotriangles (Ag NTs). Solutions of bright yellow and blue colors characteristic of both morphologies were observed. UV-vis optical analysis of NPs stabilized with DTC showed a plasmonic absorption band at 393 nm characteristic for spherical morphology, while two bands were observed at 332 nm and 762 nm, and a shoulder around 500 nm for the triangular morphology; with these spectra each morphology was confirmed. In these spectra an absorption band between 250 and 260 nm confirms the presence of DTC ligand. The stability of the NPs was achieved using an 8.69×10^{-3} mM solution of 4-(ethylaminodithiocarbamate) methylpyridine di-*n*-butyltin (IV) through a transmetallation reaction. Silver nanoparticles (Ag NPs) with spherical morphology of average diameter of 12.7 ± 1.2 nm and triangular morphology with 28.9 ± 0.8 nm for each side of the triangles were analyzed by high resolution scanning electron microscopy (HR-SEM). UV-vis spectra also showed the stability of NPs with DTC for more than three months. A copolymer derived of 3-hexylthiophene with (*E*)-2-(ethyl(4-((4-nitrophenyl) diazenyl) phenyl) amino) ethyl 2-(thiophen-3-yl) acetate (PA) was tested to get polymer NPs by reprecipitation method using THF/water systems. PA Polymer NPs having average diameter of 9.0 ± 1.7 nm were found. By quick and easy procedure, the formation of nanocomposite (NC) of spherical Ag NPs and PA polymer NPs was reached. This NC could be used as imaging agent, electrochemical biosensor, and photonic and optoelectronic device materials.

1. Introduction

New methodologies have been developed for the synthesis of NPs in order to obtain specific size and shape which in turn defines its applications field. For example, the surface plasmon resonance (SPR) of NPs has been studied for its potential applications in chemistry, optics, magneto-optics, photonics, nanoengineering, and biosensors, among others [1, 2].

The interest in synthesizing metallic NPs functionalized with a protective monolayer of some binder grew exponentially due to the numerous nanotechnology applications such as bactericidal agents, because of their antibacterial nature, formation of metallic nanostructures as hybridized