SYNTHESIS AND PROPERTIES OF SILVER NANOPARTICLES STABILIZED BY POLYTHIOCYANATOHYDROQUINONE

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The trend to miniaturization and necessity of improvement of technological processes during last 20 years have resulted in a fast increase of the researches devoted to study, functionalization and applications of metal nanoparticles. Their synthesis is one of the most promissing directions in modern nanotechnology that develops most dynamically.

The silver nanoparticles (AgNPs) deserve a special interest because of their unique physicochemical properties, including optical, magnetic and electronic characteristics, catalytic activity and biological impact; all these features serve to increase the AgNPs applications in medicine, agriculture, environment, and industry. The AgNPs have a high potential as commercial nanomaterials and an effective antimicrobial agent.

There are several methods proposed for the silver nanoparticles fabrication, including chemical and physical methods. Among them, the chemical reduction of silver ions in the presence of a protecting agent, is the most common and useful approach. In the chemical methods of the AgNP preparation the special attention is given to a choice of reducing and capping agent since the physicochemical properties of silver nanoparticles are strongly dependent on the incorporated capping agent molecules. Organic polymers are of especial interest because performing the reducer function the organic molecule can simultaneously be adsorbed on the nanoparticles thereby stabilizing them.

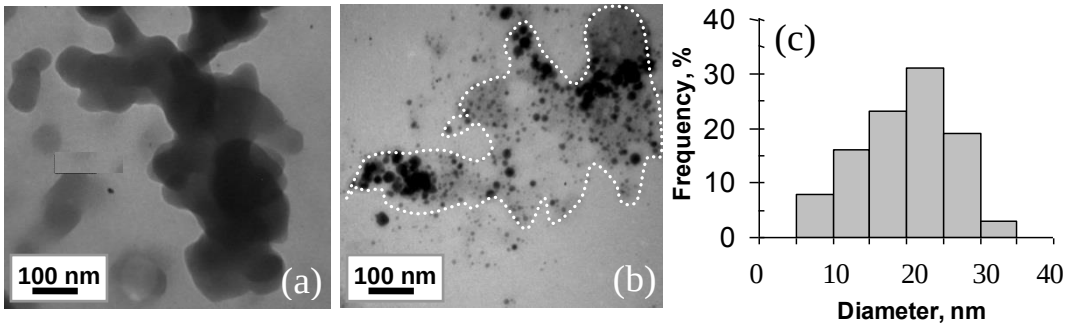

Fig. The TEM images of PTHQ (a), AgNPs (b) and the corresponding size distribution histograms of AuNPs stabilized by PTHQ (c). By dotted line (b) the borders of PTHQ globule are shown

This is the first report in the literature on the synthesis of silver nanoparticles by using polythiocyanatohydroquinone (PTHQ) as a reducing and stabilizing agent to form a small size and highly distributed AgNPs. The silver nanoparticles were characterized by different techniques such as UV–vis spectroscopy, FT-IR spectroscopy, X-ray diffraction and transmission electron microscopy. The presence of the absorption band at 400 nm indicates the presence of silver nanoparticles in solution. Transmission electron microscopy experiments indicate that these nanoparticles are formed with spherical shapes. The X-ray diffraction pattern shows a high purity and face centered cubic structure of silver nanoparticles. The FT-IR spectroscopy reveales that silver nanoparticles were functionalized with the PTHQ reagent which has various stabilizing functional groups. The presence of sulfer and nitrogen atoms in the PTHQ structure provides a perspective for possible applications in biotechnology because of tolerance and conjunction of the synthesized nanoparticles with biopolymers.