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SYNTHESIS AND CHARACTERIZATION OF POLYPYRROLE NANOPARTICLES

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Conducting polymers with extended -conjugated structures have received great attention as multifunctional materials due to their wide range of potential applications in various technological and biological areas such as polymeric rechargeable batteries, corrosion protection, coating layers, electrochromic displays, chemical and biological sensors, functional membranes, drug delivery systems and contrast agents. Among conducting polymers/organic polymer based nanoparticles, polypyrrole (PPy)/polypyrrole nano- and microparticles (PPy-NPs) have attracted a great interest owing to their high conductivity, relatively high stability in different chemical conditions, inert character for biological systems, biocompatible behavior and simplicity of preparation. Development of methods for controlling the size and surface properties of PPy-NPs has been made. PPy-NPs were synthesized via water based redox nanoprecipitation polymerization initiated by an oxidant in the presence of surfactants or soluble polymer stabilizers. To ensure the required size of synthetizing particles and good stability of colloidal dispersion, the reaction mixtures were controlled by the various concentration of organic stabilizers (e.g. polyvinylpyrrolidone (Mw=40000), poly(ethylene glycol) (Mn=4000), sodium dodecyl sulfate, docusate sodium) and specific type of oxidizing agents (e.g. H_2O_2, $(NH_4)2S_2O_8$, $FeCl_3 \cdot 6H_2O$, MnO_2). Morphological studies of prepared materials were investigated by using transmission and scanning electron microscope (TEM and SEM, Figure 1). Hydrodynamic properties, size distribution and zeta potential of the studied particles were measured and determined by dynamic light scattering on Zetasizer (Malvern device). Primary photoabsorption studies were done on UV-Vis spectrometer (Analytic Jena device) as well.

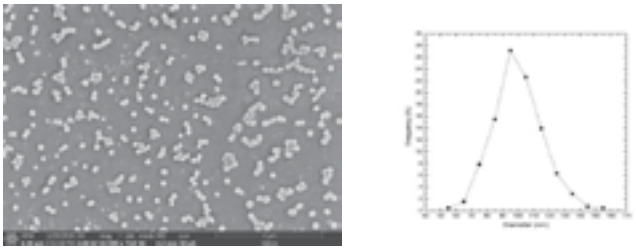

Figure 1: SEM image of PPy-NPs obtained in the presence of PVP (M_w=40000) and $FeCl_3 \cdot 6H_2O$ (left), size distribution of PPy nanoparticles (right).

Recent Publications

1. Men shikova A Yu, Shabsel s B M and Evseeva T G (2003) Synthesis of polypyrrole nanoparticles by dispersion polymerization. Russ. J. Appl. Chem. 76(5):822-826.
2. Pecher J and Mecking S (2010) Nanoparticles of conjugated polymers. Chem. Rev. 110(10):6260-6279.
3. Woo H Y (2010) Synth. Met. 160:588-591.
4. Hazarika J and Kumar A (2013) Controllable synthesis and characterization of polypyrrole nanoparticles in sodium dodecylsulphate (SDS) micellar solutions. Synth. Met. 175:155-162.
5. Vaitkuviene A et al. (2013) Evaluation of cytotoxicity of polypyrrole nanoparticles synthesized by oxidative polymerization. J. Haz. Mat. 250-251:167-174.

Biography

Monika Paúrová obtained her PhD at Charles University, Prague, Czech Republic. She has gained experiences in synthesis of bifunctional ligands for selective metal binding and low-molecular functionalized chelating compounds. She is currently investigating design, synthesis and characterization of composite polymer based on inorganic/polymer nano- and microparticles and their consequent surface modifications/ functionalization for bioapplication (at the Institute of Macromolecular Chemistry of the Academy of Science, Czech Republic).

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