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Processing CdSe/TGA Quantum dots forPotential Bio-Medical Applications

ABSTRACT

The size-dependent optical properties of CdSe nanoparticles are desirable in bio-imaging and cell sorting applications because of their tunable photoluminescence in the visible range. Previous studies have already suggested that CdSe QDs could be utilized for pathogen detection by using suitable capping agents to make it biocompatible; however, systematic works on the effect of crystallite size and composition of the nanocrystals are scarce. The present research will be focused on the effect of CdSe crystal size and composition (pure and doped systems) to systematically evaluate its applicability in detecting pathogens, e.g. *Escherichia coli* (*E. coli*). Highly luminescent water-soluble CdSe QDs were firstly synthesized in aqueous phase in presence of thioglycolic acid (TGA) as a capping agent. CdSe/TGA molar ratios, reaction temperature, time, and pH were evaluated in order to optimize the QDs optical properties. XRD measurements confirmed the formation of CdSe that exhibited hexagonal structure with an estimated averaged crystallite size in the 4-6 nm range. TEM analyses evidenced the formation of CdSe nanocrystals with particle sizes between 3-5 nm. UV-Vis measurements showed a strong exciton peak between 390-400 nm with an estimated band gap of 2.64 eV (bulk: 1.74 eV); additionally, a strong fluorescence peak was observed between 500-550 nm using an excitation wavelength of 400 nm. FT-IR analyses suggested the actual functionalization of the CdSe surface with TGA functional groups. Preliminary results of the CdSe/TGA coupling with the selected bacteria, *E. coli*, are presented and discussed.