Cadmium Sulfide Quantum Dots Stabilized By Castor Oil and Ricinoleic Acid

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Abstract

Castor oil and ricinoleic acid (an isolate of castor oil) are environmentally friendly bio-based organic surfactants that have been used as capping agents to prepare nearly spherical cadmium sulfide quantum dots (QDs) at 230, 250 and 280 °C. The prepared quantum dots were characterized by Ultra violet-visible (UV-vis), Photoluminescence (PL), Transmission Electron Microscopy (TEM), High Resolution Transmission Electron Microscopy (HRTEM) and X-ray diffraction (XRD) giving an overall CdS QDs average size of 5.14±0.39 nm. The broad XRD pattern and crystal lattice fringes in the HRTEM images showed a hexagonal phase composition of the CdS QDs. The calculated/estimated average size of the prepared castor oil capped CdS QDs for various techniques were 4.64 nm (TEM), 4.65 nm (EMA), 5.35 nm (UV-vis) and 6.46 nm (XRD). For ricinoleic acid capped CdS QDs, the average sizes were 5.56 nm (TEM), 4.78 nm (EMA), 5.52 nm (UV-vis) and 8.21 nm (XRD). Optical properties of CdS QDs showed a change of band gap energy from its bulk band gap of 2.42-2.82 eV due to quantum size confinement effect for temperature range of 230-280 °C. Similarly, a blue shift was observed in the photoluminescence spectra. Scanning electron microscope (SEM) observations show that the as-synthesized CdS QDs structures are spherical in shape. Fourier transform infra-red (FTIR) studies confirms the formation of castor oil and ricinoleic acid capped CdS QDs.