Title:	Size dependence of CdS nanoparticles on the precursor concentration and visible light driven photocatalytic degradation of methylene blue
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Abstract:	Using a Cd(II) coordination polymer, [Cd2(bpma)2(adc)2]n (where bpma = N,N′-bis(pyridylmethyl) amine and adc = acetylene dicaboxylate), as the source of Cd2+ ions and thiourea as the source of S2− ions in various ratios (1 : 3, 1 : 5, 1 : 7, 1 : 10, 1 : 15 and 1 : 20) in water, CdS nanoparticles (CdS-1 to CdS-6) were synthesized under hydrothermal conditions without a template and an added surfactant. The size of nanoparticles increases with an increase in the concentration of thiourea. These nanoparticles were characterized by powder X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), energy dispersive X-ray spectroscopy (EDS), transmission electron microscopy (TEM), and UV–vis diffuse reflectance spectroscopy. The XRD results revealed the presence of both cubic and hexagonal forms in CdS-1 to CdS-6. Based on their UV–vis diffuse reflectance, the band gap energies were estimated to be 2.26, 2.20, 2.19, 2.18, 2.17 and 2.15 eV for CdS-1, CdS-2, CdS-3, CdS-4, CdS-5 and CdS-6, respectively. The photoluminescence spectra of CdS-1 to CdS-6 (excitation wavelength: 350 nm) displayed a blue emission in the wavelength range of 434–437 nm and a green emission in the range of 533–552 nm. The blue emission resulted from the recombination of excitons, whereas the green emission was caused by sulphur vacancies in CdS nanoparticles. Furthermore, the photocatalytic degradation of the methylene blue dye was carried out in water under visible light using CdS-1 to CdS-4, where the maximum degradation efficiency of 97% was obtained using 0.02 mol% of CdS-1.
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