Fluorescence quenching caused by aggregation of water-soluble CdSe quantum dots

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We investigate the change in the optical property of water-soluble CdSe quantum dots upon aggregation. First, we synthesize the water-soluble CdSe quantum dots using surface-ligand exchange with mercaptoacetic acid. To induce the aggregation of water-soluble CdSe quantum dots, we add $CaCl_2$ solution to CdSe quantum dot suspension. To monitor the change in photochemical and physical properties upon aggregation, various experimental techniques such as quasi-elastic light scattering (QELS), transmission electron microscopy (TEM), zeta potential measurement, and photoluminescence spectroscopy are employed. We find that the addition of electrolyte to water-soluble quantum dots reduce the colloidal stability of quantum dots, causing aggregation and hence the fluorescence quenching of quantum dots. We rationalize the experimental results with the classical DLVO theory that accounts for the interparticle interaction and colloidal stability in suspension.