Detection of Single Base Mismatch Using Selective Aggregation of CdS Quantum Dots

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We have performed the detection of specific DNA sequences using selective aggregation of unmodified CdS quantum dots by the hybridization of oligonucleotide. Oligonucleotide sequences were designed to detect breast cancer 2 (BRCA2) because BRCA2 polymorphism is known to be associated with prenatal viability and breast cancer risk. To monitor selective aggregation of CdS quantum dots, we use the photoluminescence spectroscopy, quasi-elastic light scattering (QELS), zeta potential measurement and TEM. Because ssDNA and dsDNA have different electrostatic properties, and because adsorption of ssDNA stabilizes the CdS quantum dots surfaces against aggregation, we were able to selectively aggregate CdS quantum dots for the perfectly matched DNA under optimal salt concentration in presence of a phosphate buffer solution. Our results indicate that a change in the electrostatic interaction is responsible for the selective aggregation of CdS quantum dots upon the addition of DNA. This suggests a novel design principle for a rapid detection of the DNA sequences by controlling the electrostatic interactions between CdS quantum dots.