Chemical sensor based on the fluorescence quenching of CdTe quantum dots for the determination of lead ions

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TGA capped CdTe quantum dots (QDs) was synthesized and used as a sensitive fluorescent probes for the determination of lead ions (Pb^{2+}). The interaction between the CdTe QDs and lead ions was investigated using fluorescence spectroscopy and some parameters affecting to the fluorescence quenching were optimized i.e., types of stabilizer capped quantum dots (TGA, MPA, GSH, and MSA), concentration of quantum dots, pH of buffer solution, reaction time and reaction temperature. Under the optimum conditions, concentration of quantum dots was 4×10^{-7} M, pH of 9, reaction time 1 min and temperature 25˚C. The quenched fluorescence intensity (F_0/F) of CdTe QDs was linear over the concentration range of 0.05–30.0 mgL^{-1} and the detection limit was 0.05 mgL^{-1}. The possible quenching mechanism was described by the Stern–Volmer equation. The spiked water samples were extracted and preconcentrated using ion imprinted polymer. This simple, rapid and cost effective method was successfully applied for the determination of lead in water sample. Good recoveries (>80%), with a relative standard deviation less than 10% indicated that the developed method was accurate and reliable.

Keywords: CdTe Quantum dots, Ion imprinted polymer, Lead