

A novel method for the determination of cadmium ions based on the quenching of the fluorescence of CdSe quantum dots

Nassim Ben Brahim^{a,b,*}, Naim Bel Haj Mohamed^a, Rafik Ben Chaâbane^a, Mohamed Haouari^a, Michel Negrier^b, Hafedh Ben Ouada^a

^aLaboratoire des Interfaces et Matériaux Avancés, Faculté des Sciences de Monastir, Bd. de l'Environnement, 5019 Monastir, Tunisia.

^bLaboratoire d'Optique et Biosciences, INSERM U1182, CNRS UMR7645, Ecole Polytechnique, 91128 Palaiseau, France.

*Corresponding authors.

E-mail: nassim.benbrahim.fsm@gmail.com. Phone: +216 96 400 499

Abstract

A novel method for the determination of Cd²⁺ has been developed based on quenching of the fluorescence of thioglycerol-capped CdSe quantum dots (QDs) by Cd²⁺ in aqueous solutions. Under optimum conditions, the relative fluorescence intensity was linearly proportional to the concentration of Cd²⁺ between 1.0 and 22 µM with a detection limit of 0.32 µM. The detection mechanism between the thioglycerol capped CdSe QDs and Cd²⁺ ions was discussed using various experimental techniques such as TEM, fluorescence lifetime, UV–vis and fluorescence spectroscopy. Based on these optical properties, the TG-CdSe QDs could be used as a highly selective probe for the detection of Cd²⁺ ions in aqueous solutions, a species highly toxic for cells.

Keywords: CdSe quantum dots synthesis, Quenching of the fluorescence, Electronic microscopy, Cadmium detection, Cation binding selectivity