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Synthesis of N-acetyl-L-cysteine capped Mn:doped CdS quantum dots for quantitative detection of copper ions

Xiupei Yang[a, *], Zhihui Jia[a], Xiumei Cheng[a], Na Luo[a], Martin M. F. Choi[b, **]

[a] *College of Chemistry and Chemical Engineering, Chemical Synthesis and Pollution Control Key Laboratory of Sichuan Province, China West Normal University, Nanchong 637000, PR China*
[b] *Department of Chemistry, Hong Kong Baptist University, 224 Waterloo Road, Kowloon Tong, Hong Kong SAR, PR China*

ABSTRACT

In this work, a new assembled copper ions sensor based on the Mn metal–enhanced fluorescence of N-acetyl-L-cysteine protected CdS quantum dots (NAC-Mn:CdS QDs) was developed. The NAC and Mn:CdS QDs nanoparticles were assembled into NAC-Mn:CdS QDs complexes through the formation of Cd-S and Mn-S bonds. As compared to NAC capped CdS QDs, higher fluorescence quantum yields of NAC-Mn:CdS QDs was observed, which is attributed to the surface plasmon resonance of Mn metal. In addition, the fluorescence intensity of as-formed complexes weakened in the presence of copper ions. The decrease in fluorescence intensity presented a linear relationship with copper ions concentration in the range from 0.16-3.36 μM with a detection limit of 0.041 μM. The characterization of as-formed QDs was analyzed by photoluminescence (PL), ultra violet-visible (UV-vis), X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and energy dispersive spectroscopy (EDS) respectively. Furthermore, the recoveries and relative standard deviations of Cu^{2+} spiked in real water samples for the intra-day and inter-day analyses were 88.20-117.90, 95.20-109.90, 0.80-5.80 and 1.20-3.20%, respectively. Such a metal-enhanced QDs fluorescence system may have promising application in chemical and biological sensors.

***Keywords*:** Chemical sensor; Copper ions; Fluorescence; Quantum dots

[*] Corresponding author at: College of Chemistry and Chemical Engineering, China West Normal University, Nanchong 637000, PR China. Tel. : +86-817-2568081; fax: +86-817-2582029.
[**] Corresponding author. Tel. : +852-34117839; fax: +852-34117348.
E-mail addresses: xiupeiyang@163. com (X. Yang), mfchoi@hkbu. edu. hk (M. M. F. Choi).