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High selective, sensitive, paper-based probe for Cu(II) detection: A prospective form Nano-scale turn-on to Micro-scale turn-off states

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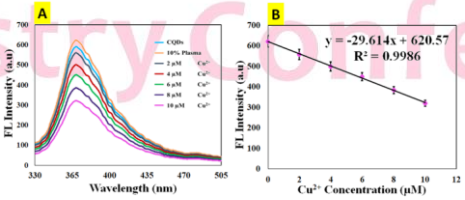
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A new fluorimetric-based method has been developed for detection of Cu(II) using neocuproine-based carbon quantum dots (CQDs). When Cu(II) is adsorbed onto the surface of the CQDs, it interacts with the functional groups, resulting in either an increase or decrease in fluorescence emission depending on the concentration of Cu(II). This is the first reported method that can detect Cu(II) at both nano-molar and micro-molar levels with two different phenomena, means that 0.001-0.1 µM addition of Cu(II) caused the enhancemnet of CQDs' FL emission intensity whereas the 1-10 µM addition of Cu(II) led the FL emission of CQDs to quench. This fascinating phenomena can turn this sensing probe into promising platform for real-world applications. A low-cost, easy-to-use, highly selective and sensitive CQD-based sensing system showed a limit of detection (LOD) of 0.001 µM and a dynamic range of 0.001-10 µM. The sensing potential of the system on human serum sample has also been tested, showing the recovery of 99.8-103.4% along with the RSD of <%6. Surprisingly, the measured concentration of cupric ions in human plasma after 2-10 µM cupric ions addition was found to be 22.157 µM, which is astonishingly well fit in the range of cupric concentration in the plasma of healthy individuals [1]. The findings indicate that the CQD-based sensor possesses high accuracy and precision toward Cu(II) detection, indicating good potential for practical use.

Keywords: Carbon Quantum Dots, Sensing Framework, Cu(II) Detection, Turn-on and Turn-off states mechanism

Samples	Cu^{2+} Spiked (µM)	Cu^{2+} Measured (µM)	Recovery (%)	RSD (%)
10% Plasma	0	0.179 ± 0.0096	-	5.4
10% Plasma + Cu^{2+}	4	4.138 ± 0.135	103.4	3.2
10% Plasma + Cu^{2+}	8	7.985 ± 0.135	99.8	1.63
10% Plasma + Cu^{2+}	10	10.149 ± 0.188	101.5	1.85



References

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