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CQD-Based Sensing Platform for Cu^{2+} Detection in Wilson's Disease

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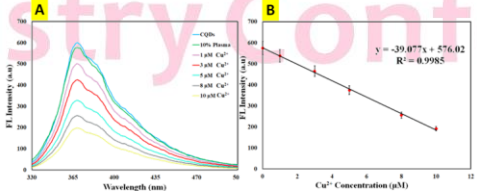
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The presence of Cu(II) is strongly linked to the emergence of Wilson's disease (WD), and accurately measuring the amount of copper is a crucial step in diagnosing WD at an early stage in a clinical setting [1]. In this work, CQDs were fabricated using pollen and citric acid through a facile technique as a novel fluorescence-based sensing platform for detecting Cu(II) in the serum sample of affected individual by WD. Cu(II) ions efficiently interact with the CQDs and give rise to QDs' Flourescence (FL) emission quenching in a wide linear ranges of 1-40 µM, with the LODs of 1 µM, respectively. To the best of our knowledge, the potential of the CQD-based sensor for Cu(II) detection in the serum sample of affected individual by WD, showing the recovery of 97.2-102.9% along with the RSD of <%5, which showed high precision, applicability, accuracy, selectivity, sensitivity toward Cu(II) ions. Surprisingly, the measured concentration of cupric ions (after the addition of 1-10 µM) to the plasma sample was determined to be 8.1236 µM. It is noteworthy that this value aligns remarkably with the observed range of cupric concentration in the plasma of affected individuals by WD [2, 3]. The findings indicate that the CQD-based sensor possesses high accuracy and precision toward Cu(II) detection, making this sensor an appealing platform for monitoring the concentration of Cu(II) ions as a crucial diagnostic tool for Wilson's disease in a clinical setting.

Keywords: Wilson's diseasm, Carbon Quantum Dots, Fluorescent Sensor, Cu(II) Detection

Samples	Cu^{2+} Spiked (µM)	Cu^{2+} Measured (µM)	Recovery (%)	RSD (%)
10% Plasma	0	0.0414 ± 0.00107	-	2.6
10% Plasma + Cu^{2+}	1	0.972 ± 0.03697	97.2	3.8
10% Plasma + Cu^{2+}	3	2.841 ± 0.11649	94.7	4.1
10% Plasma + Cu^{2+}	5	5.144 ± 0.19033	102.9	3.7



References

1. H. Feng, Q. Fu, W. Du, R. Zhu, X. Ge, C. Wang, Q. Li, L. Su, H. Yang and J. Song, *ACS nano*, **2021**, 15, 3402-3414.
2. J. Pfeiffenberger, C. M. Lohse, D. Gotthardt, C. Rupp, M. Weiler, U. Teufel, K. H. Weiss and A. Gauss, *Journal of Inherited Metabolic Disease*, **2019**, 42, 371-380.
3. C. R. Ferreira and W. A. Gahl, *Translational science of rare diseases*, **2017**, 2, 101-139.