NOVEL PAPER-BASED SENSING PLATFORM USING PHOTOLUMINESCENT GOLD NANOCLUSTERS FOR EASY, SENSITIVE AND SELECTIVE NAKED-EYE DETECTION OF Cu^{2+}

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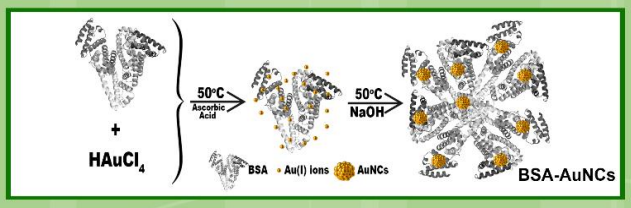
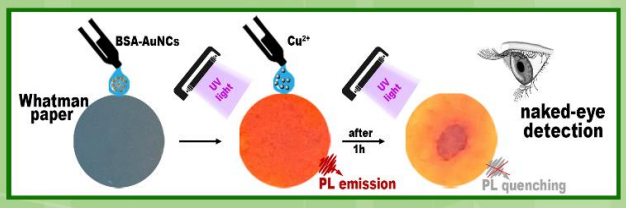
Introduction

Herein, we developed a cheap, fast and simple paper sensing platform based on the quenching of immobilized bovine serum albumin stabilized AuNCs (BSA-AuNCs) photoluminescence (PL) when interacting with Cu^{2+} from real water samples. First, the PL "turn-off" selectiveness of BSA-AuNCs against Cu^{2+} was evaluated and quantified in solution via a portable fluorescence spectrometer, yielding a LOD of 0.83 μM, which is notably lower value than the Cu limit (20 μM) admitted by the United States Environmental Protection Agency. Next, for an even improved portability and accessibility, the AuNCs-based sensor was successfully translated onto paper substrate. The new sensing platform's ability to detect Cu^{2+} ions was tested and a LOD of 5 μM was obtained by the naked eye. These results prove that the BSA-AuNCs-paper sensor is fast, portable, stable, selective, qualitative, semi-quantitative and represents a promising candidate for the environmental monitoring of Cu^{2+} levels in real water samples or other fields.

SAMPLE SYNTHESIS

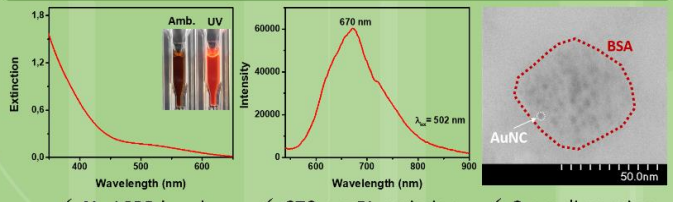


SENSING PLATFORM PREPARATION



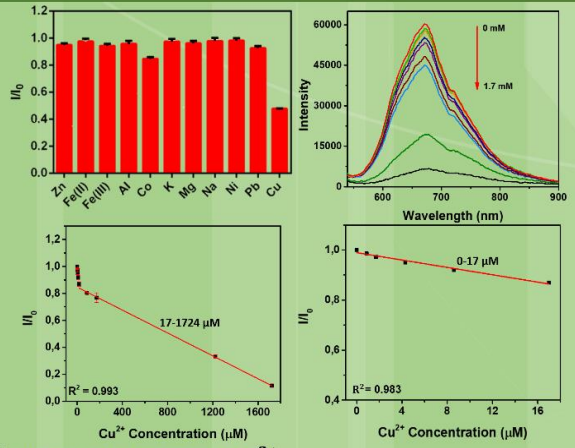
EXPERIMENTAL RESULTS

BSA-AuNCs characterization



✓ **No** LSPR band ✓ **670 nm** PL emission ✓ **3 nm** dimension

Cu^{2+} detection assay in solution



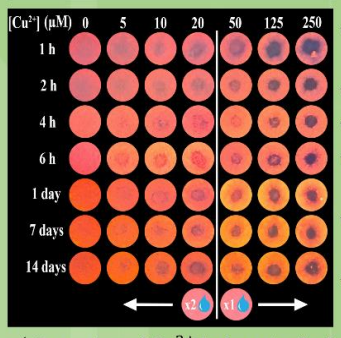
✓ High **selectivity** towards Cu^{2+}

✓ PL quenching effect proportional to Cu^{2+} concentrations

✓ **Two linear dynamic ranges** with **excellent correlation coefficients**: 0-17 μM and 17-1724 μM

✓ A **limit of detection** as low as **0.83 μM**

Cu^{2+} detection assay on paper



✓ **Easy to fabricate, cheap, fast and portable**

✓ **No** trained personnel needed

✓ **Stable** in time

✓ **Naked-eye** detection under **UV light**

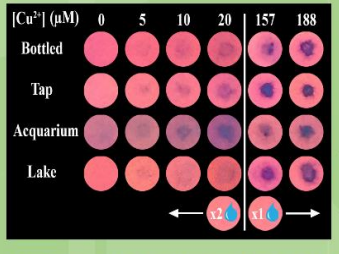
✓ PL quenching effect proportional to Cu^{2+} concentrations

✓ Detection of a **wide range of** Cu^{2+} **concentrations**

✓ Detection of Cu^{2+} **below** the **"safe" level** for humans **(20 μM)**

✓ A **limit of detection** as low as **5 μM**

Real water samples assay



✓ **Portable sensor** for **on site naked-eye** detection under **UV light**

✓ **Succesful** Cu^{2+} **detection** from contaminated real water samples

✓ A **limit of detection** as low as **5 μM**

✓ **Two ways to use the sensor:**

1) **for drinking water –** identification of Cu^{2+} concentrations over **50 μM** using one drop of sample

2) **for aquatic environment –** identification of deadly Cu^{2+} levels above **5 μM** using two drops of sample

Conclusion

We developed a cheap, fast and simple paper-based sensing platform for the detection of Cu^{2+} from real water samples, based on the selective PL quenching of BSA-AuNCs, incorporated into Whatman paper fibers.

Acknowledgements

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