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A simple quinoline-thiophene Schiff base turn-off chemosensor for Hg^{2+} detection: spectroscopy, sensing properties and applications

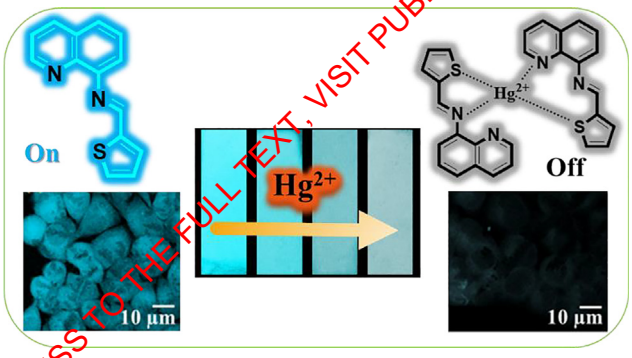
Brian Musikavanhu [a], Selvaraj Muthusamy [a], Dongwei Zhu [b,c], Zhaoli Xue [a], Qian Yu [d,*], Choonzo N. Chiyumba [e], John Mack [e,*], Tebello Nyokong [e], Shengjun Wang [b,c], Long Zhao [a,*]

[a] School of Chemistry and Chemical Engineering, Jiangsu University, Zhenjiang 212013, China
[b] Department of Immunology, Jiangsu Key Laboratory of Laboratory Medicine, School of Medicine, Jiangsu University, Zhenjiang 212013, China
[c] Department of Laboratory Medicine, The Affiliated People's Hospital, Jiangsu University, Zhenjiang 212013, China
[d] School of Life Sciences, Jiangsu University, Zhenjiang 212013, PR China
[e] Institute for Nanotechnology Innovation, Department of Chemistry, Rhodes University, Makhanda 6140, South Africa

HIGHLIGHTS

- A turn-off Shiff base chemosensor QT was synthesized for Hg^{2+} sensing.
- Chelation-enhanced quenching (CHEQ) was proposed for QT towards Hg^{2+} detection.
- Spectra of QT-Hg^{2+} were studied using experimental and theoretical calculations.
- A low detection limit of 23.4 nM was achieved.
- The probe was successfully employed to image Hg^{2+} in paper strips and HeLa cells.

GRAPHICAL ABSTRACT



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ABSTRACT

A new Schiff base probe (**QT**) consisting of 8-aminoquinoline (Q) and thiophene-2-carboxaldehyde (T) moieties has been synthesized. **QT** undergoes chelation-enhanced fluorescence quenching when exposed to Hg^{2+} due to coordination by the sulfur and nitrogen atoms of **QT** thus forming a facile "turn-off" sensor. The formation of the chelation complex was confirmed by UV–visible absorption and emission spectral measurements, ^{1}H NMR titration and density functional theory calculations. These studies revealed that the probe exhibits high selectivity and sensitivity towards Hg^{2+} in the presence of other common metal ions. A low detection limit of 23.4 nM was determined and a Job plot confirmed a 2:1 stoichiometry between **QT** and Hg^{2+}. The potential utility of **QT** as a sensor for Hg^{2+} ions in human HeLa cells was determined by confocal fluorescence microscopy, and its suitability for use in the field with environmental samples was tested with Whatman filter paper strips.

1. Introduction

Mercury, a toxic ion contaminant generated mainly from gold mining, stationary combustion and volcanic emissions, can result in dysfunction of the endocrine and central nervous systems upon exposure, leading to further human health complications such as

* Corresponding authors.
E-mail addresses: qianyu@ujs.edu.cn (Q. Yu), j.mack@ru.ac.za (J. Mack), longzhao@ujs.edu.cn (L. Zhao).

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