



## A novel bifunctional fluorescent and colorimetric probe for detection of mercury and fluoride ions

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### ABSTRACT

A fluorescent and colorimetric probe **L1** based on a simple coumarin derivative for detection of Hg<sup>2+</sup> and F<sup>-</sup> ions was developed. Upon addition of Hg<sup>2+</sup> and F<sup>-</sup> ions, **L1** underwent desulfurization and desilylation, respectively, to induce marked increase in the fluorescence intensity and sharp color change from light yellow to dark purple and light brown, respectively. Probe **L1** could be used for sensing and for quantitative measurement of Hg<sup>2+</sup> and F<sup>-</sup> ions by both UV-vis and fluorescence spectra. The bifunctional probe exhibited a high selectivity over other competitive cations and anions and could be used in both organic and aqueous media over a wide pH range.

*Keywords:* Fluorescent; Colorimetric; Coumarin; Probe; Mercury; Fluoride

### 1. Introduction

Fluoride (F<sup>-</sup>) ions play a significant role in many physiological activities including water fluoridation, caries treatment, dental care, and bone disease treatment. Therefore rapid and sensitive detection of fluoride is of high significance. Efficient optical probes especially fluorescent probes for fluoride detection have been the subject of strong interest because of their widespread application in biological, chemical, and environmental processes [1–7]. Pollution caused by mercuric ion (Hg<sup>2+</sup>) is ongoing to trig severe environmental and human health problems. For detection of the toxic Hg<sup>2+</sup> ion selectively and rapidly fluorescent probes are one of the best choice and a vast number of fluorescent mercury sensors have been reported [8–15]. Some fluorescent probes are developed for detection of two or more different analytes including different cations such as Hg<sup>2+</sup> and Ag<sup>+</sup> [16,17], Hg<sup>2+</sup> and Cu<sup>2+</sup> [18–20], Hg<sup>2+</sup> and Fe<sup>3+</sup> [21], Hg<sup>2+</sup> and Al<sup>3+</sup> [22], or different anions like F<sup>-</sup> and CN<sup>-</sup> [23,24], F<sup>-</sup> and H<sub>2</sub>PO<sub>4</sub><sup>-</sup> [25], F<sup>-</sup> and HP<sub>2</sub>O<sub>7</sub><sup>3-</sup> [26], or analytes of different structural types such as Al<sup>3+</sup> and F<sup>-</sup> [27,28], Mg<sup>2+</sup> and F<sup>-</sup> [29], Zn<sup>2+</sup> and F<sup>-</sup> [30], F<sup>-</sup> and pH change [31], Hg<sup>2+</sup> and pH change [32], Hg<sup>2+</sup> and saccharides [33], F<sup>-</sup>, CN<sup>-</sup> and Cu<sup>2+</sup> [34], Zn<sup>2+</sup>, Mg<sup>2+</sup> and F<sup>-</sup> [35]. A ratiometric bifunctional fluorescent probe for

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