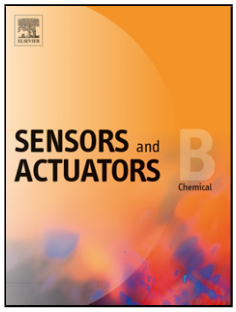


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# A Benzothiazole-based Fluorescent Probe for Efficient Detection and Discrimination of $Zn^{2+}$ and $Cd^{2+}$, using Cysteine as an Auxiliary Reagent

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## Highlights

- A new benzothiazole-based sensing system was provided for detection of $Zn^{2+}$ and $Cd^{2+}$ by employing cysteine as an auxiliary regent.
- A new verification method of aggregation by fluorescence polarized emission was developed.
- The sensing system can detect $Zn^{2+}$ and $Cd^{2+}$ with the level of nanomole and micromole detection limit, respectively.

**ABSTRACT:** This paper describes the design and synthesis of a benzothiazole-based fluorescent probe (**$H_1$**) for zinc and cadmium ion detection and discrimination, using cysteine as an auxiliary reagent. Among the various metal ions tested, zinc and cadmium ions induced blue-shifted emissions of probe **$H_1$** from 573 nm to 520 nm and 540 nm, respectively. The addition of cysteine caused the emission of **$H_1$**-$Cd^{2+}$ to red-shift back to 573 nm. In contrast, the emission of **$H_1$**-$Zn^{2+}$ with the addition of cysteine only decreased without any red-shift of wavelength. Furthermore, confocal laser scanning micrographs of HeLa cells demonstrated satisfactory cell permeability of **$H_1$** and selectivity toward zinc and cadmium ions in living cells. Test strip experiments suggest that probe **$H_1$** can recognise zinc and cadmium ions together by a remarkable fluorescence change, thus providing a convenient method for tracking zinc and cadmium ions in biological systems.

**Keywords**: Benzothiazole-based derivative, fluorescent sensor, Zn/Cd ions, biological imaging, cysteine.

## 1. INTRODUCTION

Following iron, zinc is the most abundant transition metal. It is also an element essential to life, with 2-4 g present in the human body [1-3]. It is associated with many biological processes such as cellular metabolism, gene transcription, and immune and brain functions [4-9]. In addition, several neurological disorders such as Alzheimer's disease and cerebral ischemia may be related to a lack of $Zn^{2+}$ in the human body [10-12]. Free zinc exists in many vital tissues such as the pancreas, retina and intestines, and plays an important role in apoptosis and neurotransmission