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A novel benzothiazole-based fluorescent probe for cysteine detection and its application on test paper and in living cells

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Abstract

A novel simple and readily synthesized turn-on fluorescent probe 4-(benzo[d]thiazol-2-yl)-1,3-phenylene bis(2-chloroacetate) (**BPBC**) for cysteine (Cys) was reported. This probe was designed based on an excited-state intramolecular proton transfer (ESIPT) dye: benzothiazole, and two chloroacetate groups present in benzothiazole as the reaction sites for Cys. It shows high selectivity and sensitivity for Cys over other amino acids including the similar structured homocysteine (Hcy) and glutathione (GSH). In addition, probe **BPBC** was successfully applied to bioimage intracellular Cys in living cells with low cytotoxicity. More importantly, a paper test strip system was developed with probe **BPBC** for Cys detection conveniently.

Keywords: Fluorescent probe; Cysteine; ESIPT; Bioimaging

1. Introduction

Cysteine (Cys), as a semi-essential amino acid and biothiol, can be biosynthesized in the human body and is a very important structural and functional moiety of various peptides or proteins. Cys plays an essential role in cellular redox balance. Accumulating experiment proves that the lack of Cys can cause slow growth in children, hair depigmentation, retarded growth, liver damage, neurodegeneration and so on [1-4]. Besides, chronic accumulation of free Cys can also lead to neuropathic poisoning [5]. Therefore, specific detection of Cys in living systems is becoming more important [3, 4].

Over the past decade, many methods for detecting Cys have been reported, such as high performance liquid chromatography, enzyme-linked immunosorbent assay, surface enhanced