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Authors: Yan Yang, Huan Wang, Yu-Lin Wei, Jie Zhou, Jun-Feng Zhang, Ying Zhou

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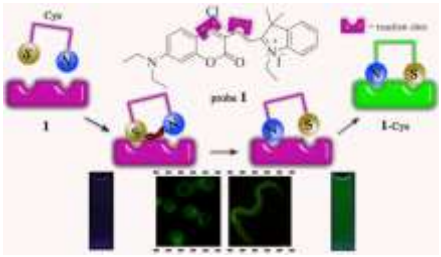
Communication

A selective coumarin-based "turn-on" fluorescent sensor for the detection of cysteine and its applications for bioimaging

Yan Yang[a], Huan Wang[b], Yu-Lin Wei[c], Jie Zhou[a], Jun-Feng Zhang[b,*], Ying Zhou[a,*]
[a] *College of Chemical Science and Technology, Yunnan University, Kunming 650091, China*
[b] *College of Chemistry and Chemical Engineering, Yunnan Normal University, Kunming 650500, China*
[c] *Department of Safety Evaluation, Technology Center of China Tobacco Yunnan Industrial Co., Ltd., Kunming 650106, China*

Graphical abstract



A coumarin-based compound (**1**) was designed and synthesized as a new turn-on fluorescent probe for the detection of cysteine. The *in vivo* imaging of Hi5 cell and Caenorhabditis elegans had further confirmed the cysteine detection by compound **1**.

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ABSTRACT

A coumarin-based compound (**1**) was designed and synthesized as a new turn-on fluorescent probe for the detection of cysteine. The probe exhibited higher selectivity towards the target molecule over other thiol and amino acids at pH 7.2 in aqueous media CH_3CN-HEPES (0.02 mol/L, pH 7.2, 1:9, v/v). The reaction mechanism is attributed to the cysteine-induced S_NAr substitution-rearrangement reaction. Remarkable enhancement of up to 20-fold in fluorescence intensity was achieved in the detection of cysteine. When applied for the fluorescence imaging of cysteine, the compound **1** emitted a green fluorescence in Hi5 cell cytoplasm. The *in vivo* imaging of Caenorhabditis elegans had further confirmed the cysteine detection by compound **1**.

Because of the high sensitivity, specificity, simplicity of implementation and fast response time, fluorescent probes for detecting biological small molecules show innate advantages over other detection methods developed [1]. Biological thiols, such as cysteine (Cys), homocysteine (Hcy) and glutathione (GSH), play crucial roles in many physiological and pathological processes, and are closely related to many diseases [2]. Cysteine (Cys), well known as an essential amino acid, is involved in protein synthesis, detoxification, and metabolism [3]. Abnormal levels of Cys can lead to slowed growth rate, hair depigmentation, edema, lethargy, liver damage, muscle and fat loss, *etc*. [4]. The high level of Hcy in the blood is a well-known risk factor for cardiovascular [5] and Alzheimer's disease [6]. In recent years, many fluorescent probes have been developed to detect and sense these biologically important species such as Cys, Hcy and GSH. Although some probes exhibit high selectivity in distinguishing these biothiols from other amino acids and biological small molecules, most of them fail to distinguish Cys/Hcy/GSH from each other due to the similar structures and reactivity of these biothiols. In fact, distinguishing them has been a tough challenge for researchers and has received considerable attention.

Except the well-studied selective detection methods using the cyclization of Cys/Hcy with aldehydes [7] or acrylates [3], the recent strategy of differentiating Cys from Hcy/GSH was achieved by taking advantage of either the Cys-induced SNAr substitution-

* Corresponding authors.

E-mail addresses: yingzhou@ynu.edu.cn, junfengzhang78@aliyun.com