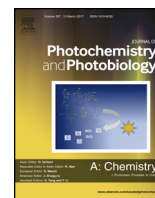




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Invited paper

## A sensitive fluorescent probe based on coumarin for detection of cysteine in living cells



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### ABSTRACT

Herein, we report a novel fluorescent probe based on coumarin to detect cysteine (Cys). The probe can react rapidly and selectively with Cys but not with the other amino acids. When the Cys was added to the solution of the probe, we could observe obvious color change from pale green to bright green. The detection limit of this probe for Cys was found to be 0.06  $\mu\text{M}$ . Additionally, bioimaging of intracellular Cys by this probe was successfully applied in living cells, which indicating that this probe holds great potential for biological applications.

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### 1. Introduction

In recent years, people pay much attention to small molecule thiols owing to their crucial roles in many physiological processes [1–8]. Compared with other amino acids, Cys plays numerous roles in maintaining biological systems because it can participate in reversible redox reactions and its cellular functions [9–13]. For example, Cys is related to detoxification, protein synthesis, and metabolism in live organisms [14–17]. The deficiency of Cys may lead to many syndromes, such as slowed growth, muscle and fat loss, liver damage, hematopoiesis reduction, hair depigmentation, skin lesions, weakness, lethargy, and edema protein synthesis, detoxification, and metabolism [18–20]. Therefore, to develop rapid and reliable methods for quantitative measurements of Cys is of great importance and has attracted much attention.

In the past few decades, large amount of effort have been made to find various methods for detecting of Cys quantitatively and selectively. These methods include electrochemical methods [21,22], high performance liquid chromatography [23–25], mass spectrometry [26,27], luminescent chemosensors [28,29], colorimetric detection [30], Gold Nanorods [31,32] and inductively coupled plasma emission spectrometry [33]. Among various detection techniques for Cys, fluorescent detection has been applied widely because of its high sensitivity, low cost, simplicity

and suitability for bioimaging analysis [34–36]. Up to now, several fluorescent probes have been reported for detection of amino acid [37,38], but most of them showed low selectivity for Cys. Thus we should focus on the study of the fluorescence probes that have high selectivity and sensitivity for Cys.

As traditional fluorescent dye, coumarin-based derivatives have strong fluorescence. Because they have high quantum stability and photoluminescence quantity, they are widely used in the detection of fluorescent probes. In this work, a coumarin-based fluorescent probe was designed and synthesized for the detection of Cys. This probe shows good selectivity and sensitivity for Cys. More importantly, it has used in fluorescence imaging of intracellular Cys in living cells. The synthetic route of probe **BTCA** is shown in Scheme 1.

### 2. Experimental

#### 2.1. Materials and measurements

All reagents and solvents were purchased from commercial sources and used without further purification, unless otherwise stated. Double distilled water was used throughout the work. All reactions were monitored using thin-layer chromatography (TLC).  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectra were recorded on a Bruker AN-400 MHz instrument for solutions in  $\text{CDCl}_3$  or  $\text{DMSO}-d_6$ , using TMS as an internal reference. Electron impact mass spectra were conducted on MAT-212 spectrometer. Elemental analyses were done at Vario EL III. Ultraviolet-visible (UV-vis) absorption spectra were measured with a Varian Cary 50 spectrophotometer at 1 cm

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