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A dual-emission and mitochondria-targeted fluorescent probe for rapid detection of SO_2 derivatives and its imaging in living cells

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Abstract

A novel mitochondria-targeted fluorescent probe for sensing SO_2 derivatives was constructed by integrating phenanthroimidazole and cyanine moieties. Excited by different channels, this probe exhibited unique dual-channel fluorescence-enhanced emissions and colorimetric response to HSO_3^- quickly (less than 20 s). The sensing process was confirmed to undergo nucleophilic addition of HSO_3^- to C=C double bond in the probe Mito-PTB *via* NMR and HRMS analyses. Furthermore, fluorescence co-localization studies demonstrated that the probe Mito-PTB was a mitochondria-targetable fluorescent probe for SO_2 derivatives with good cell membrane permeability. Thus, probe Mito-PTB has the potential applications to explore the role played by SO_2 derivatives in biology.

Key words: Fluorescent probe, colorimetric, dual-emission, mitochondria, SO_2 derivatives

1. Introduction

Sulfur dioxide (SO_2), a well-known industrial waste, has long been regarded as an environmental pollutant and generally exists in the forms of sulfite (SO_3^{2-}) and bisulfite (HSO_3^-). On the other hand, SO_2 also could be endogenously released from sulfur-containing amino acids *via* enzyme-catalyzed process and the oxidation of hydrogen sulfide, which balances with aqueous sulfites (HSO_3^- and SO_3^{2-}) in biological systems [1, 2]. Numerous epidemiological studies have shown that chronic or acute exposure to SO_2 might induce many respiratory and cardiovascular diseases, lung cancer, as well as many neurological disorders [3-6]. Like other gaseous signaling molecules (NO, CO, H_2S), endogenous SO_2 has also been recognized to mediate a series of physiological process, such as myocardial injury, swelling and