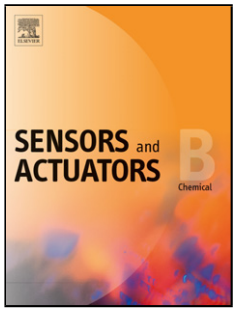

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Highly Selective, Sensitive and Naked-Eye Fluorescence Probes for the Direct Detection of Hypochlorite Anion and Their Application in Biological Environments

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Abstract: Two novel rhodamine B-based fluorescent probes **RBT** and **RBP** for the hypochlorite anion (ClO^-) were designed, synthesized, and characterized. They exhibited highly selective and sensitive recognition toward ClO^- over other metal ions，nonmetal ions, reactive oxygen species (ROS), reactive nitrogen species (RNS) and special oxidants in ethanol-water (4/6, v/v, 20mmol/L HEPES, pH 7.0) media in the fluorescence and UV-vis spectra. Cytotoxicity and bioimaging studies by L929 cells and living mice indicated that the probes were low cytotoxicity, cell permeable and suitable for detecting ClO^- in biological environments.

Keywords:

Rhodamine B; Hypochlorite anion; Fluorescence probe ; Cytotoxicity; Bioimaging

1.Introduction

Hypochlorite anion (ClO^-), one of the biologically important reactive oxygen species (ROS) [1], is produced in organisms by the reaction of H_2O_2 with Cl^- ions under the catalysis of a heme enzyme, myeloperoxidase [2]. Endogenous ClO^- is a potent antimicrobial agent for the immune system [3]. Thus, it is essential to life. However, as a result of the highly reactive and diffusible nature of ClO^- [4], its uncontrolled production within phagocytes is involved in a variety of human diseases such as cardiovascular disease and inflammatory disease [5-8]. Therefore, monitoring cellular ClO^- concentration is significant for biological research and clinical diagnoses. Until now, a number of sensitive and selective analytical methods have been proposed for conducting such research, among which fluorescent probes play an important role in this respect due to their high-time and spatial resolution capability [9-10]. Recently, ClO^- detection both in living systems and in environment by using fluorescent probe method has attracted tremendous attention [11-15].

Because of its high spatial and temporal resolutions, fluorescence imaging technology is regarded as a promising method for monitoring biological species in living cells [11-20]. The designed strategies for ClO^- fluorescent probes are based on specific reactions between recognition groups and ClO^-, affording highly fluorescent products [21-32]. These ClO^- reactive groups include p-methoxyphenol [22], dibenzoyl hydrazide [23, 24], rhodamine-hydroxamic acid [25], selenide [26], N–N single bond in acetohydrazide [27] , diaminomaleonitrile [19, 40] and so on. These reactions can efficiently differentiate ClO^- from other metal and nonmental ions, ROS, RNS and other oxidants. Under the physiological conditions, ClO^- is highly reactive, short-lived, and at a low level [4,33]. Thus, its detection with fast response and high sensitivity is desirable for real-time monitoring of the fluctuation of ClO^- in its cellular site of action [34]. Unfortunately, many of the reported ClO^- probes display a delayed response time [19, 23, 26, 30, 36, 37], Weak fluorescence intensity