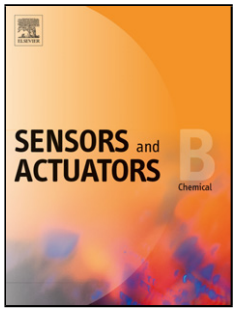

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Ratiometric Fluorescence Detection of Hydroxyl Radical Using Cyanine-Based Binary NanoGUMBOS

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Highlights

- A sensitive and selective nanoprobe for hydroxyl radicals was prepared via simple synthesis
- FRET enables measurement of ratiometric fluorescence and reduces errors introduced by environmental factors.
- Hydroxyl radicals can be quantitatively determined with a linear calibration curve.
- Confocal fluorescence imaging shows that the novel cyanine-based binary nanoGUMBOS probe is suitable for ratiometric detection of hydroxyl radicals produced in living cells.

Abstract

Overproduction of reactive oxygen species (ROS) results in oxidative stress, which is closely associated with pathogenesis of many diseases. Visualized detection of ROS in situ enables deeper insight into the mechanisms that underlie such pathological and physiological processes. Among reactive species, selective detection of hydroxyl radical is the most challenging, due to high aggression and short life time of this specie. In this regard, we have developed a sensitive and selective ratiometric fluorescence nanoprobe for detection of hydroxyl radical. This probe is based on use of GUMBOS (a Group of Uniform Materials Based on Organic Salts) that are derived from 1,1'-diethyl-2,2'-cyanine iodide and 1,1'-diethyl-2,2'-carbocyanine iodide. Each GUMBOS exhibit different reactivity towards reactive species. Without any chemical linkage, these two GUMBOS were combined into a single nanomaterial to produce a ratiometric fluorescent sensing profile through Förster resonance energy transfer. This cyanine-based ratiometric nanoprobe exhibited high selectivity for the hydroxyl radical in comparison to other ROS, including superoxide anion, singlet oxygen, hydrogen peroxide, and peroxynitrite. Furthermore, detection of hydroxyl radical was successfully demonstrated by use of these binary nanoGUMBOS in vitro using hormone-independent human breast adenocarcinoma cells (MDA-MB-231).

Keywords: Ratiometric fluorescence sensor; Organic salts; Reactive oxygen species; Hydroxyl radical detection;