

Novel fluorescence sensors for determination of Fe³⁺ in biological systems using sulfonamide derivatives of dipicolylamine ligands

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Since fluorescence techniques are highly demanded area in biological species detection, the main objective of this research was to develop real-time, ratiometric fluorescence sensors which can be used for iron cation detection in physiological systems with high sensitivity and selectivity. Previously synthesized and characterized two new ligand systems were developed into ratiometric fluorescence probes for biological Fe³⁺ ion detection. Both ligands were sulfonamide derivatives of dipicolylamine with two different R groups, biphenyl (L1=N(SO₂biphenyl)dp) and azobenzene (L2=N(SO₂azobenz)dp). The ligands were soluble at 0.2%(v/v) methanol solutions. Both L1 and L2 displayed ratiometric change with Fe³⁺ ions at 319 and 458 nm respectively. L2 had a relatively high photostability, fluorescence increasing mechanism and a lower detection limit of 18.22 nM which is a suitable concentration for biological iron detection with high sensitivity and high selectivity. L1 had a lower detection limit of 0.674 μM and fluorescence increasing and decreasing mechanisms. Since both ligands had minimum interferences from other common metal cations such as K⁺, Na⁺, Ca²⁺, Mg²⁺, Ba²⁺, Fe²⁺, Cu²⁺ and Zn²⁺, the selectivity was considered to be very high. The pH sensitivity of the both ligands were also considerably low. L2-Fe³⁺ complex was blue green in color with a possible applicability for common fluorescence microscopes. Both ligands metal complexes had higher UV-Visible absorbance than their respective free ligands. The ligands could be recovered from the metal complexes with the addition of ethylenediaminetetraacetic acid (EDTA). All the experimental procedures were carried out at physiological pH, 7.4 using HEPES buffer system. Beside the biological systems the probes are applicable for other environmental and industrial samples to ferric iron detection.

Keywords: Fluorescence probe, High sensitivity, Selectivity

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