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A novel jointly colorimetric and fluorescent sensor for Cu^{2+} recognition and its complex for sensing S^{2-} by a Cu^{2+} displacement approach in aqueous media

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Abstract: In this work, a simple and easily synthesized Schiff-based derivative colorimetric and fluorescent sensor (**1**), 4-dimethylamino-benzoic acid (2-imidazole formaldehyde)-hydrazide, was obtained for the detection of Cu^{2+} and S^{2-}. The compound **1** exhibited dual spectral responses to Cu^{2+}, that is, vivid color change and fluorescence enhancement in the presence of Cu^{2+}. The detection limits were valued as 0.46 μM and 15 nM according to absorption and fluorescent response, respectively. Both of them are below the World Health Organization (WHO) guidelines for drinking water (31.5 μM). In addition, the ensemble (**1-Cu^{2+}**) selectively and sensitively detected a low concentration of S^{2-}. As the addition of S^{2-} instantly removed Cu^{2+} from the ensemble (**1-Cu^{2+}**) resulting in a color change from yellow to colorless and a "turn-off" fluorescent response. The detection limit for S^{2-} was estimated as 0.12 μM (from fluorescent method) and 0.68 μM (from absorption method), respectively, each of which was also lower than the maximum allowable level of S^{2-} (15 μM) in drinking water defined by the WHO. The binding process was confirmed via UV-vis absorption, fluorescence measurements, ^{1}H NMR, mass spectroscopy and density functional theory calculation. What's more, successful practical application of test paper is used to inspect the S^{2-} which means the convenient and rapid assay in real samples can be achieved.

Keywords: 4-Dimethylamino-benzoic acid hydrazide derivative, colorimetry, fluorescence, Cu^{2+}, S^{2-}

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