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A novel fluorescent turn-on sensor from 8-hydroxyquinoline derivative for mercury detection in aqueous solution

Nowadays, fluorescent chemosensors play an important role in analytical and environmental chemistry especially for detection of toxic metal ions. In this work, three new 8-hydroxyquinoline (**8HQ**) derivatives **Q1**, **Q2** and **Q3** are synthesized and were used as fluorescence turn-on sensors for metal ions. For **Q1**, **8HQ** was O-substitued with acetate ester of diethylene glycol. The O-substitution of **8HQ** with diethylene glycol followed by the extension of the pi-conjugation at 5-position with 4-ethynyl N,N-dimethyl aniline moiety gives **Q2** and the acetylation of **Q2** gives **Q3**. In acetonitrile, the absorption spectra of **8HQ** and **Q1** were similar showing two absorption maxima around 240 and 300 nm, while those of **Q2** and **Q3** were around 300 and 370 nm. The emission maximum of **8HQ** and **Q1** was observed at 400 nm whereas that of **Q2** and **Q3** was red-shifted to 560 nm. In polar aprotic solvent, the fluorescence of **Q2** and **Q3** are visible to naked-eye under black light that becomes invisible in protic solvents such as CH_3OH and H_2O. Therefore, **8HQ** and its derivatives are investigated as turn-on fluorescent sensors for metal ions in mixed solvents. In CH_3CN/H_2O (90/10 v/v), only **Q1** shows selective turn-on fluorescence with trivalent ions such as Al^{3+}, Cr^{3+} and Fe^{3+}, while **8HQ**, **Q2** and **Q3** show non-selective and low fluorescence response to metal ions. In CH_3OH/H_2O (30/70 v/v), **8HQ** shows known green fluorescence enhancement with Al^{3+} while **Q3** shows interestingly strong green fluorescence (510 nm) enhancement selectively with Hg^{2+}. The detection limit of Hg^{2+} by **Q3** is 64 nM or 13 ppb. The Tyndall effect observed along with the increase of fluorescence intensity of **Q3** upon the addition of Hg^{2+} suggests that the fluorescence enhancement of **Q3** with Hg^{2+} is due to the aggregation induced emission (AIE). The AIE of **Q3** is also observed without Hg^{2+} at higher fraction of H_2O (80-90%).

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