One-pot Multicomponent Synthesis of Indole-derived Fluorometric Chemosensor for Detection of Fe^{3+} Ions in Aqueous Media

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Ferric, one of the vital trace metal ions in biological systems, is essential to the metabolism of living organisms. Thus, there is much interest in biological and environmental concerns for an easy and rapid approach to detecting Fe^{3+}. A one-pot multicomponent conventional synthesis with hydrated ferric chloride as the catalyst and benzaldehyde, indole, and 4-nitroaniline as the reactants, a simple indole-derived fluorometric "TURN-OFF" chemosensor was obtained in 62 % yield to detect the Fe^{3+} ion. The synthesized ligand was characterized by FT-IR spectroscopy and the major absorption bands of the FT-IR spectrum were positioned at 3360, 2962, 1585, 1455, 1311, 1259, 796, 742, and 696 cm^{-1}. Furthermore, the melting point of the product was in the temperature range of 155 - 157 °C. The indole-derived product exhibited fluorescence-quenched “Switch-OFF” chemosensor activity at 355 nm via paramagnetic fluorescence quenching because non-radiative quenching is a common method for paramagnetic metal ions like Fe^{3+} to deactivate the excited state. The indole-derived fluorometric chemosensor and Fe^{3+} ion were shown to have a linear relationship, with an acceptable limit of detection for Fe^{3+} of 5.28×10^{-6} M. Other interfering ions, including, Fe^{2+}, Cd^{2+}, Cu^{2+}, Co^{2+}, Zn^{2+}, Ag^{+}, Ni^{2+}, Na^{+}, and K^{+} show either no change in the fluorescence intensity of the indole-derived ligand or a very slight difference in intensity in the presence of Fe^{3+} ions. Furthermore, this study adds to the evidence supporting the importance of multicomponent reactions that have the potential to synthesis of fluorescence chemosensors for the sensitive and selective detection of biologically significant metal ions. Thus, the one-pot multicomponent synthesis with the prominent fluorescence performance of the indole-derived ligand would make it an efficient and convenient Fe^{3+} fluorometric probe.

Keywords: Fluorometric chemosensor, TURN-OFF, Indole derivatives, Multicomponent reactions, One-pot synthesis