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Synthesis and evaluation of a Cu(II) selective fluorescence sensor

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Copper ions play a pivotal role in many biological functions and copper is ranked as the third most essential trace element in the human body. However, the imbalance in copper ion level leads to various diseases including neurodegenerative diseases and cancers. Hence, the detection of the Cu(II) levels in biological samples is important. Fluorescence sensors provide a selective and non-destructive detection pathway for metal ions. Here, the synthesis and characterization of a fluorescent sensor selective for Cu(II) ions is reported. The sensor molecule (3-(4-hydroxy-3-methoxyphenyl)-N-(pyridin-2-ylmethyl)acrylamide) was synthesized by microwave irradiation of picolylamine and trans-ferulic acid followed by purification using a silica gel column. The synthesized sensor was characterized using UV-visible, fluorescence, infrared, and ^{13}C and ^{1}H NMR spectroscopies as well as gas chromatography-mass spectrometry. The sensor molecule showed a broad emission peak with emission maximum at 415 nm when excited at 355 nm. The emission intensity was studied at different pHs(1, 3, 6, 8, and 12) and the optimal pH range was determined. The effect of Cu(II) ion concentration on emission intensity was determined at optimal pH range (pH 6-7). Further, the emission profile of the sensor was investigated in the presence of a number of biologically important metal ions. The fluorescence emission of the sensor molecule was found to be pH dependent showing a hypochromic effect as pH decreases (6→1) and bathochromic shiftas pH increases (6→12). In the presence of Cu(II) ions 96 % of the fluorescence was quenched. Based on the fluorescence titrations, it was determined that the sensor forms a 2:1 complex with Cu(II). Quenching of the fluorescence by other biologically important metal ions including Na(I), K(I), Ca(II), Mg(II), Al(III), Cr(III), Zn(II), and Cd(II) was negligible or less than 50 %. However, Co(II) also showed a significant quenching effect (>50 %) while Fe(II), Fe(III), and Mn(II) each gave an insoluble precipitate with the sensor molecule. The study demonstrated that the synthesized sensor has the potential to be used as an ON-OFF probe to detect the presence of Cu(II) *in vitro.*

Key words: Cu(II), Fluorescence, chemosensors, microwave synthesis

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