ABSTRACT

The present research work explains the syntheses, characterization and assessment of the precursors and encapsulated cobalt based MOFs for fluorescence and electrochemical applications. The Cobalt MOFs (Precursors) and encapsulated Cobalt MOFs were synthesized by sonochemical method using 5-sulfoisopthalic acid sodium salt as the ligand and 1,10 phenanthroline and 4,4 bipyridine as co-ligands. Based on the porosity and flexibility of MOFs, in situ lithium encapsulation yielded promising crystalline structures, with lithium hydroxide monohydrate used as the substrate. The comprehensive structural analysis based on UV-Visible spectroscopy, FTIR spectroscopy, Thermogravimetric Analysis (TGA), fluorescence spectroscopy, and electrochemical investigations was conducted to elucidate the properties of the synthesized Cobalt MOFs (Precursors) and encapsulated lithium Cobalt MOFs. The distinctive features in the UV-Visible, FTIR, and TGA spectra of MOFs and encapsulated MOFs may indicate the successful formation of the desired products. The electrochemical analysis of MOF 1 was investigated by employing cyclic voltammetry, galvanic charge and discharge and electronic impedance spectroscopic techniques. The specific capacitance of MOF 1 was 111.36 F/g which substantiated that MOF 1 exhibited pseudo-capacitive grade characteristics, demonstrating its potential for energy storage applications. The Photoluminiscence analysis was investigated for both MOF 1 and MOF 2 in different polar and non-polar solvents. The MOF 1 Photoluminiscence displayed non-selective photoluminiscence properties for the detection of illegal preservatives. The MOF 2 photoluminiscence analysis was investigated for the chemosensing application of nitroaromatics. MOF 2 displayed highly selective photoluminiscence for the detection of picric acid, a prominent component in explosives and a potent environmental pollutant. Consequently, MOF 2 holds promising material for the detection of explosives. The LoD and LoQ values for MOF-based picric acid detections were 8×10^{-4} M and 2×10^{-3} M respectively.