ABSTRACT

Chromium (Cr) and cadmium (Cd) ion accumulation in environmental matrices is a growing issue due to their toxicological impacts on both the ecosystem and human health. Conventional techniques for detecting these ions frequently cost a lot of money, take a long time, and call for expensive equipment. This thesis focuses on the synthesis and implementation of two novel (RhB-Co-MOF) and (MB-Co-MOF) dye-functionalized (MOFs) as fluorescence-based sensors for the detection of Cd and Cr ions as a solution to this difficulty. Two precursor MOFs were created by sonication method and the dye encapsulation of these precursors was done by in-situ approach. The FTIR spectra of dye@MOF composite contained the peak of dye as well as MOF which confirmed the formation of dye@ MOF composite. The fluorescence activity of the composites was checked by performing the fluorescence spectrophotometry. The composites showed eminent selectivity and sensitivity for the cadmium. Performing further steps of PL, Stern-Volmer Plot was drawn as well as the values of LOD and LOQ were calculated which were **7.754 M^{-1} and 25.848 M^{-1}** respectively. These RhB-Co-MOF and MB-Co-MOF composites displayed not only good sensitivity and selectivity, but also remarkable stability across a wide pH and temperature range, making them ideal for real-world environmental monitoring. Thus, the work presents an effective, economically viable, and simply deployable approach for detecting environmental toxins with major implications for environmental safety and public health.