Amino Acid Based MOF: A Promising Green Material for Electrochemical Sensing of HMIs

A thesis submitted to

COMSATS University Islamabad, Lahore campus

In the partial fulfillment

of the requirements for the degree of

Master of Science

in

Chemistry

by

Hooria Aslam

CIIT/SP24-R06-008/LHR

Department of Chemistry

Faculty of Science

COMSATS University Islamabad,

Lahore campus

Fall 2025

Amino Acid Based MOF: A Promising Green Material for Electrochemical Sensing of HMIs

This thesis is submitted to the Department of Chemistry in partial fulfillment of the requirements for the award of the degree of Master of Science in Chemistry.

Name	Registration Number
Hooria Aslam	CIIT/SP24-R06-008/LHR

Supervisor

Dr. Lubna Sherin

Tenured Associate Professor

Department of Chemistry

COMSATS University Islamabad (CUI), Lahore Campus

Abstract

Amino Acid Based MOF: A Promising Green Material for Electrochemical Sensing of HMIs

By

Hooria Aslam

Heavy metal ion contamination of freshwater bodies has been a concern around the world. Pb and Hg are some of the HMIs toxic and chronic to human health due to their bioaccumulation and non-degradability. Identification of these water bodies prior to utilization is important. Electrochemical sensing may be proved to be a sensitive detection platform in the detection of HMIs. In this case, an energy-efficient microwave method was applied to synthesize MOF of bismuth and cobalt as the central metal ions and L-Tyrosine as the linker. L-Tyrosine is a biocompatible amino acid that is found naturally. Microwave synthesis provides a technique that is environmentally less polluting, stable in heat rate, low in reaction time, and high in yield in the synthesis of MOFs. Good surface properties are exhibited by the synthesized MOF. Ionic Liquid addition to MOF, namely BMIM BF_4, has enhanced its conductivity, HMI adsorption sites, and hence possible sensing platform window. Therefore, for electrochemical sensitive detection of HMIs, the synthesized MOF displayed large active surface area, excellent charge transfer rate, enhanced conductivity, and time stability. FTIR and XRD were applied to study the synthesized composite. The electrochemical response of MOF (L-Tyr-BiCo)/IL/GCE was characterized using cyclic voltammetry and electrochemical impedance spectroscopy.