INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Environmentally benign synthesis of Sn(II)-based metal-organic-framework and its derivative SnO_2 nanoparticles for the decontamination of water

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SHORT ABSTRACT

In summary, the thesis has some substantial and promising results in the domain of sustainable environmental chemistry and engineering where environmentally toxic organic compounds or cations/ anions are captured by a series of hydrothermally/ solvothermally synthesized water-stable Sn-based metal-organic-framework. Analytical methods, especially FT-IR, IC, DLS, and AAS, heavily corroborated the efficient sorption of the target analytes on the synthesized adsorbent material. In general, the findings will help understand the relatively underexplored space of Sn(II) as inorganic metal ion for stable composite material synthesis and its potential application in environmental remediation. Each of the synthesized Sn(II)-MOF unveiled interesting characteristic properties that were exploited in the remediation of toxic environmental pollutants from the aqueous medium.

The rhomboidal shaped benzene-1,4-dicarboxylate based Sn(II)-MOF illustrated excellent anionic dye removal capacity along with multi-cyclic reusability. The findings demonstrated that the low surface area of the adsorbent was not a limiting factor for dye removal from the aqueous medium. The findings clearly suggest that the electrostatic interaction and the presence of the abundant amount of C═O and –OH functional groups played a vital role in preferential adsorption of the anionic dye. On the other hand, the spherical Sn(II)- benzene-1,3,5-tricarboxylate MOF displayed significant fluoride removal efficiency and remarkable anti-interference activity in the presence of other co-existing anions. Besides, the 1,2,4,5-benzenetetracarboxylate based Sn(II)-MOF exhibited selective sensing of the CrO_4^{2-} ions from the aqueous medium and displayed good high-pressure CO_2 adsorption potential at atmospheric pressure. Furthermore, the Sn(II)-MOF synthesized using BDC recovered from waste PET bottles demonstrated remarkable removal efficiency of the environmentally hazardous anions *viz*. AsO_4^{3-} and PO_4^{3-}. Moreover, the SnO_2

NPs synthesized following the Sn(II)-MOF calcination route, displayed high colloidal stability. The present finding also elucidates the role of surface charge reversal in excellent Mn(II) ions removal efficiency from the aqueous medium. Importantly, the present work can prove to be an economically viable method of recycling the waste PET bottle into value-added adsorbent material for the decontamination of water.