INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Design and Development of Advanced Porous Organic Polymeric Adsorbents for the Efficient and Selective Removal and Recovery of Phosphate and Arsenate from Water

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SHORT ABSTRACT

The thesis entitled as “Design and Development of Advanced Porous Organic Polymeric Adsorbents for the Efficient and Selective Removal and Recovery of Phosphate and Arsenate from Water”, mainly focuses on the design, synthesis, and application of novel modern polymeric adsorbents for the efficient removal and recovery of environmentally hazardous oxoanions – specifically phosphate and arsenate – from aqueous media. This thesis comprises five distinct chapters, which begins with a thorough review of pertinent literature and is followed by chapters that outline the development and findings of the experimental investigations conducted during the research period.

Chapter 1 represents an in-depth analysis of the present literature on reported adsorbent materials for oxoanion remediation, especially phosphate and arsenic, emphasizing their structural properties and basic adsorption mechanisms.

Chapter 2 presents the development of a Zn(II)-coordinated, 1-aminoguanidine-functionalized cellulose biopolymer (Zn-gCP) with efficient phosphate removal and recovery.

Chapter 3 describes the synthesis of a pH-responsive 2D covalent organic network (2D ag-CON) incorporating tris-aminoguanidine units. The material enabled rapid, selective phosphate capture and release via pH modulation. Phosphate adsorption induced a morphological change from spherical to sheet-like structures, serving as a distinguishing feature of ag-CON.

Chapter 4 introduces a bis-imidazolium-based covalent organic network (IC-CON) and is intended for the selective extraction of phosphate and arsenate ions. Because of its strong affinity for arsenate as compared to phosphate, IC-CON is useful for removing arsenate from phosphate-rich environments.

Chapter 5 outlines future directions for the rational design of advanced polymeric adsorbents, along with a summary of the major findings from the thesis.