INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Synthesis and Modification of Aniline-Formaldehyde Condensate and Chitosan Schiff Base Polymers for Application in Cr(VI) and Hg(II) Binding**

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SHORT ABSTRACT

This thesis represents the effort to use principles of coordination chemistry in polymeric systems to address problems related to heavy metal removal from wastewater. In the present research, emphasis was given to understanding amine polymers and increasing their adsorption capacities by modifying their current forms or introducing new functional groups to the monomeric units to increase site accessibility for better metal adsorption.

The first dissertation chapter explores the synthesis, characterization, and application of aniline formaldehyde condensate (AFC) polymers. AFC is a polymer with an amine functional group that can exist in either an acid salt or free amine form. Using a simple solvent switch and acidity control, we have engineered AFC polymers in their salt form as efficient chromate adsorbents, effective over a broader range of concentrations than ever reported before.

The second chapter focused on three topics, (a) Leaching of chemicals, if any from the salt forms of AFC polymer, (b) Long-term storage effect on the salt versions of AFC in chromate adsorption, and (c) Application of the salt versions in another toxic heavy metal, Hg(II) adsorption. Our idea was to make an easy to synthesize material, which can serve as adsorbents for different heavy metals and be stored and used for a long time without losing efficiency.

In the first two chapters, we focused on synthetic modification of AFC polymer to increase its metal adsorption and effectivity in long-term storage. We wanted to incorporate some other metal coordinating donor sites into the polymeric system. This chapter studied the Hg(II) complexation behavior with some imidazole, pyridine, and thiophene-derived small-molecule ligands before introducing them in the polymeric chain. We synthesized the ligands and their Hg(II) complex, characterized them and studied which donor site shows better Hg(II) complexation. The Hg(II) complexes' characterization was performed using ^{1}H, COSY, HETCOR NMR, ESI mass, elemental analysis, and single-crystal X-ray diffraction studies.

So far, we have worked with an aniline-derived polymer, which is not environmentally friendly. Therefore, we wanted to use an environment-friendly system that can be used for areas where our AFC cannot be used. For the last chapter of the thesis, we choose chitosan, a biopolymer with similar free amine groups. We modified chitosan with the same donor sites, imidazole, pyridine, and thiophene donor groups. Characterization data on the complexes helped us understand the bonding of mercury in the polymer system. By nature, adsorbents have to be insoluble, limiting the understanding of chemical bonds between the materials and the mercury as not all spectroscopy support characterization in an insoluble form. This method of parallel study is simple enough to implement and can lead to more efficient adsorbents in other areas.