INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: New insight into the Adsorptive Removal of Organic and Inorganic Pollutants from Aqueous set up with tailored cellulosic and polymer based biomaterials: Modeling and Eco toxicological assessment

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SHORT ABSTRACT

The significance of water as a resource for the survival of humanity is incomparable. With the rapid advancement in various technologies, the demand for water usage has been augmented exponentially. From the industry domain to fulfilling the basic necessity for the people, water conservation with proper qualitative allocation has been at the forefront of all activities. While the swift developments in the technological industries have been a boon for appeasing the hefty consumer demand in the market, it leaves a deterrent impact on the environment. To eradicate the grave danger to the aquatic environment, the treatment of wastewater is crucial and imperative.

This thesis work examines the efficiency of the removal of heavy metals Chromium, various dyes, antibiotics, anti-inflammatory agent and rare earth element using lignocellulosic and cellulosic composite materials. Adsorption parameters like pH, adsorbent dosage, temperature, and initial metal concentration were optimised in the batch study and in column. The optimised data were further equilibrated using detailed two-parameter and three-parameter isotherm models, kinetics, and thermodynamic models to determine the nature of the sorbent-sorbate interaction. Cellulose, which is the major component of lignocellulose, was explored by converting it to nano size that further significantly enhances the specific surface area and minimises the intraparticle diffusion distance. Despite their ability to adsorb various pollutants, the challenge in scaling up the process lies in the agglomeration and disintegration of cellulosic material in the aqueous media. In the past decade, various studies have been reported to overcome these difficulties by using polymer matrices as support which provide high mechanical strength and stability under different environmental conditions to improve the adsorption efficiency of the cellulosic base material. A fundamental understanding of cellulose fibre composite with tailor-made personalization has contributed to a diverse range of high-end engineering applications. This modification provides superior properties, enhanced functionality, and application in dye removal. This work may serve as an alternative to the conventional method for removing pollutants from industrial effluent, providing an essential, fascinating field of cellulose-based nanocomposite application.