INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Biosorption of Hexavalent Chromium Cr(VI) from Synthetic Waste Solutions by Novel Modified and Raw Lignocellulosic Biosorbents**

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SHORT ABSTRACT

Clean water is a basic need of all organisms including humans. However, due to industrial and human activities of human, there is release of toxic pollutants in unprecedented amounts into the water sources. One such toxic pollutant is hexavalent chromium. Hexavalent chromium has been found to cause many ailments including cancer. Conventional methods of removal of hexavalent chromium have various drawbacks such as use of toxic chemicals, generation of toxic by-products. Biosorption is a method which is eco-friendly, does not involve the use of toxic chemicals. Lignocellulosic plant materials are cheap, available in plenty amount, biodegradable, eco-friendly and have been found to be good material for biosorption of toxic pollutants including hexavalent chromium.

In the present work, we have explored three different lignocellulosic plant materials namely *Pinus kesiya*, *Senna siamea* and *Phanera vahlii* and activated carbon prepared from these materials for the abatement of hexavalent chromium from synthetic waste solutions. All materials were characterized using FESEM, EDX, FTIR, BET and TGA. Parameters influencing adsorption process such as pH, biosorbent dose, contact time, temperature and initial metal concentration were optimized. Further, adsorption isotherms such as Langmuir, Freundlich and

others were fitted to the experimental data to determine important parameters such as maximum adsorption capacity. Kinetic models were also applied to infer the mechanism of adsorption process. Thermodynamics studies were conducted to determine the spontaneity and other important parameters. We conducted regeneration and reuse investigations to find the recyclability of the adsorbent materials. Among the investigated biosorbents, we find the *Phanera vahlii* zinc chloride activated carbon (PVZCAC) to possess the highest adsorption capacity of approx. 300 mg/g. The surface area of the PVZCAC was also maximum among the explored materials with a value of 1673.0 m^2/g.

Having explored the various materials in batch mode and found the best material, we conducted continuous column studies for further determining the capability of the prepared material PVPZAC. Various parameters influencing adsorption process in continuous mode such as bed height, initial metal concentration and flow rate were modulated for determining the best conditions. The experimental data of breakthrough curves was fitted to various theoretical models such as Thomas, Yoon Nelson, Adams Bohart and Bed Depth Service time to establish and determine vital parameters such as maximum adsorption capacity. We find that low initial metal concentration and flow rate and high bed depth showed high magnitude removal of hexavalent chromium. We find that the PVZCAC has adsorption capacity at par with other materials investigated so far