INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study	:	Ph.D.

Thesis Title: Studies on Energy and Environmental Applications of Ravenna Grass (*Saccharum ravennae*) Biomass

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SHORT ABSTRACT

The Ph.D. thesis focuses on the utilization of *Saccharum ravennae* grass as a biofuel source and for environmental applications. Bioethanol production involved optimizing sugar yields using enzymatic hydrolysis with various pretreatment methods, including CCD-RSM for alkaline lignin extraction, which were targeted as the first two objectives of the thesis. Thereafter, the last two objectives of the thesis affirmed the utilization of the extracted lignin with the PSf membranes for Cr(VI), Pb^{2+}, and dye removal from water.

Saccharum ravennae, abundant in Assam, India, offers potential for biofuel due to its high polysaccharide content. Various pretreatment methods (acid, alkali, and acid followed by alkali pretreatment) were explored to optimize sugar conversion. Enzymatic hydrolysis with surfactants improved sugar yields, particularly with Tween 20. The cellulose and hemicellulose digestibility of pretreated samples significantly improved. The optimized sugar yield enhances *Saccharum ravennae*'s potential as a biofuel substrate.

Additionally, KOH-mediated alkaline hydrothermal pretreatment facilitated the extraction of highly pure alkaline lignin from Saccharum ravennae. Response surface methodology (RSM) aided in optimizing lignin recovery. The extracted lignin exhibited higher purity and functional groups, making it suitable for future applications.

The extracted alkaline lignin was further utilized to effectively fabricate lignin-based mixed matrix membranes. Under the ideal experimental scenario, the M2 (0.5 wt.% lignin/PSf) and M3

(1.0 wt.% lignin/PSf) membranes demonstrated good pure water flux values and higher removal Cr (VI) values of 98.5% and 98.75% respectively. Further, to increase the water flux, functional property, and removal efficiency of the membranes, lignin/Graphene oxide incorporated polysulfone composite membranes were fabricated with the phase inversion method and with PEG 6000 as a pore-forming agent. Composite membranes incorporating lignin and graphene oxide (GO) exhibited improved physicochemical characteristics and efficient removal of Pb^{2+} and Eosin Y dye from synthetic wastewater solution systems.

Overall, the thesis demonstrates advancements in biofuel production, lignin extraction, and membrane fabrication. Thereby, valuable insights have been gained for the sustainable utilization of biomass for value-added product development-based environmental remediation.