



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: **Studies on the Synthesis of Bacterial Cellulose and its Utilization in Value-Added Chemical Transformation and Biomedical Applications**

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SHORT ABSTRACT

The fabrication of BC and BCNCs is a promising technology as it opens dimensions with multiple application possibilities with the “waste to wealth” strategy. The impregnation of biodegradable polymers, such as PCL into the BC network resulted in the presence of polymer layers on the surface as well as inside the pores of the BC matrix indicating a good fiber-matrix interaction. These fabricated BC and BCP composite membranes were biocompatible and nontoxic to BHK-21 cells even after 72 h, allowing cell proliferation. Electrospun nanofibrous dressings based on lidocaine hydrochloride loaded bacterial cellulose/ polycaprolactone (BCP) revealed their cytocompatible nature. The utilization of BCNCs can aid in the reduction of carbon dioxide that is responsible for global warming and climate change. The strategic functionalization of BCNCs through the sustainable approach avoids the utilization of harmful chemicals. BCNC templated catalysts, are one of the versatile nanomaterials developed in this work, with potential application as biocatalysts in value-added chemical transformation. On the other hand, 5-Hydroxymethyl-2-furfural (HMF) is considered an important platform chemical among other intermediates derived from biomass. In this study, we have used mesoporous BCNC templated zirconium phosphate as a catalyst for the conversion of furfural into HMF. The catalyst was synthesized using a wet-precipitation method and was characterized using powder XRD, FT-IR spectroscopy, FETEM, BET and FESEM. The as-prepared BCNC templated catalyst showed mesoporous structure with high surface area and exhibited excellent catalytic activity as compared to pristine ZrP for the formation of HMF, from furfural. Also, the HrP-immobilized BCNC hydrogel exhibited good self-healing properties and was reused efficiently for 6 cycles with greater than 50% of its original activity retained even after 60 days, which facilitated their application as promising biomaterials. Therefore, this doctoral thesis focuses on the utilization of BC and its functionalization for development of polymeric scaffolds, biocatalysts, as well as their advanced applications as biosensors, in biotechnological applications.