# INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
## SHORT ABSTRACT OF THESIS

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Thesis Title: Synthesis of Biomass Based Microcrystalline Cellulose for Food Packaging Application

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## SHORT ABSTRACT

The thesis focused on the extraction of microcrystalline cellulose (MCC) from two lignocellulosic waste biomass sources, elephant grass and tea factory waste, and exploration of its potential application in the food packaging sector. MCC was extracted from elephant grass (*Pennisetum purpureum*) through successive bleaching with alkaline hydrogen peroxide, the synthesized product was characterized using various analytical techniques and compared with the commercially available MCC. The prepared elephant grass microcrystalline cellulose was then incorporated as reinforcing fillers into the polymer matrix of corn starch films. The filler significantly improved the thermal, mechanical, and water barrier properties of the corn starch composite films making them suitable for application as food packaging material.

MCC was also synthesized from black tea waste generated in the tea industries by microwave-assisted peroxide bleaching method. The synthesized tea waste microcrystalline cellulose was characterized and compared with conventionally prepared tea waste MCC. The characterization results revealed that the microwave-extracted black tea waste MCC possesses high crystallinity and good thermal properties, suggesting its potential to be a used as a filler material in polymer composites. Microwave-assisted successive bleaching can be used as a promising, energy-efficient, time-saving, and cost-effective technology for extracting MCC from tea industry waste that can serve as a renewable, abundant, and cheap source of valuable crystalline cellulose derivatives. The synthesized tea waste MCC was incorporated as fillers into PVA films and the physicochemical characteristics of the fabricated PVA composites were investigated. Tea waste MCC enhanced the thermal, mechanical, water resistance, moisture barrier and UV-blocking properties of the PVA composites up to a great extent. Tea waste MCC reinforced PVA film extended the shelf life of grapes by preserving them for 18 days.

The present research provides a sustainable approach for the utilization of waste lignocellulosic biomass sources like elephant grass and tea industry wastes, while minimizing the global plastic pollution issue at the same time. This study promotes the "waste to wealth" strategy for sustainable development and a greener environment.