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

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| Programme of Study | : | Ph.D. |

Thesis Title: Studies on Development of Functionalized Biopolymeric Nanocomposite Based Edible Nanocoating on Food Products and Sustainable Secondary Packaging

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| Thesis Submitted to the Department/ Center | : | Chemical Engineering |
| Date of completion of Thesis Viva-Voce Exam | : | 16/03/2021 |
| Key words for description of Thesis Work | : | Edible nanocoating; Functionalized biopolymeric nanocomposites; Perishable food products; Secondary packaging |

**SHORT ABSTRACT**

In the current century, the rising environmental issues caused by increased carbon footmarks and waste generations from conventional packaging have gained concern in developing environment benign polymers based edible and non-edible food packaging. The specified packaging systems as primary and secondary packaging are commonly developed from renewable resources and their modified forms, which can transport the food products to end-users in a safe condition. Additionally, the use of renewable biomaterials for the fabrication of edible coated food products (a kind of edible food packaging) has become indispensable to reduce the food waste generations. In this context, the present thesis work directs the use of bionanostructures based on modified polysaccharide (iron functionalized cellulose nanofiber, and sodium tripolyphosphate crosslinked nanochitosan) and protein (silk nanodisc) to tailor the inherent properties of biopolymers to be used as edible coating materials on perishable fruit products (a type of primary packaging) and their sustainable secondary packaging (a packaging system for edible coated food products) for safe delivery. The bionanostructures based on modified polysaccharide including iron functionalized cellulose nanofiber (mgCNF), nanochitosan (NCS) and protein (silk nanodisc (SND)) are used to tailor the inherent properties of biopolymers to be used as edible coatings (edible packaging) on perishable fruit products (primary packaging). The fabrication of mgCNF following a single step co-precipitation technique is a way to adsorb iron particles on CNF and is used as a reinforcement in chitosan (CS) nanocomposites. Additionally, the formulation of curcumin (Cur) doped mgCNF/CS nanocomposite as edible coating on cut pineapple delivers functionalized nanocomposite with anti-cancerous and iron-fortified ready to eat pineapple fruit products. The edible nanocoatings are applied on kiwifruits and are analysed during the storage period. Further, NCS is another polysaccharide nanostructure fabricated

following ionic gelation method and is used in modifying starch (ST) and guar gum (GG) based edible coatings. The inclusion of NCS (a food based nanomodifier) in ST-GG biocomposites improves the surface, thermal, optical, antimicrobial, mechanical, and other properties. The development of edible nanocoating on cut apple using NCS modified ST-GG biocomposites significantly improved the food properties during storage life. The formulation of silk nanodisc (SND) dispersed edible CS coating for bananas acts as a candidate with superior thermal, hydrophobic, optical, mechanical, and food properties. It is noteworthy to mention that SND dispersed CS edible coatings provide an improved texture of banana fruits. In this way, the current thesis work addresses the use of functionalized biopolymeric nanocomposite as an edible coating to improve the storage of perishable fruits. In line with this, the development of secondary packaging can provide a complete set of packaging for the delivery of food products. The industrially viable secondary packagings for edible coated food products are fabricated based on blown films of poly (lactic acid) (PLA) based biocomposites. The study manifests an in-depth understanding of the effect of modified biofillers on the bulk properties of PLA blown films from the aspects of thermomechanical, crystallinity, thermal stability, color, migration, surface wettability and others to be used as secondary packaging materials. Further, the study provides a new area of the application utilizing biodegradable blown films for food packaging application of edible coated food.