PREFACE

Currently, for sustainable development, the utilization of renewable resources in polymer synthesis has received worldwide attention in the age of depletion of fossil resource, global warming, and other environmental concerns. Among the various types of renewable raw materials, vegetable oils and tannic acid have attracted much more consideration owing to their easy availability, environmental, inherent biodegradability, low price and low toxicity. The utilization of renewable resources can substitute petro-based products and avoiding emissions of major greenhouse gas CO_2 which is mainly responsible for global warming. For that reason, academic and industrial researchers are trying to use renewable resources for the production of both chemicals and polymeric materials as raw materials.

A wide range of vegetable oils has been used to synthesize various polymeric resins such as epoxy, polyurethane, polyester and polyetheramide etc. Among the various vegetable oils based polymer, polyurethane is a special group of polymeric materials that are used in many different applications. However, these resins suffer some major drawbacks in synthesis. The use of isocyanates precursor for the synthesis of it is the main drawbacks due to its high moisture sensitivity and toxicity. Therefore, the development of PU without the use of isocyanates precursor is the main challenge ideally from renewable resources to make environmentally friendly materials

This thesis mainly focuses on the development of PU without the use of isocyanate (so-called NIPUs) from renewable resources. The bio-based NIPU are prepared by using renewable raw material like vegetable oils, tannic acid, and glycerol. Further in this work, instead of using toxic isocyanate, we have tried to utilize the major greenhouse gas CO_2 to synthesize fully sustainable polyurethane. Finally, in order to make them suitable for applications, efforts have been devoted to improve the physico-chemical properties of these NIPUs by blending and reinforcing various nano-fillers. This thesis is comprised of seven chapters. The first chapter, Chapter 1, contains the general introduction and motivation of the research work. Chapter 2 introduces solvent and catalyst-free synthesis of sunflower oil based non-isocyanate polyurethane and its coating properties. Chapter 3 deals with the development of sunflower oil based non-isocyanate polyurethane hybrid and its nanocomposites with organically modified graphene oxide. Chapter 4 presents sunflower oil based non-isocyanate polyurethane

and its nanocomposites with modified multi walled carbon nanotubes. Chapter 5 demonstrates the blending of carbonated soybean oil with carbonated highly branched polyester. Chapter 6 explores the tannic acid as renewable material to synthesized bio-based non-isocyanate polyurethane and its clay nanocomposites. Finally, Chapter 7 summarizes the outcome, the overall conclusion of the present work and the future scope.

We hope that this thesis will contribute to the fast-growing field of bio-based polymer and utilization of CO_2 in polymer synthesis, and open up the new possibilities of further research on this topic.

This research was carried out in the Department of Chemical Sciences, Tezpur University with financial assistance from the Tezpur University and UGC, India.

Simanta Doley