JAIST Repository
https://dspace.jaist.ac.jp/

Title	トルキシル酸由来高性能フォトニクスバイオポリアミド材料の開発
Author(s)	舟橋，靖芳
Citation	
Issue Date	2023-03
Type	Thesis or Dissertation
Text version	ETD
URL	http://hdl.handle.net/10119/18442
Rights	
Description	Supervisor:金子 達雄，先端科学技術研究科，博士

JAIST
JAPAN
ADVANCED INSTITUTE OF
SCIENCE AND TECHNOLOGY

Japan Advanced Institute of Science and Technology

Abstract

Bioplastics have been the subject of much research in recent years in the interest of a sustainable society. Bioplastics are also expected to contribute to transparent materials, one of the most important applications of plastics. In order to apply bioplastics as transparent materials, in addition to high transparency, it is desirable for bioplastics to have mechanical, thermal, and moldability properties. In this study, the other focused on biopolyamides derived from 4-aminocinnamic acid as high-performance transparent bioplastics.

This thesis is composed of following five chapters: Chapter 1 describes the background and objectives of this research.

Chapter 2 describes the synthesis of *co*-polymers with aliphatic dicarboxylic acids and the preparation of tough fibers and self-standing thin membranes. The mechanical properties of biopolyamides were controlled by selecting the type and quantity ratio of 4-aminocinnamic acid-derived diamines and dicarboxylic acids and aliphatic dicarboxylic acids for the synthesis of *co*-polymers.

In Chapter 3 describes controlling the solubility of biopolyamides and their composites with cellulose nanofibers. The methyl esters in the side chains of biopolyamides were hydrolyzed by alkali to give the polyamides water solubility. Further insolubilization was achieved by doping divalent metal ions into the prepared films. The toughness of the water-soluble polyamide was improved by compositing it with cellulose nanofibers while maintaining its transparency.

In Chapter 4 describes the control of refractive index by compositing with metal oxides. Composite membranes were prepared by sol-gel reaction of titanium or zirconium alkoxides. The refractive index of the resulting membranes was measured, and an increase in the refractive index was observed as the amount of metal oxide increased.

Composite films of titanium dioxide and biopolyamide were also prepared. The obtained films were transparent and flexible. Further TEM observation showed that titanium dioxide particles of a few nm in size were uniformly dispersed in the film.

Chapter 5 summarizes the design of optical materials based on 4-aminocinnamic acid-based biopolyamides.

In this study, the auther focused on the main and side chain structures of biopolyamides. Since the structure of biopolyamides has many parts in common with other polymers, I believe that it can be expanded to design materials based on other polymers.

Keywords: Biobased polymers, Polyamide, Cinnamic acid, Cellulose nanofibers, Nanocomposites.