Controlling Toughness and Degradation Properties of Marine Biodegradable Polymers through Polymer Processing

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18th NSTDA Annual Conference (NAC 2023)

31 March 2023

Nowadays, marine pollutions, especially plastic garbage and microplastics have attracted worldwide attention. One of the most garbage is fishing goods that occupied 25% of whole garbage in ocean. An environmentally friendly biodegradable plastic has been proposed for solving this problem. Currently, research in Japan is focusing on marine biodegradable plastics (goal 4) in the Moonshot research and development program, which is organized by New Energy and Industrial Technology Development Organization (NEDO). We are involved in the control of toughness improvement and marine biodegradability through novel polymer processes for the implementation of marine biodegradability in society.

In this presentation, several marine biodegradable polymers are studied: Polycaprolactone, Polyglycolic acid (PGA) and Polybutylene succinate (PBS). Polyglycolic acid (PGA), a type of biodegradable plastic, has high strength and hydrolysable and a very fast degradation rate, which is advantageous in reducing marine pollution. However, the brittleness of PGA limits its processability and applications. Polybutylene succinate (PBS) is one of the most promising biodegradable aliphatic polyesters due to its excellent processability, thermal properties, biodegradability and compostability. However, its poor tearing properties compared to conventional polymers as polyolefin limit its large-scale application. The aim of this study is to improve the toughness of PGA and the tear strength of PBS by adding polyrotaxane. The effect of molecular weight (MW) and content of PR on the toughness of polymer/PR blends prepared by melt kneading was determined. Melt kneading controlled the internal morphology and improved the mechanical properties.

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Keywords: Polymer blends, Biodegradability, Polyrotaxane, Mechanical properties

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Biography

Professor Dr. Hiroshi ITO studied from Undergraduate to Graduate School in Yamagata University, Japan and received Doctor of Engineering in 1996. His academic career started in 1993 in Assistant Professor at Tsuruoka National College of Technology and 1996 at Tokyo Institute of Technology. He has promoted to Professor at Yamagata University in 2010.

He is currently the Dean of Graduate School of Organic Materials Science; Vice Dean of Faculty of Engineering; and the Director of Research Center for GREEN Materials and Advanced Processing, Yamagata University.

Prof. ITO's research field is to clarify and control the development of higher-order structure in polymeric materials through experimental and theoretical studies on the polymer processing. His research projects cover various types of polymer processing. His innovative research in this area indicates that the successful development of advanced polymer processing technologies for polymer blends and polymer composites, injection molding, film processing, fiber spinning, nano-imprint technology, and so on. More recently, his most research interest is material development and structural development for polymer alloy, polymer blends and composites. He has achieved many awards and recognition. He has continuing received research grants since 1994. He has published over 190 papers in International Academic Journal, 34 Book Chapters, has achieved over 20 patents and has over 55 Invited lectures.