

**PREPARATION AND CHARACTERIZATION OF CHITOSAN/SILK
FIBROIN BLEND FILMS**

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
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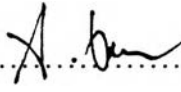
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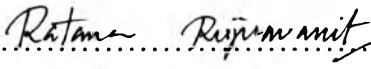
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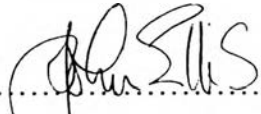
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ABSTRACT

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Jantip Suesat: Preparation and Characterization of Chitosan/Silk Fibroin Blend Films. Thesis Advisors: Prof. Alexander M. Jamieson and Dr. Ratana Rujiravanit, 80 pp. ISBN 974-334-171-4

Natural polymer blend films composed of chitosan and silk fibroin were prepared with various ratios of chitosan to silk fibroin, with and without glutaraldehyde as a crosslinking agent. The effects of the ratio of chitosan to silk fibroin and crosslinking agent on swelling behavior and mechanical properties of the blend films were studied. For the swelling behavior, the blend films exhibited a dramatic change in the degree of swelling when immersed in acidic solutions. The degree of swelling of the films increased as the chitosan content increased; the blend film with 80% chitosan content had the maximum degree of swelling. It appeared that crosslinking had occurred in the blend films which helped the films retain their three dimensional structure. In addition, FTIR spectra of the films showed evidence of hydrogen bonding interaction between chitosan and silk fibroin. For the effect of salt type, the films were immersed in various types of aqueous salt solutions, viz NaCl, LiCl, CaCl₂, AlCl₃, and FeCl₃. The films immersed in AlCl₃ and FeCl₃ aqueous solutions gave the maximum degree of swelling. The effects of AlCl₃ and FeCl₃ concentrations on swelling behavior were also investigated. It was found that the maximum degree of swelling of the films occurred at 1.0×10^{-2} M of AlCl₃ and FeCl₃ aqueous solutions. In addition, the tensile strength of the films increased by crosslinking in both dry and wet states whereas the elongation at break decreased.

บทคัดย่อ

จันทร์ทิพย์ ชื่อสัตว์ : การศึกษาฟิล์มของพอลิเมอร์ผสมระหว่างไคโตซานและซิลค์ไฟโบรอิน (Preparation and characterization of chitosan/silk fibroin blend film) อ. ที่ปรึกษา: ศ. อเล็กซานเดอร์ เอ็ม เจมิสัน และ อาจารย์รัตนา รุจิรวนิช 80 หน้า ISBN 974-334-171-4

งานวิจัยนี้ศึกษาการเตรียมฟิล์มของสารพอลิเมอร์ผสมระหว่างไคโตซานและซิลค์ไฟโบรอินที่อัตราส่วนของไคโตซานและซิลค์ไฟโบรอินต่างๆ โดยเปรียบเทียบระหว่างฟิล์มที่เดิมและไม่เติมสารก่อการเชื่อมโยง ในงานวิจัยนี้ใช้กลูตารัลดีไฮด์เป็นสารก่อการเชื่อมโยงสำหรับไคโตซาน โดยทำการศึกษาถึงอิทธิพลของอัตราส่วนระหว่างไคโตซานและซิลค์ไฟโบรอินและสารก่อการเชื่อมโยงต่อพฤติกรรมการบวมตัวและคุณสมบัติทางกลของฟิล์มสารพอลิเมอร์ผสม จากผลการวิเคราะห์สเปกตรัมที่ได้จากฟูเรียร์ทรานสฟอร์มสเปกโตรโฟโตมิเตอร์พบว่ามีการเกิดพันธะไฮโดรเจนเกิดขึ้นระหว่างไคโตซานและซิลค์ไฟโบรอิน สำหรับพฤติกรรมการบวมตัวของฟิล์มสารพอลิเมอร์ผสมดังกล่าว พบว่า ฟิล์มของสารพอลิเมอร์ผสมให้ค่าการบวมตัวที่สูงในสารละลายบัฟเฟอร์และสารละลายเกลือเมื่อปริมาณไคโตซานเพิ่มขึ้น นอกจากนี้ ฟิล์มพอลิเมอร์ผสมที่เติมสารก่อการเชื่อมโยงยังสามารถรักษารูปร่างไว้ได้เมื่ออยู่ในสารละลายบัฟเฟอร์ที่มีค่าพีเอชเป็นกรดและสารละลายเกลืออลูมิเนียมคลอไรด์และเฟอร์ริกคลอไรด์ ในการศึกษาผลของการเปลี่ยนแปลงความเข้มข้นของสารละลายเกลืออลูมิเนียมคลอไรด์และเฟอร์ริกคลอไรด์ พบว่าฟิล์มของสารพอลิเมอร์ผสมสามารถบวมตัวได้สูงสุดเมื่อความเข้มข้นของเกลือเท่ากับ 1.0×10^{-2} M นอกจากนี้ สารพอลิเมอร์ผสมระหว่างไคโตซานและซิลค์ไฟโบรอินยังช่วยปรับปรุงคุณสมบัติทางกลของฟิล์มที่ได้จากซิลค์ไฟโบรอินเพียงอย่างเดียวได้เช่นเดียวกัน

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