

**SILK FIBROIN/POLYCARBAZOLE COMPOSITE AS ARTIFICIAL
MUSCLE**

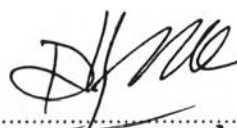
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A Thesis Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
Case Western Reserve University, and Institut Français du Pétrole
2013

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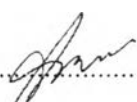
Thesis Title: Silk Fibroin/Polycarbazole Composite as Artificial Muscle
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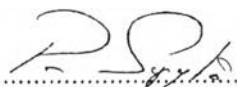
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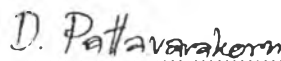
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ABSTRACT

5472051063 Polymer Science Program

Thanida Srisawasdi: Silk Fibroin/Polycarbazole Composite as Artificial Muscle.

Thesis Advisors: Prof. Anuvat Sirivat, Prof. Alexander M. Jamieson
119 pp.

Keywords: Silk fibroin/ Hydrogels/ Polycarbazole/ Actuator/ Biopolymer

Pure silk fibroin (SF) hydrogel and composites of polycarbazole/silk fibroin (PCZ/SF) hydrogel were fabricated by solvent casting technique to investigate electromechanical properties, dielectric properties, and deflection properties as functions of SF concentration, glutaraldehyde concentration, and particle concentration in the blends electric field strength. Electromechanical properties were characterized using oscillatory shear mode over a frequency range from 0.1 to 100 rad/s under various electric field strengths from 0 to 600 V/mm at a temperature of 27 °C. For both pristine SF hydrogel and the composites, the storage modulus response ($\Delta G'$) and the storage modulus sensitivity ($\Delta G'/G'_0$) increase dramatically with increasing electric field strength; the pristine hydrogel possesses the highest storage modulus sensitivity value of 5.87, a relatively high value when compared with other electroactive polymers. With increasing incorporation of conductive polycarbazole into the SF hydrogel, the storage modulus sensitivity and the relative dielectric constant decrease; the conductive polymer thus provides a softening effect. In a deflection experiment with using a cantilever fixture, for both the pure SF hydrogel and the composites, the dielectrophoresis force and deflection distance increase monotonically with electric field strength, with the pure SF hydrogel showing the highest deflection distance and dielectrophoresis force.

บทคัดย่อ

ธนิดา ศรีสวัสดิ์ : การศึกษาพอลิเมอร์ผสมระหว่างใยไหมและพอลิคาร์บาโซล เพื่อใช้ในงานกล้ามเนื้อเทียม (Silk Fibroin/Polycarbazole Composite as Artificial Muscle)

อ. ที่ปรึกษา : ศ. อนุวัฒน์ ศิริวัฒน์ และ ศ. อเล็กเซนเดอร์ เอ็ม เจมิชัน 119 หน้า

ใยไหมบริสุทธิ์และพอลิเมอร์ผสมระหว่างใยไหมและพอลิคาร์บาโซลถูกขึ้นรูปโดยวิธีการทำให้เป็นไฮโดรเจล เพื่อศึกษาคุณสมบัติเชิงกลที่ตอบสนองทางไฟฟ้า, ค่าคงที่ไดอิเล็กทริก, และการตอบสนองการเบี่ยงเบนในกระแสไฟฟ้า ในปัจจัยของปริมาณความเข้มข้นของใยไหม, กลูตาเอมิไฮด์, และผลของปริมาณพอลิคาร์บาโซลในวัสดุผสม การทดลองกระทำโดยการให้แรงเฉือนแบบกลับไปกลับมาจากความถี่ 0.1 ถึง 100 เรเดียนต่อวินาที และให้สนามไฟฟ้าตั้งแต่ 0 ถึง 600 โวลต์ต่อมิลลิเมตรกับสารตัวอย่าง ที่อุณหภูมิ 27 องศาเซลเซียส สำหรับไฮโดรเจลใยไหมแรกเริ่ม ค่าการเปลี่ยนแปลงสตอเรจมอดูลัส และค่าความแข็งเพิ่มขึ้น เมื่อเพิ่มความเข้มของสนามไฟฟ้า ซึ่งแสดงค่าความแข็งสูงสุดที่ 5.87 เมื่อเปรียบเทียบกับพอลิเมอร์ที่ตอบสนองต่อไฟฟ้าชนิดอื่นๆ อย่างไรก็ตาม เมื่อผสมพอลิคาร์บาโซลกับใยไหม พบว่าค่าความแข็งและค่าคงที่ไดอิเล็กทริกลดลง เนื่องจากพอลิเมอร์นำไฟฟ้าช่วยทำให้เกิดการนูนขึ้นของชิ้นงาน ในการทดลองการตอบสนองการเบนในสนามไฟฟ้า แรงไดอิเล็กโตรโฟรีซิส และระยะเบี่ยงเบนเพิ่มขึ้น เมื่อเพิ่มความเข้มของสนามไฟฟ้า ซึ่งไฮโดรเจลใยไหมบริสุทธิ์ แสดงระยะการเบี่ยงเบน และแรงไดอิเล็กโตรโฟรีซิสมากที่สุด

ACKNOWLEDGEMENTS

The author would like to thank all faculties who have provided invaluable knowledge to her, especially, Prof. Anuvat Sirivat and Prof. Alexander M. Jamieson who is her advisor.

Special thank goes to Conductive and Electroactive Polymers Research Unit of Chulalongkorn University, Thailand Research Fund (TRF-RTA), and Royal Thai Government.

She would like to express her sincere appreciation to Prof. Pitt Supaphol and Dr. Datchanee Pattavarakorn for being on her committee and her friends in Conductive and Electroactive Polymers Research Unit of Chulalongkorn University for their various suggestions and discussion on this work and the oral presentation.

The author is grateful for the scholarship and funding of this thesis work provided by the Petroleum and Petrochemical College; and the National Excellence Center for Petroleum, Petrochemicals, and Advanced Materials, Thailand.

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