

**PLASMA ASSISTED SERICIN-G-PLA CLAY AEROGEL
WITH ACRYLIC ACID**

Somruethai Saetae

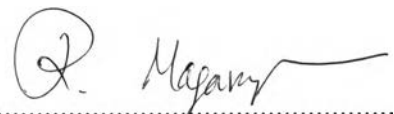
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By: Somruethai Saetae
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Thesis Advisors: Assoc. Prof. Rathanawan Magaraphan


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..... College Dean
(Asst. Prof. Pomthong Malakul)

Thesis Committee:


.....
(Assoc. Prof. Rathanawan Magaraphan)


.....
(Asst. Prof. Thanyalak Chaisuwan)


.....
(Dr. Orasa Onjun)

ABSTRACT

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Clay aerogel is light weight, low density and high porosity material produced from bentonite via freeze-drying technique which the morphology is suitable for several applications including biodegradable absorbent material. In this study, sericin-g-PLA clay aerogel with acrylic acid, the new material to use as ethylene adsorption material, was successfully prepared. Silk sericin, the glue like protein from silk cocoon, is interested in the ability to adsorb the ethylene gas due to its high amino groups. Silk sericin was extracted from 4 species of traditional Thai silk cocoon; Nang Noi, Nang Lai, Dok Bua and Luang Pairote. To overcome the fragile problem of the clay aerogel, the incorporation of clay with polymeric material is required. Lactide monomer was employed to improve the mechanical properties via grafting with sericin in bulk polymerization. Moreover, acrylic acid was used as a cross-linking agent that initiated the reaction by plasma treatment. The aim of this study was to prepare sericin-g-PLA clay aerogel by freeze-drying technique using acrylic acid as cross-linked agent and studied the influence of acrylic acid, clay contents, plasma treatment time and mass ratios of silk sericin and LA monomer to the properties of the aerogel. The mechanical properties were improved by increasing acrylic acid and clay loading. Increasing of acrylic acid content, was improved the thermal properties of the aerogels. Plasma treatment time at 30 s was highly enhanced the thermal and mechanical properties of the aerogels. In contrast, the increasing of clay content strongly reduced the thermal stability. The increase of silk sericin content in sericin-g-PLA powerfully increased ethylene adsorption ability.

บทคัดย่อ

สมฤทัย แซ่เต๋ : พลาสมาเสริมซีรีซินกราฟท์พีแอลเอเคลย์แอโรเจลด้วยกรดอะคริลิก (Plasma Assisted Sericin-g-PLA Clay Aerogel with Acrylic Acid) อ. ที่ปรึกษา : รศ. ดร. รัตนวรรณ มกรพันธุ์ 123 หน้า

เคลย์แอโรเจลเป็นวัสดุที่มีน้ำหนักเบา ความหนาแน่นต่ำ และมีความเป็นรูพรุนสูง เคลย์แอโรเจลสามารถสร้างขึ้นจากการนำดินเบนโทไนต์ไปผ่านกระบวนการที่เรียกว่าการแช่แข็งแห้ง เมื่อพิจารณาโครงสร้างของเคลย์แอโรเจลที่เกิดขึ้น โครงสร้างที่มีความพรุนสูงและรูพรุนเป็นแบบต่อเนื่องมีความเหมาะสมสำหรับการนำไปใช้งานหลายด้านซึ่งรวมถึงวัสดุดูดซับ งานวิจัยนี้มีจุดประสงค์ในการเตรียมซีรีซินกราฟท์พีแอลเอเคลย์แอโรเจลกับกรดอะคริลิก โดยกระบวนการแช่แข็งแห้ง จากการทดลองพบว่าผงไหมซีรีซินมีคุณสมบัติในการดูดซับก๊าซเอทิลีน เคลย์แอโรเจลชนิดใหม่นี้มุ่งหวังเพื่อนำไปใช้เป็นวัสดุดูดซับก๊าซเอทิลีน ผงไหมซีรีซินถูกสกัดมาจากไหมแตกต่างสายพันธุ์ทั้งหมดสี่ชนิด คือ นางน้อย นางลาย ดอกบัวและเหลืองไฟโรจน์ เนื่องด้วยเคลย์แอโรเจลเป็นวัสดุที่มีสมบัติเชิงกลต่ำ ดังนั้นมอนอเมอร์แลคไทด์จึงถูกนำมาใช้เพื่อปรับปรุงสมบัติเชิงกลโดยการกราฟท์กับซีรีซินด้วยพอลิเมอไรเซชันแบบบัลค์ นอกจากนี้กรดอะคริลิกถูกนำมาใช้เพื่อจุดประสงค์ให้เกิดการสร้างการเชื่อมขวางของโครงสร้างโดยใช้พลาสมาเป็นตัวกำเนิดปฏิกิริยา จากงานวิจัยพบว่า การเพิ่มปริมาณกรดอะคริลิกและเคลย์ส่งผลให้เกิดการปรับปรุงทางด้านสมบัติเชิงกล นอกจากนี้ยังพบว่า การเพิ่มปริมาณกรดอะคริลิกส่งผลให้เกิดการปรับปรุงทางด้านสมบัติทางความร้อน เวลาในการพลาสมาที่ 30 วินาที ส่งผลให้เกิดการปรับปรุงทางด้านสมบัติเชิงกลและสมบัติทางความร้อน แต่เมื่อปริมาณของดินเบนโทไนต์เพิ่มขึ้นส่งผลให้สมบัติทางความร้อนต่ำลง และปริมาณของซีรีซินที่เพิ่มขึ้นในซีรีซินกราฟท์พีแอลเอส่งผลให้ประสิทธิภาพในการดูดซับก๊าซเอทิลีนเพิ่มขึ้น

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ABBREVIATIONS

DB	Dok Bua species
LA	Lactide Monomer
LP	Luang Pairote species
MMT	Montmorillonite clay
NL	Nang Lai species
NN	Nang Noi species
NR	Natural rubber
PLA	Poly(lactic alcohol)
SS	Silk sericin

SYMBOLS

ρ	Mass density
M	Mass
V	Volume
W	Weight