

**A NOVEL PROCESSIBLE-WHITE NATURAL RUBBER MODIFIED BY
ADMICELLAR POLYMERIZATION OF STYRENE AS NANO-CORE
SHELL STRUCTURE**

Nattapong Preechasup

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By: Nattapong Preechasup
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Thesis Advisor: Assoc. Prof. Rathanawan Magaraphan

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University, in partial fulfilment of the requirements for the Degree of Master of
Science.

Nantaya Yanumet
..... College Director
(Assoc. Prof. Nantaya Yanumet)

Thesis Committee:

R. Mag
.....
(Assoc. Prof. Rathanawan Magaraphan)

Nantaya Yanumet
.....
(Assoc. Prof. Nantaya Yanumet)

JM
.....
(Asst. Prof. Manit Nithitanakul)

ABSTRACT

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The evaluation of a new process for promoting the polystyrene thin film coated on surface of natural rubber particles was studied by admicellar polymerization which is a process involving the polymerization of a monomer adsolubilized in adsorbed surfactant aggregates on a substrate surface. Natural rubber was used as a substrate in admicellar polymerization reactions to support surfactant bilayers of cetyltrimethylammonium bromide (CTAB) and sodium dodecylsulfate (SDS) which are cationic and anionic, respectively, and styrene was used as a monomer to form a polymer film. The natural rubber round particles of about 0.5-1 μm were successfully coated by polystyrene thin films of thickness about 0.3-0.5 μm , as observed by SEM. The polystyrene thin films improved the colour of natural rubber. As investigated by GPC, the molecular weight of polystyrene was found to be about 331,133 and 177,702 in CTAB and SDS, respectively, when using the mole ratio between styrene and initiator at 1:0.04. The molecular weight tended to increase slightly in CTAB but the increasing was significant in SDS under salt condition. From the tensile testing, blending between modified natural rubber and pure polystyrene improved the modulus and stiffness by using high concentration of styrene monomer in modified natural rubber. The values of stress and strain between aging and no aging blended sample were not different for SDS but aging makes poorer stress and strain of the blended sample with CTAB modified NR.

บทคัดย่อ

ณัฐพงศ์ ปรีชาทรัพย์ : นวัตกรรมยางธรรมชาติสีขาวและขึ้นรูปได้ที่คัดแปรโดยการสังเคราะห์พอลิเมอร์แอ็คไมเซลล์ของสไตรีนให้มีโครงสร้างนาโนแกน-เปลือก (A Novel Processible-White Natural Rubber Modified by Admicellar Polymerization of Styrene as Nano-Core Shell Structure) อ. ที่ปรึกษา: รศ.ดร.รัตนวรรณ มกรพันธุ์ 60 หน้า ISBN 974-9937-95-3

กระบวนการผลิตแบบใหม่ที่สร้างฟิล์มพอลิสไตรีนเคลือบผิวอนุภาคของยางธรรมชาติศึกษาได้ด้วยเทคนิคแอ็คไมเซลล่าพอลิเมอร์ไรเซชัน โดยเทคนิคนี้เกี่ยวข้องกับการสังเคราะห์พอลิเมอร์ของมอนอเมอร์ที่ถูกคูดซิมเข้าไปในชั้นของสารลดแรงตึงผิวที่ก่อตัวอยู่บนผิวของอนุภาค ในการทดลองนี้อนุภาคของยางธรรมชาติจะถูกสารลดแรงตึงผิวสองชนิดคือ CTAB และ SDS ที่มีคุณสมบัติเป็นสารลดแรงตึงผิวประจุบวก และสารลดแรงตึงผิวประจุลบตามลำดับก่อตัวเป็นชั้นโดยสไตรีนมอนอเมอร์จะถูกคูดซิมเข้าไประหว่างชั้นของสารลดแรงตึงผิว แล้วเกิดปฏิกิริยาเป็นฟิล์มบางของพอลิสไตรีนขึ้น จากการตรวจสอบด้วยกล้องจุลทรรศน์ชนิดส่องผ่านหลังทำปฏิกิริยาสมบูรณ์พบว่า อนุภาคยางธรรมชาติขนาด 0.5-1 ไมครอน ถูกล้อมรอบด้วยฟิล์มพอลิสไตรีนที่มีความหนาประมาณ 0.3-0.5 ไมครอนอย่างสมบูรณ์ ฟิล์มของพอลิสไตรีนจะช่วยปรับปรุงคุณสมบัติสีของยางธรรมชาติ น้ำหนักโมเลกุลของพอลิสไตรีนที่ตรวจสอบด้วยเครื่อง GPC ในสภาวะการทำปฏิกิริยาที่มีอัตราส่วน โดยโมลระหว่างสไตรีนต่ออินิทิเอเตอร์ 1:0.04 และเดิมเกลือพบว่าน้ำหนักโมเลกุลมีขนาดประมาณ 331,133 กับ 177,702 ในสารลดแรงตึงผิวชนิด CTAB และ SDS ตามลำดับ จากผลการทดสอบพบว่าน้ำหนักโมเลกุลของพอลิสไตรีนที่สังเคราะห์โดยใช้ CTAB จะมีค่าเปลี่ยนแปลงเพียงเล็กน้อยในสภาวะที่มีเกลือ แต่ในการสังเคราะห์โดยใช้ SDS จะมีค่าเปลี่ยนแปลงไปมากเมื่ออยู่ในสภาวะที่เดิมเกลือ จากผลการทดสอบความทนต่อแรงดึง พบว่าชิ้นตัวอย่างที่ผสมระหว่างยางที่ผ่านการปรับปรุงคุณภาพกับเม็ดพอลิสไตรีนมีค่ามอดูลัสและค่าความแข็งแรงเพิ่มขึ้นตามความเข้มข้นของสไตรีนมอนอเมอร์ที่ใช้ในการสังเคราะห์ ในขณะที่ค่าความเค้น และความเครียดระหว่างชิ้นตัวอย่างที่มีการบ่มและไม่มีบ่มมีค่าไม่แตกต่างกันมากนัก สำหรับยางสังเคราะห์ที่ได้จากสารลดแรงตึงผิวชนิด SDS แต่ในยางธรรมชาติที่ใช้สารลดแรงตึงผิวชนิด CTAB ค่าความเค้นและความเครียดจะมีค่าต่ำลงเมื่อผ่านการบ่ม

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