

**ADMICELLAR POLYMERIZATION IN A CONTINUOUS STIRRED TANK
REACTOR FOR SURFACE MODIFICATION OF SILICA
: COMMERCIAL GRADE MIXED SURFACTANT**

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ABSTRACT

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Silica is one of the most widely used fillers in rubber products, providing improvements in mechanical performance such as the tensile strength of the rubber. A major problem of using silica for such a purpose is its poor compatibility with the rubber. However, better compatibility between the two components can be achieved by admicellar polymerization. This technique has been studied in a continuous stirred tank reactor to modify the silica surface. It was found from previous work that a high purity grade mixed surfactant system of cetyltrimethylammoniumbromide (CTAB) and Triton[®]X-100 had been successfully used. In this work, commercial grade cationic and nonionic surfactants, octadecyl trimethyl ammonium chloride (Arquad[®]T-50 HFP) and octylphenol ethoxylate (Teric[®]X-10), having similar structures to the two previous surfactants, were used instead of high purity grade surfactants in order to reduce production costs. In addition, the effects of surfactant type and polymerization time of the modification using low surfactant coverage on the silica surface were studied. Various types of surfactants, cationic and nonionic, and mixed surfactants were investigated using polymerization times of 15 and 30 minutes. The compatibility of the rubber and modified silicas produced was assessed by the improved mechanical performance of the composite materials. The modified silicas were found to improve the overall rubber mechanical performance.

บทคัดย่อ

ปิยนาด สุขนาม : กระบวนการแอคไมเซลาร์พอลิเมอร์ไรเซชันในถังปฏิกรณ์แบบต่อเนื่องเพื่อปรับปรุงผิวของซิลิกา : ศึกษาการใช้สารลดแรงตึงผิวชนิดผสมเกรดการค้า (Admicellar Polymerization in a Continuous Stirred Tank Reactor for Surface Modification of Silica : Commercial Grade Mixed Surfactants) อ. ที่ปรึกษา : รศ. ดร. ปราโมช รังสรรค์วิจิตร รศ. ดร. สุเมธ ชวเดช รศ. ดร. จอห์น เฮช โอ เฮเวอร์ และ ดร. นุชนาฏ ธรรมนง 86 หน้า ISBN 974-9937-00-7

ซิลิกาเป็นสารที่ใช้กันอย่างแพร่หลายในผลิตภัณฑ์ต่าง ๆ ซึ่งสามารถปรับปรุงคุณสมบัติเชิงกลของยางได้ เช่น ความต้านทานแรงดึง ปัญหาหนึ่งในการใช้งานซิลิกาเพื่อจุดประสงค์ดังกล่าวคือการผสมเข้ากับยางได้ยาก อย่างไรก็ตามการผสมเข้ากันระหว่างยางและซิลิกาสามารถปรับปรุงให้ดีขึ้นได้โดยกระบวนการแอคไมเซลาร์พอลิเมอร์ไรเซชัน ได้มีการศึกษากระบวนการนี้ในระบบถังปฏิกรณ์แบบต่อเนื่องเพื่อปรับปรุงผิวของซิลิกา จากการวิจัยที่ผ่านมาพบว่าสารลดแรงตึงผิวระบบผสมระหว่าง เซทิลไตรเมทิลแอมโมเนียมโบรไมด์ (ซีแทบ) และไทรทอน เอ็กซ์-100 สามารถใช้ได้เป็นอย่างดี สำหรับงานวิจัยนี้สารลดแรงตึงผิวชนิดประจุบวกและไม่มีประจุ เกรดการค้า และมีโครงสร้างเหมือนสารลดแรงตึงผิวที่ใช้ในงานวิจัยที่แล้วได้ถูกนำมาศึกษาเพื่อค้นหาในการผลิต สารลดแรงตึงผิวดังกล่าวคือ ออกตะเด็กซิลไตรเมทิลแอมโมเนียมคลอไรด์ หรือชื่อทางการค้าคือ อาร์ควาดี-50 และ ออกทิลฟีนอลเอททอกซิลเลท หรือชื่อทางการค้าคือ เทอริกเอ็กซ์-10 งานวิจัยนี้ได้ศึกษาผลของชนิดของสารลดแรงตึงผิวและเวลาที่ใช้ในกระบวนการพอลิเมอร์ไรเซชัน เพื่อปรับปรุงผิวซิลิกาที่ใช้สารลดแรงตึงผิวในปริมาณต่ำ ชนิดของสารลดแรงตึงผิวที่ใช้คือชนิดประจุบวก ไม่มีประจุ และชนิดผสม เวลาที่ใช้ในกระบวนการพอลิเมอร์ไรเซชันคือ 15 และ 30 นาที การผสมเข้ากันได้ระหว่างยางและซิลิกาที่ปรับปรุงผิวแล้วประเมินจากคุณสมบัติเชิงกลของยางคอมโพสิต จากการศึกษพบว่าซิลิกาที่ได้รับการปรับปรุงผิวสามารถปรับปรุงคุณสมบัติเชิงกลของยางได้

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