

**REACTIVE SEPARATION FOR DIMETHYLNAPHTHALENE  
ISOMERIZATION**

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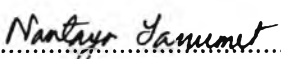
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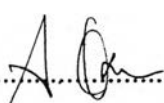
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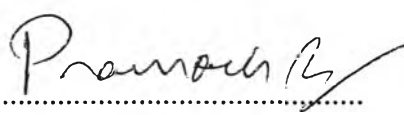
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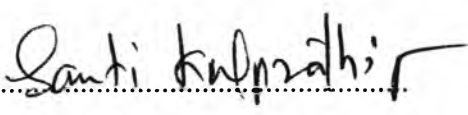
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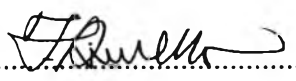
  
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## ABSTRACT

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Polyethylene naphthalate (PEN) is one of the engineering plastics with superior properties suitable for utilizing in many innovative applications. However, its widespread utilizations are still limited by its relatively high cost. One of the factors bolstering the polymer price is the price of 2,6-dimethylnaphthalene (2,6-DMN), which is a precursor for the polymer synthesis. Commercially, 2,6-DMN is synthesized using the BP Amoco process, in which a complex synthesis route with a thermodynamical limitation and freeze crystallization are employed. As a result, the low availability and high utility used for the production of 2,6-DMN entail its high cost. In this study, attempts to demonstrate a non-energy intensive alternative for producing the chemical were made. Catalytic isomerization of 1,5- to 2,6-DMN and adsorptive separation were of interest. Insight studies to understand both systems were individually performed. It was found that the maximum yield of the isomerization can be achieved at significantly lower temperatures and the adsorptive purification of 2,6-DMN can be accomplished in a reactive system by using toluene as a media. The combinations of the isomerization and adsorption were also demonstrated in two different approaches and their potential to produce high purity 2,6-DMN have been proven under different operating conditions. For instance, performing the isomerization in equilibrium is suitable for the system that connects the adsorption unit right after the isomerization with the selected adsorbent, catalyst and desorbent, while the reactive adsorption should be carried out at the appropriate temperatures below the equilibrium.

## บทคัดย่อ

ณัฐกร ไกรกุล : การแยกแบบเกิดปฏิกิริยาของปฏิกิริยาการเปลี่ยนไอโซเมอร์ของไดเมทิลแนฟทาซีน (Reactive Separation for Dimethylnaphthalene Isomerization) อ. ที่ปรึกษา : รศ. ดร. ปราโมช รังสรรค์วิจิตร และ ดร. สันติ กุลประทีปปัญญา 106 หน้า

โพลีเอทิลีนแนฟทาเลท (พีอีเอ็น) เป็นหนึ่งในพลาสติกวิศวกรรมที่มีคุณสมบัติดีมากเหมาะสำหรับนำมาใช้กับงานสมัยใหม่มากมาย อย่างไรก็ตามการใช้งานอย่างแพร่หลายของพลาสติกดังกล่าวยังคงถูกจำกัดด้วยราคาที่สูง หนึ่งในตัวแปรที่ทำให้ราคาของพลาสติกดังกล่าวสูงคือราคาของ 2,6-ไดเมทิลแนฟทาซีน (2,6-ดีเอ็มเอ็น) ซึ่งเป็นสารตั้งต้นในการผลิตพีอีเอ็น ในทางการค้า 2,6-ดีเอ็มเอ็นผลิตโดยกระบวนการของบริษัทบีพีอะมอโค ซึ่งมีกระบวนการสังเคราะห์ที่ซับซ้อนและมีข้อจำกัดทางอุณหพลศาสตร์ นอกจากนี้ยังต้องใช้กระบวนการตกผลึกแบบเยือกแข็งในการทำให้สารดังกล่าวมีความบริสุทธิ์สูงขึ้น ส่งผลให้ปริมาณ 2,6-ดีเอ็มเอ็นที่ผลิตได้ต่ำ ใช้พลังงานมากในการผลิต ทำให้สารดังกล่าวมีราคาสูง ในงานวิจัยนี้เสนอทางเลือกในการผลิต 2,6-ดีเอ็มเอ็นที่ประหยัดพลังงาน โดยศึกษาปฏิกิริยาการเปลี่ยนไอโซเมอร์ด้วยสารเร่งปฏิกิริยาจาก 1,5-ไปสู่ 2,6-ดีเอ็มเอ็นและการแยก 2,6-ดีเอ็มเอ็นด้วยวิธีดูดซับ จากการศึกษาพบว่าผลผลิตสูงสุดของปฏิกิริยาการเปลี่ยนไอโซเมอร์สามารถทำได้ที่อุณหภูมิต่ำลงอย่างมีนัยสำคัญ และการแยกด้วยวิธีดูดซับสามารถทำได้ในระบบรีเจ็คทีฟเมื่อใช้โทลูอินเป็นตัวกลาง ในส่วนของการรวมกระบวนการเปลี่ยนไอโซเมอร์และกระบวนการดูดซับเข้าด้วยกัน พบว่าระบบดังกล่าวสามารถผลิตสาร 2,6-ดีเอ็มเอ็นที่มีความบริสุทธิ์สูงได้อย่างมีประสิทธิภาพ โดยระบบที่มีการติดตั้งหน่วยดูดซับต่อจากหน่วยปฏิกิริยาการเปลี่ยนไอโซเมอร์โดยใช้ตัวดูดซับ สารเร่งปฏิกิริยา และตัวปลดปล่อยที่ถูกเลือกไว้ นั้นควรทำที่สภาวะสมดุลของปฏิกิริยาการเปลี่ยนไอโซเมอร์ ในขณะที่ระบบการดูดซับแบบเกิดปฏิกิริยาคควรทำที่อุณหภูมิที่เหมาะสมซึ่งอยู่ต่ำกว่าสภาวะสมดุล

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