

**ENHANCEMENT OF CO₂ GAS ADSORPTION OF HIGHLY POROUS
MATERIAL FROM POLY(DVB) POLYHIPE BY USING
LAYER-BY-LAYER SURFACE**

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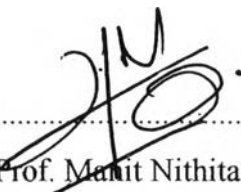
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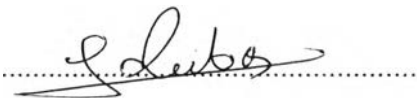


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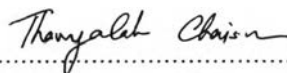
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ABSTRACT

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Jirasuta Chungprempree: Enhancement of CO₂ Gas Adsorption of Highly Porous Material from Poly(DVB)PolyHIPE by Using Layer-by-Layer Surface.

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Keywords: Poly(S/DVB)HIPEs/ Layer-by-Layer / Mix surfactants/ CO₂ gas absorption

PolyHIPE is a highly porous polymer synthesized from high internal phase emulsions using polystyrene (S) and polydivinylbenzene (DVB). The surface of polyHIPE was modified by Layer-by-Layer (LbL) technique by using alternate deposition. This technique consisted of two main layers, the primary layer was repeated until six layers of poly(diallyldimethylammonium chloride) and poly(styrene sulfonate), polycation and polyanionic, respectively. The secondary layer, which used as CO₂ adsorbing layer, was the solution of polyethylenimine (PEI) and tetraethylenepentamine (TEPA). In this experiment, polyHIPE were prepared with ratios of S:DVB were varied by 0:100, 80:20, and 20:80.

Pore diameter of the prepared Poly(S/DVB)HIPE were determined and found to be decreased from 79.4 to 41.2 μm with increased amount of DVB used. Moreover, the compressive modulus and decomposition temperature of poly(S/DVB)HIPEs was increased from 1.79 to 5.41 MPa and 440.98 to 373.79°C, respectively.

CO₂ adsorption tests were carried out on the obtained modified and unmodified poly(S/DVB)HIPE and it was found to be improved: this is due to the influence of ratio of S:DVB and amine solution investigated by GC-TGA technique. As the result, modified polyHIPE using S/DVB content; 0:100 with PEI on surface has the highest of CO₂ adsorption at 1.04 mmol/g.

บทคัดย่อ

จิรสุตตา จึ้งเปรมปรี : การเพิ่มประสิทธิภาพการดูดซับก๊าซคาร์บอนไดออกไซด์ด้วยวัสดุ
รูพรุนสูงที่ผ่านการปรับปรุงด้วยเทคนิคเคลือบชั้นผิวพอลิเมอร์ (Enhancement of CO₂ Gas
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พอลิฮิป คือวัสดุรูพรุนสูงที่ถูกสังเคราะห์จากพอลิเมอร์ไฮดรอกซีของอิมัลชันที่
ประกอบด้วยพอลิสไตรีน และไดไวนิลเบนซีน ซึ่งมีการปรับสภาพพื้นผิวของพอลิฮิป โดยใช้
เทคนิคเคลือบชั้นผิวพอลิเมอร์ โดยเทคนิคนี้ประกอบด้วย 2 ชั้นหลัก ได้แก่ชั้นปฐมภูมิ
ประกอบด้วยสารละลายที่มีประจุบวกของพอลิไคเมทิลแอมโมเนียมคลอไรด์ และประจุลบของ
พอลิสไตรีนซัลโฟเนต ที่มีการวางสลับกันไปมา 6 ชั้น และชั้นทุติยภูมิที่ใช้ในการดูดซับก๊าซ
คาร์บอนไดออกไซด์ซึ่งประกอบด้วยพอลิเอทิลีนอิมิน และเทอะเอทิลีนเพนทามีน ซึ่งในงานวิจัยนี้
มีการเตรียมอัตราส่วนของพอลิสไตรีนต่อไดไวนิลเบนซีน ไว้ดังนี้ 0:100, 20:80 และ 80:20

จากผลการวิจัยพบว่าเส้นผ่านศูนย์กลางของพอลิฮิป ลดลงจาก 79.4 ถึง 41.2 ไมโครเมตร
เมื่อมีการเพิ่มสัดส่วนของไดไวนิลเบนซีน อีกทั้งค่าโมดูลัสการกดอัดและอุณหภูมิการสลายตัวของ
สารมีค่าเพิ่มขึ้น จาก 1.79 ถึง 5.41 เมกะปาสคาล และ 440.98 ถึง 373.79 องศาเซลเซียส
ตามลำดับ

จากการทดสอบการดูดซับก๊าซคาร์บอนไดออกไซด์โดยพอลิ(สไตรีน/ไดไวนิลเบนซีน)
ฮิป พบว่าสัดส่วนของพอลิสไตรีนต่อไดไวนิลเบนซีน และสารละลายเอมีน มีผลต่อการดูดซับ
ก๊าซคาร์บอนไดออกไซด์ของพอลิฮิป โดยพบว่าพอลิฮิป ที่มีสัดส่วนของพอลิสไตรีนต่อไดไวนิล
เบนซีน 0:100 และผ่านการปรับปรุงผิวด้วยสารละลายเอมีนของพอลิเอทิลีนอิมิน มีค่าการดูดซับ
คาร์บอนไดออกไซด์สูงสุดที่ 1.04 มิลลิโมลต่อกรัม

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