

**MERCURY REMOVAL FROM HEAVY NAPHTHA BY  
VARIOUS ADSORBENTS**

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**ABSTRACT**

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Previous research has shown the feasibility of using Beta zeolite for mercury removal from n-heptane (90% and 15% adsorption were achieved for diphenyl mercury and metallic mercury, respectively). In this work, the adsorption capacity for metallic mercury ( $Hg^0$ ) on Beta zeolite impregnated with copper sulfide was studied in an attempt to increase the adsorption efficiency for a removal of metallic mercury. For comparison, various adsorbents – alumina ( $Al_2O_3$ ), Beta zeolite (BEA), activated carbon (AC), CuS on alumina, CuS on Beta zeolite, and CMG273 – were tested. Heavy naphtha spiked with metallic mercury was used for kinetics of adsorption and adsorption isotherm studies in a batch system at 50°C. The results from kinetics studies showed that for unimpregnated adsorbents, the adsorption efficiencies were low. The significant improvement was observed on CuS impregnated adsorbents. The adsorption kinetics followed the pseudo second order rate expression and the equilibrium data fitted reasonably well to Langmuir isotherm. All the adsorption parameters derived from the experimental data reflect the feasibility of metallic mercury removal by using CuS adsorbents. The breakthrough curves from a continuous system showed that CuS/BEA exhibited longer breakthrough time and shorter mass transfer zone than CuS/ $Al_2O_3$ .

## บทคัดย่อ

รัฐกิจ กิจสงวน : การกำจัดสารปรอทจากแนฟทาหนัก โดยตัวดูดซับที่แตกต่างกัน (Mercury Removal from Heavy Naphtha by Various Adsorbents) อ. ที่ปรึกษา : ดร. ศิริพร จงผาคิวุฒิ, รศ. ดร. จินตนา สายวรรณ และ ดร. โซฟี จูเลียน 68 หน้า

งานวิจัยก่อนหน้านี้นี้พบว่า ซีโอไลต์เบตามีความเหมาะสมในการกำจัดสารปรอทในนอร์มอลเฮปเทน (ประสิทธิภาพในการดูดซับคือ ร้อยละ 90 และ 15 สำหรับไดเฟนิลเมอร์คิวรี และปรอทโลหะ ตามลำดับ) งานวิจัยนี้ศึกษาการดูดซับปรอทโลหะด้วยคอปเปอร์ซัลไฟด์บนซีโอไลต์เบตา เปรียบเทียบกับตัวดูดซับชนิดต่างๆ เช่น อลูมินา, ซีโอไลต์เบตา, ถ่านกัมมันต์, คอปเปอร์ซัลไฟด์บนอลูมินา, คอปเปอร์ซัลไฟด์บนซีโอไลต์เบตา และซีเอ็มจี273 โดยความพยายามที่จะเพิ่มประสิทธิภาพในการดูดซับสารปรอทโลหะ การทดลองแบบกะใช้สารตั้งต้นคือ แนฟทาหนักซึ่งเจือปนด้วยปรอทโลหะ เพื่อศึกษาจลพลศาสตร์และไอโซเทิร์มของการดูดซับที่อุณหภูมิ 50 องศาเซลเซียส ผลการทดลองพบว่า ตัวดูดซับที่ไม่เติมคอปเปอร์ซัลไฟด์ให้ประสิทธิภาพในการดูดซับต่ำ ขณะที่ประสิทธิภาพในการดูดซับนี้เพิ่มขึ้นอย่างมากโดยใช้ตัวดูดซับที่เติมคอปเปอร์ซัลไฟด์ จลพลศาสตร์ของการดูดซับเป็นไปตามสมการชูโดลำดับที่สอง และข้อมูลสอดคล้องอย่างดีกับแบบจำลองไอโซเทิร์มของแลงมัวร์ ตัวแปรทั้งหมดซึ่งได้จากข้อมูลการทดลอง ซึ่งให้เห็นถึงความเหมาะสมในการกำจัดปรอทโลหะโดยใช้ตัวดูดซับที่เติมคอปเปอร์ซัลไฟด์ กราฟเบรคทรูซึ่งได้จากการศึกษาระบบต่อเนื่องแสดงให้เห็นว่า ตัวดูดซับคอปเปอร์ซัลไฟด์บนซีโอไลต์เบตาให้เวลาเบรคทรูนานกว่า และช่วงการแลกเปลี่ยนมวลสารสั้นกว่าตัวดูดซับคอปเปอร์ซัลไฟด์บนอลูมินา

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