

**MICROEMULSION BASED RESIDUAL OIL RECOVERY FOR SPENT  
BLEACHING EARTH FROM BIODIESEL PRODUCTION**

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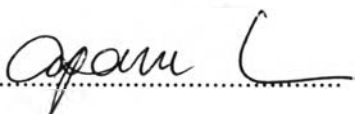
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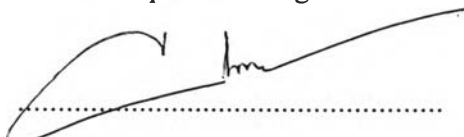
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**ABSTRACT**

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Spent bleaching earth (SBE), an industrial solid waste generated at bleaching process of vegetable oil refinery, usually recovers oil retained in SBE through solvent extraction which can lead to environmental impact and high cost of disposal. Consequently, this work investigated the use of microemulsion extraction technique to extract residual oil adsorbed on SBE. The most important criterion of this method is the ability of lowering interfacial tension (IFT) between oil and aqueous surfactant solution in order to liberate oil from SBE. The surfactant systems with different structure (anionic extended and nonionic ethoxylated surfactant) were selected to formulate middle phase microemulsion (Winsor type III) with crude palm oil. In the oil extraction, the predetermined optimum formulations were selected to study the effect of extraction parameters based on total oil extraction efficiency. In addition, the extracted oil qualities were evaluated. The result showed that  $C_{12,13}-(PO)_4-SO_4Na$  and  $C_{12,13}-(PO)_8-SO_4Na$  produced an ultralow IFT ( $<0.1$  mN/m) with crude palm oil whereas  $C_{12,14}-(EO)_3-OH$  and  $C_{12,14}-(EO)_9-OH$  were not observed due to limited temperature. The  $C_{12,13}-(PO)_8-SO_4Na$  system provided the highest of total oil extraction efficiency (25%) at the optimum surfactant concentration of 1wt.% with 2.5 wt.% NaCl at stirring 1000 rpm, using solid to liquid ratio (g/ml) of 2/15 and contact time 20 min. Microemulsion technology could not replaced a solvent technique due to the interactions between surfactant and waxy solid in vegetable oil is limited compared to that of vegetable oil in liquid form. However, the extracted oil obtained aqueous microemulsion based extraction had superior oil quality in terms of low free fatty acid.

## บทคัดย่อ

รติปรัชญ์ เอี่ยมทองคำ : การสกัดน้ำมันที่เหลืออยู่บนดินฟอกสีใช้แล้วจากกระบวนการผลิตน้ำมันดีเซลด้วยวิธีไมโครอิมัลชัน (Microemulsion based Residual Oil Recovery for Spent Bleaching Earth from Biodiesel Production) อ. ที่ปรึกษา : ดร. อัมพิรา เจริญแสง  
101 หน้า

ดินฟอกสีที่ผ่านกระบวนการฟอกสีในอุตสาหกรรมการกลั่นน้ำมันพืชกลายเป็นของเสียที่ส่งผลกระทบต่อสิ่งแวดล้อมและค่าใช้จ่ายในการกำจัด โดยทั่วไปน้ำมันที่เหลืออยู่บนผิวของดินฟอกสีใช้แล้วจะถูกสกัดด้วยตัวทำละลาย ซึ่งเป็นสารระเหยง่ายมีความอันตรายต่อร่างกายและสิ่งแวดล้อม ดังนั้นงานวิจัยนี้จึงพิจารณาการสกัดด้วยวิธีไมโครอิมัลชัน หลักการสำคัญของวิธีการนี้คือการลดแรงตึงผิวระหว่างวฏภาคน้ำและวฏภาคน้ำมัน เป็นผลให้อนุภาคน้ำมันหลุดออกจากผิวของดินฟอกสีใช้แล้ว สารลดแรงตึงผิวที่ใช้ในการศึกษานี้ประกอบด้วยสารลดแรงตึงผิวที่มีโครงสร้างแตกต่างกัน (สารลดแรงตึงผิวที่มีประจุลบและไม่มีประจุ) เพื่อศึกษาการเกิดสภาวะไมโครอิมัลชันประเภทที่สาม (Winsor type III) กับน้ำมันปาล์มดิบ หลังจากนั้นสูตรสารลดแรงตึงผิวที่เหมาะสมจะนำไปศึกษาตัวแปรที่มีผลต่อประสิทธิภาพในการสกัดน้ำมัน นอกจากนี้มีการเปรียบเทียบคุณภาพของน้ำมันที่สกัดได้จากวิธีไมโครอิมัลชันและสกัดด้วยตัวทำละลาย ผลการศึกษาพบว่าสารลดแรงตึงผิว  $C_{12,13}H_{25,27}-(PO)_4-SO_4Na$  และ  $C_{12,13}H_{25,27}-(PO)_8-SO_4Na$  สามารถลดแรงตึงผิวระหว่างสารละลายลดแรงตึงผิวและน้ำมันปาล์มดิบได้ต่ำกว่า 0.1 มิลลินิวตันต่อเมตร ในขณะที่  $C_{12,14}H_{25,29}-(EO)_3-OH$  และ  $C_{12,14}H_{25,29}-(EO)_9-OH$  ไม่สามารถลดแรงตึงผิวได้ต่ำ เนื่องจากข้อจำกัดของอุณหภูมิระบบ สารลดแรงตึงผิว  $C_{12,13}H_{25,27}-(PO)_8-SO_4Na$  มีประสิทธิภาพในการสกัดสูงสุด (ร้อยละ 25) โดยใช้ความเข้มข้นของสารลดแรงตึงผิวและเกลือ ร้อยละ 1 และ 2.5 โดยน้ำหนัก ตามลำดับ ด้วยแรงหมุน 1,000 รอบต่อนาที ใช้อัตราส่วนของน้ำหนักดินฟอกสีใช้แล้วต่อปริมาตรของสารลดแรงตึงผิว (2 ต่อ 15) และเวลาในการสกัด 20 นาที นอกจากนี้การสกัดด้วยวิธีไมโครอิมัลชันไม่สามารถทดแทนการสกัดด้วยตัวทำละลายได้แต่อย่างไรก็ตามคุณภาพของน้ำมันที่สกัดได้จากวิธีไมโครอิมัลชันดีกว่าน้ำมันที่สกัดได้จากตัวทำละลายในแง่ของกรดไขมันอิสระมีปริมาณต่ำกว่า

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