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**ALKALOID EXTRACTION FROM HERBS BY  
EMULSION LIQUID MEMBRANE PROCESS**



**Mrs. Sirikul Chunsawang**

**A Dissertation Submitted in Partial Fulfillment of the Requirements  
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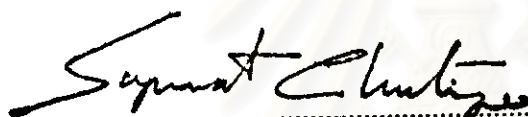
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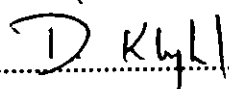
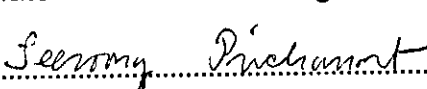
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ได้ศึกษาสมรรถภาพการสกัดของสารละลายเบอร์เบรินสังเคราะห์ (Synthetic Berberine Solution) และสารละลายเบอร์เบรินตามธรรมชาติ (Crude Berberine Solution) ในภาวะที่มีค่า pH ต่าง ๆ กัน คือ 8, 9, 10, 11 และ 12 ในตัวทำละลาย 3 ชนิด คือ n-hexane, kerosene และ paraffin ที่อุณหภูมิ 25 องศาเซลเซียส เป็นเวลา 96 ชั่วโมงที่ความเร็วรอบของการกวนเป็น 240 รอบต่อนาที จากการทดลองพบว่า ค่าคงที่ของการกระจาย ( $K_D$ ) ของการสกัดที่ภาวะสมดุลระหว่างเบอร์เบริน/n-hexane มากกว่า เบอร์เบริน/kerosene และ เบอร์เบริน/paraffin นอกจากนี้ ยังพบว่า  $K_D$  มีค่าเพิ่มขึ้นเมื่อค่า pH เพิ่มขึ้น ในการทดลองนี้ได้เลือกตัวทำละลายเป็น kerosene เพื่อใช้ในกระบวนการเยื่อแผ่นเหลวแบบอิมัลชัน

ได้ศึกษาการสกัดสารเบอร์เบรินสังเคราะห์ และเบอร์เบรินธรรมชาติออกจากสารละลายเจือจางไปยังสารละลายกรดเกลือแบบไม่ต่อเนื่อง โดยกระบวนการเยื่อแผ่นเหลวแบบอิมัลชัน โดยแบ่งการทดลองออกเป็น 2 ขั้นตอน คือ 1) การสกัดเบอร์เบรินสังเคราะห์ โดยการเปลี่ยนแปลงค่าตัวแปรต่างๆ คือ ค่าความเป็นกรดของสารที่ วัฏภาคภายนอก (pH 8, 9, 10, 11 และ 12) ความเข้มข้นของสารลดแรงตึงผิวใน kerosene (Span-80 ละลายใน kerosene 1, 3, 5, และ 7% (v/v) ) ความเข้มข้นของกรดเกลือในวัฏภาคภายใน (0.1, 0.01, 0.02 และ 0.03 M) จากการทดลองพบว่า ภาวะที่เหมาะสมในการสกัดเบอร์เบรินสังเคราะห์ที่อุณหภูมิห้องคือ วัฏภาคภายนอกมีค่า pH 11 วัฏภาคเยื่อใช้ความเข้มข้นของสารลดแรงตึงผิว Span-80 ใน kerosene 1% (v/v) และ 0.02 M ของสารละลายกรดเกลือเป็นวัฏภาคภายใน ซึ่งทำให้สามารถสกัดเบอร์เบรินสังเคราะห์ได้เข้มข้น 5 เท่าของสารตั้งต้น และสกัดเบอร์เบรินได้ 80 ถึง 99% ในเวลา 1 นาที ถึง 4 นาทีตามลำดับ 2) การสกัดเบอร์เบรินธรรมชาติกระทำเช่นเดียวกับการสกัดเบอร์เบรินสังเคราะห์ จากการทดลองได้ภาวะที่เหมาะสมคือ วัฏภาคภายนอกมีค่า pH 12 วัฏภาคเยื่อใช้ความเข้มข้นสารลดแรงตึงผิว Span-80 ใน kerosene 1% (v/v) และ 0.03 M ของสารละลายกรดเกลือเป็นวัฏภาคภายใน ทำให้สามารถสกัดเบอร์เบรินตามธรรมชาติได้เข้มข้น 4.19 เท่าของสารตั้งต้น และสกัดเบอร์เบรินได้มากถึง 70 % ในเวลา 1 นาที

นอกจากนี้ยังได้เสนอแบบจำลองเพื่อใช้ทำนายอัตราการผลิตเบอร์เบรินแบบไม่ต่อเนื่องโดยกระบวนการเยื่อแผ่นเหลวแบบอิมัลชัน

ภาควิชา.....วิศวกรรมเคมี  
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# # : MAJOR CHEMICAL ENGINEERING  
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SIRIKUL CHUNSAWANG : ALKALOID EXTRACTION FROM HERBS BY EMULSION LIQUID-MEMBRANE PROCESS.  
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The extraction equilibrium of synthetic berberine and crude berberine solution were studied at various conditions of pH (pH 8, 9, 10, 11, and 12) with three solvents (n-hexane, kerosene, and paraffin at 25°C). In each case the solution was stirred at 240 rpm for 96 hrs. The experimental results showed that at each extraction equilibrium, the distribution (partition) coefficient ( $K_D$ ) of berberine/n-hexane is higher than berberine/kerosene and berberine/paraffin. It was also found that  $K_D$  increased with the increasing of pH. In this research kerosene is a selected solvent for emulsion liquid membrane process (ELM).

The experiment of ELM extraction was divided to 2 parts. Firstly, batch synthetic berberine extraction was conducted at various conditions of external phase pH (pH 8, 9, 10, 11 and 12), concentration of surfactant in kerosene (1, 3, 5, and 7% of Span-80 dissolved in kerosene) and concentration of internal phase (0.1, 0.01, 0.02 and 0.03 M HCl solution). It was found that at room temperature the suitable conditions of synthetic berberine extraction are pH 11, the concentration of Span-80 in kerosene and HCl at 1% (v/v) and 0.02 M, respectively. It can extract 5 times higher concentration than initial synthetic berberine solution. The percentage of berberine extraction was 80 and 99 within 1 and 4 minutes, respectively. Secondly, batch crude berberine extraction was conducted by the same process. The experimental results showed that the suitable conditions of crude berberine extraction are pH 12, the concentration of Span-80 in kerosene and HCl at 1%(v/v) and 0.03 M, respectively. It can extract 4.19 times higher concentration than initial crude berberine solution. The percentage of berberine extraction was 70% within 1 minute.

The model that can predict the batch berberine extraction rate by ELM was also presented in this study.

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จุฬาลงกรณ์มหาวิทยาลัย

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