

**SURFACTANT-ENHANCED BIODEGRADATION OF OIL SLUDGE IN
SEQUENCING BATCH REACTOR: EFFECTS OF SURFACTANT
CONCENTRATION, OIL LOADING RATE AND
NUMBER OF CYCLE PER DAY**

Kwanruethai Comchumpoo

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By: Kwanruethai Comchumpoo
Program: Petrochemical Technology
Thesis Advisors: Assoc. Prof. Sumaeth Chavadej
Asst. Prof. Pomthong Malakul

Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfilment of the requirements for the Degree of Master of Science.

Nantaya Yanumet
..... College Director
(Assoc. Prof. Nantaya Yanumet)

Thesis Committee:

Sumaeth Chavadej
.....
(Assoc. Prof. Sumaeth Chavadej)

Pomthong Malakul
.....
(Asst. Prof. Pomthong Malakul)

Apanee Luengnaruemitchai
.....
(Asst. Prof. Apanee Luengnaruemitchai)

J. h' n'
.....
(Dr. Siriporn Jongpatiwut)

ABSTRACT

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Biological treatment has been proposed to treat crude oil sludge but it is often restrained by the limited availability of hydrocarbons present in the sludge due to their poor solubility in aqueous phase. The way to overcome this problem is to use surfactant to increase solubilization of the hydrocarbons and enhancing their bioavailability to degrade microorganisms. In this research, two units of sequencing batch reactors (SBR) were used for study the biodegradation of crude oil sludge obtained from Bangchak Public Company Limited. The solubilization experiment was first studied to improve the biodegradation efficiency, polyoxyethylene sorbitan monoleate (Tween 80), a nonionic surfactant was selected to enhance the solubilization of the crude oil sludge. The optimum surfactant concentration was found to be 0.2% w/v. Then oil loading was examined to find the optimum oil loading by using surfactant concentration at 0.1% w/v and the result showed that at oil loading 1 kg/m³d provided the highest removal efficiency. Then the effect of number of cycle per day of SBR operation was studied, when the number of cycle per day increased, the removal efficiency decreased. When changing the surfactant concentration to 0.2% w/v, the result showed that the highest removal efficiency provided at 1 cycle per day of SBR operation as high as 80%.

บทคัดย่อ

ขวัญฤทัย คำชุมภู: การเพิ่มประสิทธิภาพของการย่อยสลายกากตะกอนน้ำมัน โดยวิธีทางชีวภาพด้วยสารลดแรงตึงผิวชนิดในระบบถังปฏิกรณ์แบบกึ่งกะเพื่อศึกษาผลของความเข้มข้นของสารลดแรงตึงผิว ปริมาณกากตะกอนน้ำมันดิบต่อวัน และจำนวนวัฏจักรต่อวัน (Surfactant-Enhanced Biodegradation of Crude Oil Sludge in Sequencing Batch Reactor: Effect of Surfactant Concentration, Oil Loading Rate and Number of Cycle per Day) อ.ที่ปรึกษา: รศ. ดร. สุเมธ ชวเดช และ ผศ.ดร. ปมทอง มาลากุล ณ อุทยาน 95 หน้า

วิธีทางชีวภาพได้ถูกนำมาใช้ในการย่อยสลายสารไฮโดรคาร์บอนในน้ำมันปิโตรเลียม แต่วิธีการนี้มีข้อจำกัดเนื่องจากสมบัติการละลายน้ำที่ต่ำของสารไฮโดรคาร์บอน ในกรณีนี้สารลดแรงตึงผิวสามารถช่วยเพิ่มการละลายของสารไฮโดรคาร์บอนในน้ำซึ่งจะเพิ่มประสิทธิภาพในการย่อยสลายของแบคทีเรียได้ ในงานวิจัยนี้ถังปฏิกรณ์แบบกึ่งกะจำนวน 2 หน่วยได้ถูกใช้ในการศึกษาการย่อยสลายโดยวิธีทางชีวภาพของสารไฮโดรคาร์บอนจากกากตะกอนน้ำมันดิบที่ได้รับจากบริษัท บางจาก จำกัด (มหาชน) ในขั้นแรกได้ทำการทดลองเกี่ยวกับการละลายน้ำของสารไฮโดรคาร์บอนเพื่อเพิ่มประสิทธิภาพในการย่อยสลาย โดยเลือกใช้สารลดแรงตึงผิวชนิดไม่มีขั้ว โพลีออกซีเอทีลิน ซอบิแทน โมโนลิเอต (ทวิน 80) เพื่อเพิ่มการละลายของสารไฮโดรคาร์บอนในกากตะกอนน้ำมันดิบ ซึ่งพบว่าความเข้มข้นของสารลดแรงตึงผิวที่ให้ผลในการละลายของสารไฮโดรคาร์บอนดีที่สุดที่ 0.2% โดยน้ำหนักต่อปริมาตร จากนั้นได้ศึกษาผลของการเติมกากตะกอนน้ำมันดิบในปริมาณที่ต่างกันโดยใช้ความเข้มข้นของสารลดแรงตึงผิวที่ 0.1% โดยน้ำหนักต่อปริมาตร ซึ่งพบว่า ที่ปริมาณกากตะกอนน้ำมันดิบ 1 กิโลกรัมต่อลิตรต่อวันให้ประสิทธิภาพในการย่อยสลายสูงสุด นอกจากนี้ยังได้ศึกษาผลของจำนวนวัฏจักรของถังปฏิกรณ์แบบกึ่งกะ ซึ่งพบว่า เมื่อวัฏจักรต่อวันเพิ่มขึ้น ประสิทธิภาพในการย่อยสลายลดลง และเมื่อเปลี่ยนความเข้มข้นของสารลดแรงตึงผิวไปที่ 0.2% โดยน้ำหนักต่อปริมาตร พบว่า ที่ 1 วัฏจักรต่อวันให้ประสิทธิภาพในการย่อยสลายสูงที่สุดถึง 80%

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