THE EFFECT OF PRECIPITANT ON APHALTENE AGGREGATION AND DEPOSTION

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ABSTRACT

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Asphaltenes are fraction of crude oil that cause serious problems in the petroleum industry. The goal of this study is to compare trends in asphaltene aggregation and deposition. More specifically, to relate the asphaltene aggregation particle-particle collision efficiency to the deposition rate by varying the precipitant carbon number and concentration. Establishing a relationship between the aggregation and deposition behavior of asphaltenes will provide valuable insight into both processes. The amount of asphaltenes that are destabilized with different precipitants and at various concentrations was obtained from centrifugation experiments, and the collision efficiency for asphaltene aggregation was calculated using a geometric population balance model. The results revealed that for a fixed volume fraction of precipitant, the asphaltene-asphaltene collision efficiency decreased with higher carbon number precipitants. Decreasing the precipitant concentration resulted in lower collision efficiency. A correlation between collision efficiency and mixture solubility parameter was established for the oil used and different precipitants. In order to investigate asphaltene deposition behavior using different precipitants, the deposition rate was measured using capillary flow. The consistency of the capillary deposition apparatus has been improved by considering the initial inner diameter of the capillary. Scanning electron microscopy (SEM) images of the asphaltene deposits were obtained and used to assess the mixing of oil and precipitant.

บทคัดย่อ

วรรธนะ ชัยสุนทรโยธิน : ผลของสารตกตะกอนต่อการรวมตัวและการเกาะติดของแอลฟัลทีน (The Effect of Precipitant on Asphaltene Aggregation and Deposition) อาจารย์ที่ปรึกษา: ศาสตราจารย์ ดร. เอช สก๊อตต ฟอกเลอร์ และผู้ช่วยศาตราจารย์ ดร. ปมทอง มาลากุล ณ อยุธยา 50 หน้า

แอลฟัลทีนคือส่วนประกอบในน้ำมันดิบที่ก่อให้เกิดปัญหาสำคัญในอุตสาหกรรมปิโตรเลียม จุดประสงค์ของงานวิจัยนี้คือ ทำการเปรียบเทียบแนวโน้มของการรวมตัวและการเกาะติดของแอลฟัลทีนและเชื่อมโยง collision efficiency ระหว่างอนุภาคในการรวมตัวของแอลฟัลทีนกับอัตราการเกาะติดของแอลฟัลทีนโดยทำการเปลี่ยนจำนวนคาร์บอนและความเข้มข้นของสารตกตะกอน ทั้งนี้ ปริมาณแอลฟัลทีนซึ่งถูกทำให้ไม่เสถียรโดยใช้สารตกตะกอนและความเข้มข้นต่างๆสามารถหาได้จากการทดลองโดยใช้การเหวี่ยง ส่วน collision efficiency ของการรวมตัวของแอลฟัลทีนนั้นสามารถคำนวณได้จากการใช้โมเดลgeometric population balance ผลจากการทดลองแสดงให้เห็นว่าที่ความเข้นข้นคงที่ collision efficiency ระหว่างแอลฟัลทีนลดลงตามการเพิ่มจำนวนคาร์บอนของสารตกตะกอน ส่วนการลดความเข้มข้นของสารตกตะกอนส่งผลให้ collision efficiency มีค่าลดลง ความสัมพันธ์ระหว่าง collision efficiency และ solubility parameter ของของผสมสำหรับน้ำมันที่ใช้และสารตกตะกอนต่างๆถูกสร้างขึ้นสำหรับน้ำมันและสารตกตะกอนต่างๆ ที่ใช้ นอกจากนี้ พฤติกรรมการเกาะติดของแอลฟัลทีนโดยใช้สารตกตะกอนต่างๆ ได้ถูกศึกษาโดยวัดอัตราการเกาะติดด้วยอุปกรณ์การไหลในแคปปิลารี่ และทำการปรับปรุงความสอดคล้องของการวัดการเกาะติดในแคปปิลารี่โดยการคำนึงถึงขนาดเส้นผ่านศูนย์กลางภายในของแคปปิลารี่ ภาพของแอลฟัลทีนที่เกาะติดที่ถ่ายโดยใช้กล้องจุลทรรศน์อิเลคตรอนถูกนำมาใช้ในการประเมินการผสมของน้ำมันและสารตกตะกอน

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