

**KINETICS OF ASPHALTENE PRECIPITATION:
EFFECT OF DIFFERENT N-ALKANE PRECIPITANTS**



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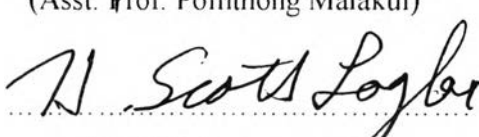
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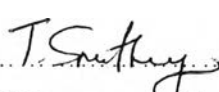
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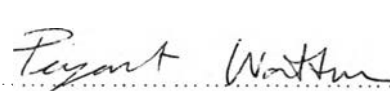

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ABSTRACT

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Asphaltenes are a class of molecules that have a tendency to precipitate from crude oils due to changes in its solubility. Asphaltene precipitation can eventually lead to serious problems in oil production such as plugging well bores and reservoirs. Furthermore, precipitated asphaltenes can also deposit onto oil pipelines and decrease oil production. To induce asphaltene precipitation, n-alkanes are usually added to the crude oils. In a typical precipitation experiment, the effect of time is often neglected and measurements are conducted with a waiting time that varies from a few minutes to 24 hours. Based on this short waiting time, it is conventionally believed that asphaltenes can only precipitate when the precipitant concentration is above a critical value. However, this study demonstrates that kinetic effects are significant during asphaltene precipitation. By using optical microscopy, it was shown that asphaltenes can precipitate below the “critical precipitant concentration”. The time required for precipitation varied from a few minutes to several months, depending on the precipitant concentration. A centrifugation-based separation technique was used to determine the amount of precipitated asphaltenes as a function of time until equilibrium was reached. The precipitation kinetics using different n-alkane precipitants was also investigated. It was found that the type of n-alkane has a profound effect on the precipitation kinetics. Additionally, a geometric population balance model has been applied to simulate the kinetic effects discussed above.

บทคัดย่อ

อาร์เจมส์ ที บาโกอา: จลศาสตร์ของการตกตะกอนของแอสฟัลทีน: อิทธิพลของสารเร่งตกตะกอนประเภทนออัลแอลเคน (Kinetics of Asphaltene Precipitation: Effect of Different n-Alkane Precipitants) อาจารย์ที่ปรึกษา: ศาสตราจารย์ ดร.เอช สก๊อตต์ ฟอกเลอร์ และ ผู้ช่วยศาสตราจารย์ ดร.ปมทอง มาลากุล ณ อยุธยา 68 หน้า

แอสฟัลทีน (Asphaltenes) คือกลุ่มโมเลกุลซึ่งสามารถตกตะกอนออกจากน้ำมันดิบได้ เนื่องจากการเปลี่ยนแปลงค่าการละลาย ตะกอนแอสฟัลทีนจะเกาะสะสมตามท่อลำเลียงน้ำมัน การตกตะกอนของแอสฟัลทีนทำให้เกิดปัญหาในการผลิตน้ำมัน เช่น การอุดตันของช่องลำเลียงน้ำมัน และการอุดตันภายในแหล่งน้ำมัน ส่งผลกระทบทำให้ประสิทธิภาพของการผลิตน้ำมันลดลง สารนออัลแอลเคนจึงถูกผสมลงไปเพื่อเร่งการตกตะกอนของแอสฟัลทีน ในการทดสอบการตกตะกอน แอสฟัลทีนถูกเชื่อว่าจะสามารถตกตะกอนเมื่อความเข้มข้นของสารเร่งตกตะกอนมีค่าสูงกว่าค่าวิกฤต ณ ช่วงเวลาสั้นๆ แต่อย่างไรก็ตาม การศึกษานี้ชี้ให้เห็นถึงความสำคัญของอิทธิพลทางจลศาสตร์ของการตกตะกอนของแอสฟัลทีน การศึกษาโดยใช้กล้องจุลทรรศน์พบว่า แอสฟัลทีนสามารถตกตะกอนได้โดยใช้สารเร่งตกตะกอนที่มีความเข้มข้นต่ำกว่าค่าวิกฤต เวลาในการตกตะกอนอยู่ในช่วงเวลาในระดับนาที่ไปจนถึงระดับหลายเดือน ขึ้นอยู่กับความเข้มข้นของสารเร่งตกตะกอน เทคนิคการแห้วแยกถูกนำมาใช้ในการวัดปริมาณตะกอนแอสฟัลทีนที่แปรผันตามเวลา การศึกษาจลศาสตร์ของการตกตะกอนโดยใช้สารเร่งตกตะกอนที่แตกต่างกันพบว่า ชนิดของสารเร่งตกตะกอนส่งผลต่อจลศาสตร์ของการตกตะกอนอย่างมาก นอกจากนี้ สมการการสมดุลประชากรเชิงเรขาคณิตถูกนำมาใช้ในการอธิบายอิทธิพลทางจลศาสตร์ของระบบดังกล่าวด้วย

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