

TIME BASED FRACTIONATION OF ASPHALTENES

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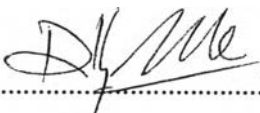
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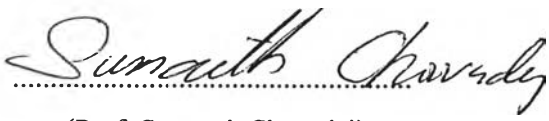
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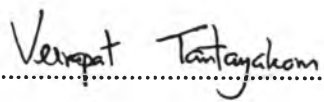

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ABSTRACT

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The precipitation of asphaltenes has been established as a time-dependent process. Asphaltenes precipitated first are expected to be the most unstable asphaltenes and cause severe problems in oil productions. It has also been observed that the aggregation rate of asphaltenes is controlled by asphaltene concentration. In this study, we utilized time and solubility based fractionation to investigate the polydispersity of asphaltenes and differences in the aggregation tendency for asphaltenes precipitated at different asphaltene concentrations. Asphaltenes extracted from two different crude oils (A1 and K1) were separately mixed with toluene to generate model mixtures with two different asphaltene concentrations (3 wt% and 8 wt% asphaltenes in toluene). The solutions were fractionated by adding heptane as a precipitant at fixed concentrations. Destabilized asphaltenes were then collected at different times until equilibrium was reached. Microscopy and small-angle X-ray scattering (SAXS) results showed that the aggregation rate of fractionated asphaltenes strongly depends on time and asphaltene concentration. The fraction that precipitated earlier is more unstable and form larger nanoaggregates than the fraction precipitated later. Moreover, the results of asphaltene concentration suggest that asphaltenes precipitated from a higher asphaltene-content solution have more variation in properties, which influences their aggregation behaviour, compared to solutions with a lower asphaltene-content.

บทคัดย่อ

พิษณุ ธีรภาพกุล : การตกตะกอนของแอสฟัลทีนตามเวลา (Time Based Fractionation of Asphaltenes) อาจารย์ที่ปรึกษา: ศาสตราจารย์ ดร. เอช สก็อต ฟอกเลอร์ และ ผู้ช่วยศาสตราจารย์ ดร. ปมทอง มาลากุล ณ อยุธยา 46 หน้า

การตกตะกอนของแอสฟัลทีนนั้นเป็นกระบวนการที่ขึ้นกับเวลา โดยเชื่อว่าแอสฟัลทีนที่ตกตะกอนก่อนเป็นแอสฟัลทีนที่มีความเสถียรน้อยที่สุดซึ่งก่อให้เกิดปัญหาในกระบวนการผลิตน้ำมัน ความเข้มข้นของแอสฟัลทีนถูกศึกษาว่าเป็นหนึ่งในตัวแปรที่ควบคุมอัตราการตกตะกอนของแอสฟัลทีน งานวิจัยนี้ใช้การแยกตามเวลาและตัวแปรของการละลายของแอสฟัลทีนในการศึกษาพอลิดีสเพอร์ซิตี (polydispersity) ของแอสฟัลทีนและความแตกต่างของแนวโน้มในการตกตะกอนของแอสฟัลทีนที่ความเข้มข้นของแอสฟัลทีนต่างกัน แอสฟัลทีนที่สกัดได้จากน้ำมันดิบสองชนิดคือ A1 และ K1 ถูกแยกผสมด้วยโทลูอี้น เพื่อเตรียมน้ำมันตัวอย่างที่ความเข้มข้นของแอสฟัลทีนต่างกันคือ 3 เปอร์เซ็นต์ และ 8 เปอร์เซ็นต์ โดยน้ำหนักของแอสฟัลทีนในโทลูอี้น แอสฟัลทีนในสารละลายถูกทำให้ตกตะกอนโดยการเติมตัวตกตะกอน (เฮปแทน) ตามความเข้มข้นที่กำหนด แอสฟัลทีนที่ไม่เสถียรได้ถูกเก็บตัวอย่างที่เวลาต่างกันจนกระทั่งถึงจุดสมดุล ผลการทดลองจากกล้องจุลทรรศน์และ SAXS แสดงให้เห็นว่าอัตราของการตกตะกอนของแอสฟัลทีนที่ถูกแยกขึ้นอยู่กับเวลาและความเข้มข้นของแอสฟัลทีน ส่วนที่ตกตะกอนก่อนมีความเสถียรน้อยกว่าและสร้างกลุ่มก้อนนาโนที่ใหญ่กว่าแอสฟัลทีนส่วนที่ตกทีหลัง นอกจากนี้ผลจากความเข้มข้นของแอสฟัลทีนชี้ให้เห็นว่าแอสฟัลทีนที่ตกตะกอนจากสารละลายที่มีความเข้มข้นของแอสฟัลทีนสูงกว่ามีความหลากหลายของคุณสมบัติมากกว่าซึ่งมีผลกระทบของพฤติกรรมของการตกตะกอนมากกว่าสารละลายแอสฟัลทีนที่มีความเข้มข้นน้อยกว่า

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