

**EFFECT OF AMPHIPHILIC MOLECULES ON ASPHALTENE
PRECIPITATION**

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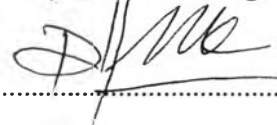
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ABSTRACT

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The ability of amphiphilic molecules to stabilize crude oil by adsorption with asphaltenes is an active area of research. Based on the structure of amphiphilic molecules, one would expect these molecules to stabilize asphaltenes by creating physical dispersion and hindering the particles from aggregating. The purpose of this study is to investigate the relationship between degree of stabilization and pKa which provides important information on how acid-base reactions with alkylbenzenes stabilize asphaltenes at low alkylbenzene concentrations. In order to study how the strength of alkylbenzene basicity affects asphaltenes, several basic alkylbenzenes were used: nonylacetophenone (NNPN), octyloxybenzotrile (OOBN), nonylphenol (NP), nonylaniline (NNAL), and dodecyloxybenzaldehyde (DDBD). The stability of asphaltenes in the presence of alkylbenzenes was measured in microscopy experiments. The pKa measurements of alkylbenzenes were performed in tetrahydrofuran using potentiometric titration. The results from microscopy experiments have demonstrated that the presence of amphiphilic molecules destabilizes crude oil because chemical adsorption is dominant at low alkylbenzene concentrations. The degree of destabilization was found to be in the order: DDBD > NNAL > NP > OOBN > NNPN. The pKa values of DDBD, NNAL, NP, OOBN, and NNPN are 8.06, 7.76, 6.47, 4.97, and 4.78, respectively. These findings suggest that there is a correlation between the pKa and the degree of destabilization; the weakest bases were the most destabilizing and the strongest bases were the least destabilizing.

บทคัดย่อ

ปองคุณ สิริประเสริฐศิลป์ : ผลของแอมฟิฟิลิกโมเลกุลต่อการตกตะกอนของแอสฟัลทีน (Effect of Amphiphilic Molecules on Asphaltene Precipitation) อาจารย์ที่ปรึกษา: ศาสตราจารย์ ดร. เอช สก๊อตต ฟอกเลอร์ และผู้ช่วยศาสตราจารย์ ดร. ปมทอง มาลากุล ณ อยุธยา 47 หน้า

ความสามารถในการเพิ่มเสถียรภาพของน้ำมันดิบด้วยแอมฟิฟิลิกโมเลกุลเป็นหัวข้อที่มีการศึกษาอย่างกว้างขวาง จากลักษณะโครงสร้างพื้นฐานของแอมฟิฟิลิกโมเลกุลทำให้สามารถตั้งสมมติฐานได้ว่า โมเลกุลเหล่านี้สามารถเพิ่มเสถียรภาพของแอสฟัลทีนในน้ำมันดิบได้โดยสร้างการกระจายตัวเชิงกายภาพอีกทั้งยังขัดขวางการรวมตัวกันของอนุภาคแอสฟัลทีน นำมาซึ่งวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างระดับเสถียรภาพของแอสฟัลทีนและ ค่าคงที่สมดุลของกรด หรือ pKa ของแอมฟิฟิลิกโมเลกุล ซึ่งเป็นตัวบ่งชี้ว่าการเติมอัลคิลเบนซีนที่ความเข้มข้นต่ำนั้นส่งผลต่อปฏิกิริยาเชิงกรดเบสในการเพิ่มเสถียรภาพแอสฟัลทีน งานวิจัยนี้ได้เลือกใช้อัลคิลเบนซีนชนิดที่เป็นเบสหลายชนิดมาทำการทดลอง ได้แก่ Nonylacetophenone (NNPN), Octyloxybenzotrile (OONB), Nonylphenol (NP), Nonylaniline (NNAL) และ Dodecyloxybenzaldehyde (DDBD) เพื่อศึกษาผลของความเป็นกรดเบสของอัลคิลเบนซีนต่อเสถียรภาพแอสฟัลทีน โดยเสถียรภาพของแอสฟัลทีนที่มีส่วนผสมของแอมฟิฟิลิกโมเลกุลสามารถวัดได้โดยใช้กล้องจุลทรรศน์ ส่วนค่า pKa ของแอมฟิฟิลิกโมเลกุลถูกวัดด้วยการไตเตรดโดยการวัดศักย์ไฟฟ้าในเตตระไฮโดรฟูเรน ผลการทดลองที่ได้จากการใช้กล้องจุลทรรศน์แสดงให้เห็นว่า การเติมแอมฟิฟิลิกโมเลกุลที่ความเข้มข้นต่ำ ลดเสถียรภาพของแอสฟัลทีนลงเนื่องจากการดูดซับเชิงเคมีของแอมฟิฟิลิกโมเลกุลเป็นหลัก ลำดับของความไม่เสถียรและ pKa เป็นไปในลักษณะเดียวกัน ซึ่งเป็นไปดังนี้ DDBD (8.06) > NNAL (7.76) > NP (6.47) > OONB (4.97) > NNPN (4.78) จากผลการทดลองทั้งหมด ทำให้ทราบได้ว่ามีความสัมพันธ์ระหว่าง pKa และลำดับของความไม่เสถียร โดยเบสที่อ่อนที่สุดทำให้เสถียรภาพของแอสฟัลทีนลดลงมากที่สุด และเบสที่แก่ที่สุดทำให้เสถียรภาพของแอสฟัลทีนลดลงน้อยที่สุด

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