MIXED ANIONIC-NONIONIC SURFACTANT MICROEMULSION WITH DECANE AND SPONTANEOUS IMBIBITION TEST FOR ENHANCED OIL RECOVERY

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ABSTRACT

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Nattawit Khomsanit: Mixed Anionic-Nonionic Surfactant Microemulsion with Decane and Spontaneous Imbibition Test for Enhanced Oil Recovery

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Crude oil production focuses on recovering the highest amount of oil from a reservoir. However, only 45% to 50% of the original oil in place is recovered by natural pressure and water flooding techniques. The challenge lies in developing new methods to extract the remaining oil in the reservoir. In this work, sulfate or sulfonate anionic surfactants were mixed with a non-ionic surfactant to study phase behavior. The effect of salinity was studied by the varying NaCl concentration from 1wt% to 10wt%. Decane was used as representative of oil phase. Phase behavior especially middle phase (Winsor type III) was studied and used for screening suitable surfactant formulas. Results show that single anionic surfactant systems cannot provide the middle phase and precipitation of the anionic surfactant is observed at high salt concentration. The precipitate of anionic surfactant can solve by adding of non-ionic surfactant to improve solubilization of the middle phase. The middle phase with thick layer and equal phase height was obtained from sodium dodecylbenzene sulfonic acid (SDBS) as anionic surfactant mixed with the nonionic surfactant, Triton X-100 at 12.5wt% NaCl and Tergitol TMN6 at 8.5wt% NaCl, respectively. Spontaneous imbibition tests also determined the mixed SDBS/Tergitol® TMN6 surfactant at 8.5%wt salinity is the optimum surfactant formula with the lowest IFT and had capacity to recovered 39.55% of decane from sandstone core sample.

บทคัดย่อ

ณัฐวิทย์ ขมสนิท : การเกิดไมโครอิมัลชันโดยการผสมระหว่างสารลดแรงตึงผิวชนิดแอนไอออนนิคกับชนิดนอนไอออกนิคกับเดคเคน และการทดสอบ สปอนเทเนียส อิมบิบิชั่น เพื่อเพิ่มประสิทธิภาพการดึงน้ำมัน (Mixed Anionic-Nonionic Surfactant Microemulsion with Decane and Spontaneous Imbibition Test for Enhanced Oil Recovery) อ. ที่ปรึกษา : ผศ.ดร.บุนยรัชต์ กิติยานันท์ และ ศร.เจฟฟรี่ เฮท ฮาร์เวลล์ 54 หน้า

เป้าหมายของกระบวนการผลิตน้ำมันดิบคือการดึงปริมาณน้ำมันดิบจากหลุมจุดเขาะให้มากที่สุด อย่างไรก็ตาม น้ำมันดิบปริมาณร้อยละ 45 ถึง 50 คือปริมาณน้ำมันดิบที่ได้จากแรงดันธรรมชาติและเทคนิคการผลักดันด้วยน้ำ ดังนั้นความท้าทายคือการพัฒนากรรมวิธีเพื่อสกัดน้ำมันดิบที่เหลืออยู่ในหลุมน้ำมันออกมาให้ได้เพิ่มมากขึ้น ในงานวิจัยนี้ สารลดแรงดึงผิวชนิดแอนไอออนนิคแบบซัลเฟตหรือซัลโฟเนตมาผสมกับสารลดแรงตึงผิวชนิดนอนไอออนนิค เพื่อศึกษาลักษณะของวัฏภาค โดยอิทธิพลของปริมาณเกลือจะทดสอบด้วยโซเดียมคลอไรด์ ในปริมาณร้อยละ 1 ถึง 10 และใช้ decane เป็นตัวแทนวัฏภาคน้ำมัน การศึกษานี้จะใช้ลักษณะของวัฏภาคตรงกลางหรือ Winsor type III สำหรับการจำแนกหาสูตรของสารลดแรงตึงผิวที่มีความเหมาะสม ผลการทดสอบได้แสดงว่าการใช้สารลดแรงตึงผิวแบบแอนไอออนนิคเพียงอย่างเดียว ไม่สามารถทำให้การวัฏภาคตรงกลางที่เหมาะสมได้ ทั้งยังได้เกิดการตกตระกอนของสารลดแรงตึงผิวที่ใช้ในระบบอีกด้วย อย่างไรก็ตามการผสมสารลดแรงตึงผิวแบบนอนไอออนนิค สามารถช่วยกำจัดตระกอนที่เกิดขึ้นและเพิ่มความสามารถในการละลายของวัฏภาคตรงกลาง โดยวัฏภาคตรงกลางที่มีความเหมาะสมเกิดขึ้นจากการผสมสารลดแรงตึงผิวระหว่าง SDBS/ Triton X-100 ที่สัดส่วนของ NaCl ร้อยละ 12.5 และ SDBS/ Tergitol TMN6 ที่สัดส่วนของ NaCl ร้อยละ 8.5 ผลของการทดสอบการดึงน้ำมันแบบ สปอนเทเนียส อิมบิบิชั่น ยังแสดงว่าสารลดแรงตึงผิวผสมระหว่าง SDBS/ Tergitol TMN6 ที่สัดส่วนของ NaCl ร้อยละ 8.5 มีประสิทธิภาพในการดึงน้ำมันจากหินทราย ได้ร้อยละ 39.55

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