

**STUDY OF Ca-ATMP PRECIPITATION WITH
THE PRESENCE OF MAGNESIUM ION**

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มงคล บัวหลวง : การศึกษากระบวนการตกตะกอนของตะกอนแคลเซียม-ATMP ในสถานะที่มีแมกนีเซียม ไอออน (Study of Ca-ATMP Precipitation with the Presence of Magnesium Ion) อ. ที่ปรึกษา : ศ. เอช สกอตต์ ฟอกเลอร์ (Prof. H Scott Fogler), ร.ศ. สุเมธ ชวเดช และ ดร. ปมทอง มาลากุล ณ อยุธยา เอกสารจำนวน 77 หน้า ISBN 974-13-0695-4

การบำบัดน้ำเสียด้วยตะกอนแบบวิธีการตกตะกอน จัดเป็นวิธีการที่มีประสิทธิภาพในการนำเข้าไปของสารขี้ตะกอนในปริมาณต่ำสุดที่มีผลโดยอาศัยหลักการตกตะกอนระหว่างสารขี้ตะกอนกลุ่มฟอสเฟต และ แคลไอออนที่มีประจุบวกสอง ซึ่งจะถูกกักเก็บไว้ในชั้นหินเพื่อป้องกันการเกิดตะกอนและตกตะกอนในการผลิตน้ำมัน แคลเซียมไอออนมักจะทำปฏิกิริยาการเกิดตะกอนได้ดีกับสารขี้ตะกอน เนื่องจากมีปริมาณแคลเซียมสูงมากภายในน้ำชั้นหิน อย่างไรก็ตาม แคลไอออนชนิดอื่น ๆ เช่น แมกนีเซียม สามารถรวมตัวเกิดเป็นตะกอนกับสารขี้ตะกอนกลุ่มฟอสเฟตได้เช่นกัน ดังนั้นงานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบของแมกนีเซียม ไอออนต่อการเกิดตะกอน แคลเซียม-ATMP ในการทดลองนี้สารขี้ตะกอนที่ศึกษาคือ Amino trimethylene phosphonic acid (ATMP) จากผลการศึกษาพบว่าที่ สถานะความเป็นกรดสูงเท่ากับ 1.5 แมกนีเซียมไอออนมีอิทธิพลต่ออัตราส่วนโดยโมลของแคลเซียมต่อสาร ATMP น้อยมาก ในขณะที่ความเป็นกรดในสารละลายมีค่าเท่ากับ 4 และ 7 อัตราส่วนโดยโมลของแคลเซียมต่อ ATMP ลดลง เมื่อความเข้มข้นของแมกนีเซียมที่ให้สู่ระบบเพิ่มขึ้น ปรากฏการณ์นี้บ่งชี้ว่า ตำแหน่งในการทำปฏิกิริยาของสาร ATMP บางส่วนถูกครอบครองโดย แมกนีเซียมไอออนแทนที่แคลเซียม ไอออน ยิ่งไปกว่านั้น การเพิ่มอย่างมากของไอออนในสารละลาย เนื่องมาจากการเพิ่มความเข้มข้นโดยรวมของแมกนีเซียมที่เติมให้ระบบ มีผลต่อการเปลี่ยนแปลงค่าอัตราส่วนโดยโมลรวมของแคลเซียมและแมกนีเซียมต่อATMPในตะกอน จากผลการศึกษาการละลายของตะกอนในระบบบะ โดยใช้ปฏิกรณ์แบบจานหมุน สนับสนุนว่าตะกอนแมกนีเซียม-ATMP สามารถตกตะกอนไปพร้อมกับตะกอนแคลเซียม-ATMP

ABSTRACT

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Precipitation squeeze treatment has been proven to be an effective method for placing threshold scale inhibitors via precipitation mechanism between divalent cations and phosphonate scale inhibitor into a formation in order to prevent scale formation and deposition in petroleum production. Calcium-scale inhibitor precipitates is formed easily due to the high amount of calcium ion in formation water. However, other divalent cations such as magnesium may also have potential to form precipitates with phosphonate scale inhibitor. Therefore, the goal of this work was to study the effect of Mg ion in modulating the formation of Ca-ATMP precipitates whereas ATMP (Aminotri Methylene Phosphonic Acid) was used as a phosphonate scale inhibitor. The results revealed Mg ion had little effect on Ca-ATMP precipitates at precipitating solution pH of 1.5, while at higher precipitating solution pHs (pH 4 and 7), Ca to ATMP molar ratios of the precipitates decreased with increasing the total magnesium concentration added into the systems. It implied that some of available sites of ATMP were replaced by Mg ions instead of Ca ions. Furthermore, substantially increasing the ionic strength due to an increase of total magnesium concentration added into the systems resulted in a change of total molar ratio (Ca+Mg/ATMP) in the precipitates. The results from batch dissolution performed by using a rotating disk reactor supported that Mg-ATMP precipitates could co-precipitate along with Ca-ATMP precipitates.

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