

**UNDERSTANDING THE MECHANISM OF BARIUM SULFATE  
DEPOSITION USING CAPILLARY FLOW**

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The University of Michigan, The University of Oklahoma,  
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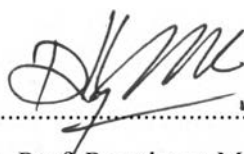
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Using Capillary Flow  
**By:** Thanawat Thanthong  
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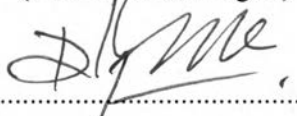


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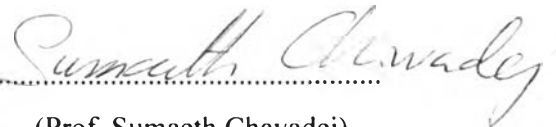
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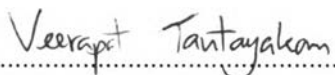
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## บทคัดย่อ

ธนวัฒน์ แทนทอง : การศึกษากลไกการเกาะติดของแบเรียมซัลเฟตด้วยการไหลในท่อแคปิลลารี (Understanding the Mechanism of Barium Sulfate Deposition Using Capillary Flow) อาจารย์ที่ปรึกษา: ศาสตราจารย์ ดร. เอก สก๊อต ฟอกเลอร์ และผู้ช่วยศาสตราจารย์ ดร. ปมทอง มาลากุล ณ อยุธยา 27 หน้า

แบเรียมซัลเฟตเป็นหนึ่งในเกลือที่ไม่ละลายน้ำที่สามารถตกตะกอนและเกาะติดในกระบวนการปิโตรเลียมทั้งต้นน้ำและปลายน้ำ งานวิจัยนี้นำเสนอวิธีการใหม่ในการศึกษาการเกาะติดของแบเรียมซัลเฟต โดยแบเรียมซัลเฟตในการทดลองนี้ได้มาจากการผสมสารละลายแบเรียมคลอไรด์และโซเดียมซัลเฟตในท่อแคปิลลารีโลหะ โดยใช้การไหลในท่อแคปิลลารีที่อัตราการไหลต่างๆ จากนั้นจึงใช้เทคนิคแคปิลลารีในการศึกษาการเกาะติดของแบเรียมซัลเฟตโดยการวัดความเข้มข้นของแบเรียมไอออนที่เวลาต่างๆ ด้วยเครื่องมือ Inductively-coupled plasma mass spectroscopy (ICP-MS) และสังเกตความดันลดในท่อแคปิลลารีตามเวลาต่างๆ นอกจากนี้ ยังได้ใช้กล้องจุลทรรศน์อิเล็กตรอนแบบส่องกราด Scanning electron microscope (SEM) ถ่ายภาพท่อแคปิลลารีทั้งด้านขาเข้าและขาออก งานวิจัยนี้ช่วยให้สามารถเข้าใจรูปแบบการเกาะติดของแบเรียมซัลเฟตที่อัตราการไหลต่างๆ ได้ดีขึ้น

## ABSTRACT

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Barium sulfate is one of the most insoluble salts that can precipitate and deposit in both upstream and downstream processes. This study presents a new technique for investigating barium sulfate scale deposition. Barium sulfate deposits were generated in metal capillaries by mixing two equimolar solutions of barium chloride ( $\text{BaCl}_2$  (aq)) and sodium sulfate ( $\text{Na}_2\text{SO}_4$  (aq)) using capillary flow apparatus at different flow rates. A capillary technique was used to study the deposition of barium sulfate by measuring barium ion concentrations at different times using Inductively-Coupled Plasma Mass Spectroscopy (ICP-MS) and observing the pressure drop along the capillary as a function of time. Electron microscopy images at inlet and outlet of used capillaries were also taken using scanning electron microscope (SEM). This work will potentially provide a better understanding of barium sulfate deposition patterns at different flow rates.

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