

**INVESTIGATION OF ASPHALTENE DEPOSITION
IN FLOWING CONDITION**

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
Case Western Reserve University, and Institut Français du Pétrole
2015

I 2836 8423


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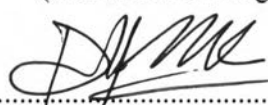
Thesis Title: Investigation of Asphaltene Deposition in Flowing Condition
By: Pantid Phichphimok
Program: Petrochemical Technology
Thesis Advisors: Prof. H. Scott Fogler
Asst. Prof. Pomthong Malakul

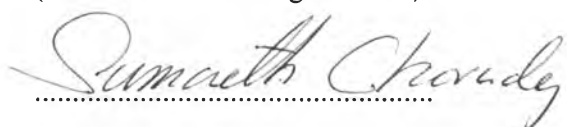
Accepted by The Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfilment of the requirements for the Degree of Master of Science.

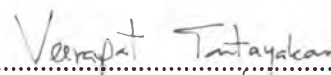

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ABSTRACT

5671021063: Petrochemical Technology Program
Pantid Phichphimok: Investigation of Asphaltene Deposition in
Flowing Condition.
Thesis Advisors: Prof. H. Scott Fogler, and Asst. Prof. Pomthong
Malakul 61 pp.
Keywords: Asphaltene/ Deposition/ Flow condition

Asphaltenes are one of the most problematic compounds in crude oil. They have high tendency to aggregate and deposit on the surface of pipeline and production equipment. In this work, a packed-bed of large spheres flow-loop apparatus was designed and built to investigate asphaltene deposition. For the first time, an asphaltene deposition apparatus has been proven to have good performance and high reproducibility. Experimentally, a crude oil was initially mixed with heptane to destabilize asphaltenes then the oil-heptane mixture was flown through the packed-bed column at a given superficial velocity for a certain period of time. The deposit mass was measured for different deposition time and the deposition rate can be obtained. It was observed that the asphaltene deposition rate initially increases then decreases as the superficial velocity increases. The initial increasing of deposition rate is limited by mass transfer of the asphaltene particles to surface. However, the deposition is suggested to be inhibited by shear force at high superficial velocity causing the deposition rate to decrease. This observation shows that the asphaltene deposition rate has a strong dependency on the superficial velocity of the flow. Moreover, the value of dependency of the asphaltene deposition rate on superficial velocity of the flow has been established for asphaltene deposition rate in both regimes and the mechanism of asphaltene deposition is uncovered.

บทคัดย่อ

พันธิตร์ พิชญ์พิโมกษ์ : การศึกษาการเกาะติดของแอสฟัลทีนในสภาวะที่มีการไหล (Investigation of Asphaltene Deposition in Flowing Condition) อาจารย์ที่ปรึกษา : ศาสตราจารย์ เอช สกอตต์ ฟอกเลอร์ และผู้ช่วยศาสตราจารย์ ดร. ปมทอง มาลากุล ณ อยุธยา 61 หน้า

แอสฟัลทีนเป็นหนึ่งในสารที่มีปัญหาามากที่สุดในน้ำมันดิบ แอสฟัลทีนมีแนวโน้มสูงที่จะตกตะกอนและเกิดการเกาะติดบนพื้นผิวของท่อขนส่งน้ำมันดิบและอุปกรณ์การผลิตต่างๆ งานวิจัยนี้ได้ทำการออกแบบและสร้างเครื่องมือเพื่อใช้ในการศึกษาพฤติกรรมของการเกาะติดของแอสฟัลทีน โดยเครื่องมือชนิดนี้คือแพคเกจที่บรรจุทรงกลมขนาดใหญ่ที่มีการไหลเวียนของการไหล เครื่องมือที่สร้างขึ้นมาผ่านการตรวจสอบพิสูจน์แล้วว่าประสิทธิภาพที่ดีและมีความแม่นยำสูง ในส่วนของขั้นตอนการทดลองนั้นน้ำมันดิบจะถูกเติมด้วยเฮปเทนอย่างช้าๆจนถึงความเข้มข้นที่ต้องการ หลังจากนั้นสารผสมระหว่างน้ำมันดิบและเฮปเทนจะถูกบีบขึ้นในคอลัมน์แพคเกจที่ความเร็วของการไหลค่าหนึ่ง เมื่อครบตามเวลาที่ต้องการศึกษาแล้วแอสฟัลทีนที่เกาะติดอยู่ภายในคอลัมน์จะถูกนำมาชั่งน้ำหนัก จากนั้นจะทราบค่าอัตราการเกาะติดของแอสฟัลทีน ผลจากการเปลี่ยนความเร็วของการไหลพบว่าอัตราการเกาะติดของแอสฟัลทีนจะเพิ่มขึ้นจนถึงจุดหนึ่ง จากนั้นจะลดลงเมื่อความเร็วของการไหลเพิ่มขึ้น การเพิ่มขึ้นของอัตราการเกาะติดของแอสฟัลทีนนั้นมีสาเหตุจากการถ่ายเทของมวลอนุภาคแอสฟัลทีนเป็นขั้นกำหนดอัตราการเกาะติดของแอสฟัลทีน แต่ในช่วงของการลดลงของอัตราการเกาะติดนั้นเมื่อความเร็วของการไหลเพิ่มขึ้นนั้นอาจเกิดการขัดขวางยับยั้งการเกาะติดของแอสฟัลทีน โดยแรงเฉือนจากการไหล จากผลการทดลองนี้ทำให้ทราบว่า การเกาะติดของแอสฟัลทีนมีความสัมพันธ์อย่างมากกับความเร็วการไหล นอกจากนี้ในงานวิจัยนี้ยังได้แสดงค่าความสัมพันธ์ระหว่างอัตราการเกาะติดของแอสฟัลทีนและความเร็วการไหลในช่วงที่อัตราการเกาะติดของแอสฟัลทีนเพิ่มขึ้นและลดลง อีกทั้งเปิดเผยกลไกการเกาะติดของแอสฟัลทีน

ACKNOWLEDGEMENTS

I would like to express my profound gratitude to my advisor, Prof. H. Scott Fogler for offering me a great opportunity and support to do research at University of Michigan. I also would like to acknowledge my co-advisor, Asst. Prof. Pomthong Malakul for giving me good advices. In addition, I would like to thank Prof. Sumaeth Chavadej and Dr. Veerapat Tantayakom for being my thesis committee.

I would like to express my appreciation to Cláudio Vilas Bôas Fávero for giving me valuable advices and helping me in all aspects of my research as well as being a good friend and making my time in Ann Arbor to be such a memorable time. I would like to thank all other group members, especially, Kamol Kitpakapanit and Kasidit Smathwittayawech for being good friends, having helpful research discussion and sharing impressive time together.

I would like to give a deepest thank to the sponsors of the University of Michigan Industrial Affiliates Program for financial support. The program members include: Chevron, ConocoPhillips, Halliburton, Nalco, Phillips66, Shell, Statoil, Total, and Woodgroup Kenny. Furthermore, I am grateful for the partial scholarship and partial funding of the thesis work provided by the Petroleum and Petrochemical College. Also

I would like to thank the University of Michigan staffs: Laura bracken, Susan Hamlin, Shelly Fellers, Michael Africa, Harald Eberhart, and Ying Qi who provided technical support, departmental and visiting scholar business.

I would like to give a special thanks to Pongkhun Siriprasurtsilp and Phitsanu Teeraphakul for giving me helpful suggestions and training me in performing experiments in laboratory. Lastly, I would like to thank my family for their love and encouragement.

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