

Asphaltene Deposition from Destabilized Oils with Water Emulsions Using Porous Microfluidics Chip

Hunter Ducharme¹, Peng He², Yu-Jiun “Nate” Lin², Sibana Lisa Biswal²

¹ Rice Office of STEM Engagement, Rice University

² Chemical and Biomolecular Engineering, Rice University

Introduction

- **Asphaltenes** are naturally found inside of crude oil that precipitate in the presence of a solvent, a change in pressure, and/or a change in temperature [1].
- **The problem** is water emulsions increase the deposition of asphaltenes inside of flow lines and reservoir rocks [2].
- **The objective** is to understand the effects of various salts on asphaltene deposition relating to water-in-oil emulsions.



Figure 1: Deposition of asphaltenes inside of a pipe. Andrews, A. (2006, September/October). [Clogged pipe]. Retrieved August, 2016.

Materials and Methods

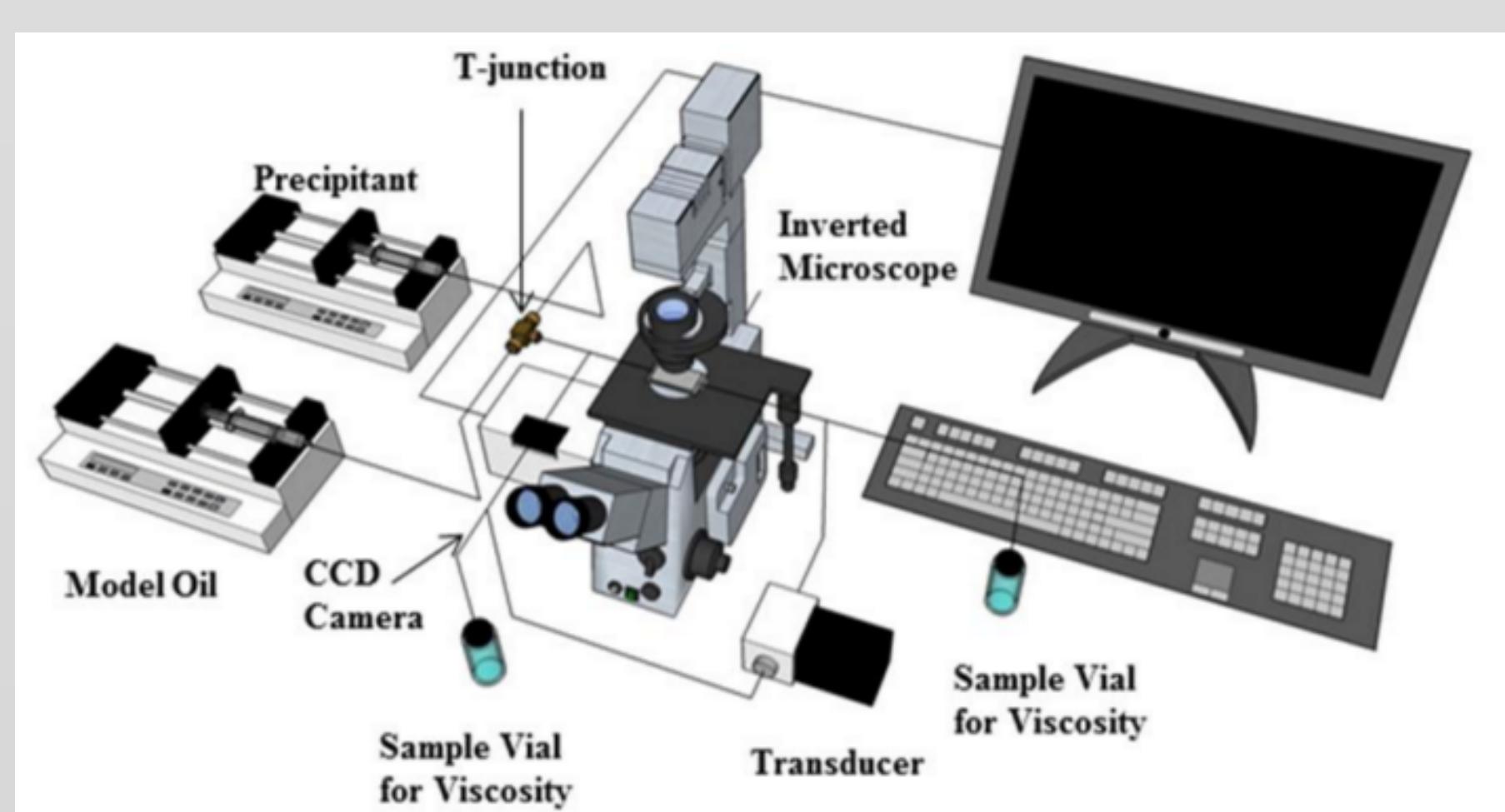


Figure 2: Experimental setup. Courtesy of Yu-Jiun “Nate” Lin.

- ① All materials are set up according to Figure 2.
- ② Heptane and crude oil are pumped into the microfluidic device.
- ③ The pressure is recorded using a transducer.
- ④ Asphaltene deposition is recorded and measured using high speed optical microscopy.

Water's Impact on Deposition

Increasing the presence of water in crude oil positively correlates with asphaltene deposition and the aggregation of emulsions.

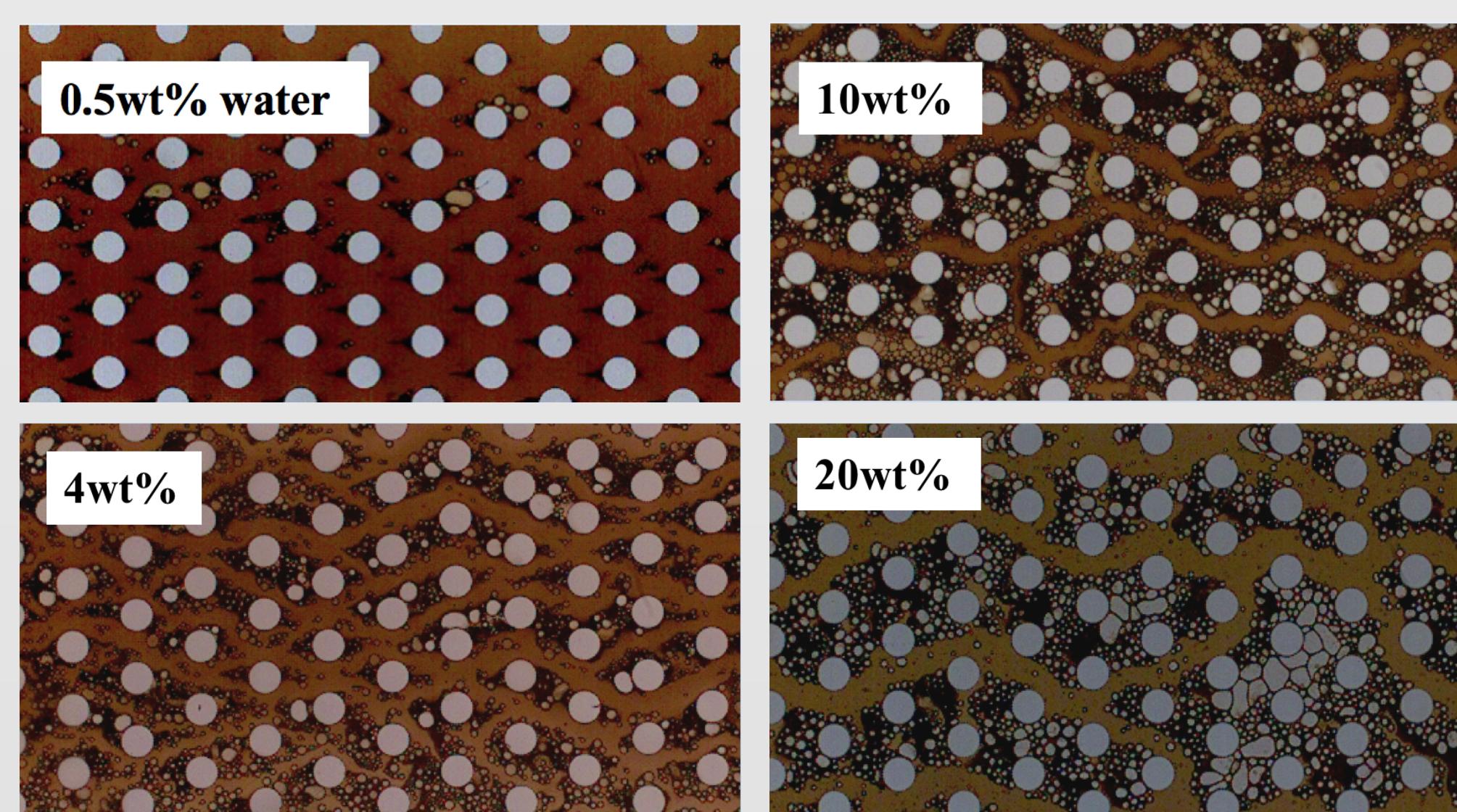


Figure 3: Asphaltene deposition inside the porous media with varying water concentrations. Courtesy of Yu-Jiun “Nate” Lin.

Salt's Impact on Deposition

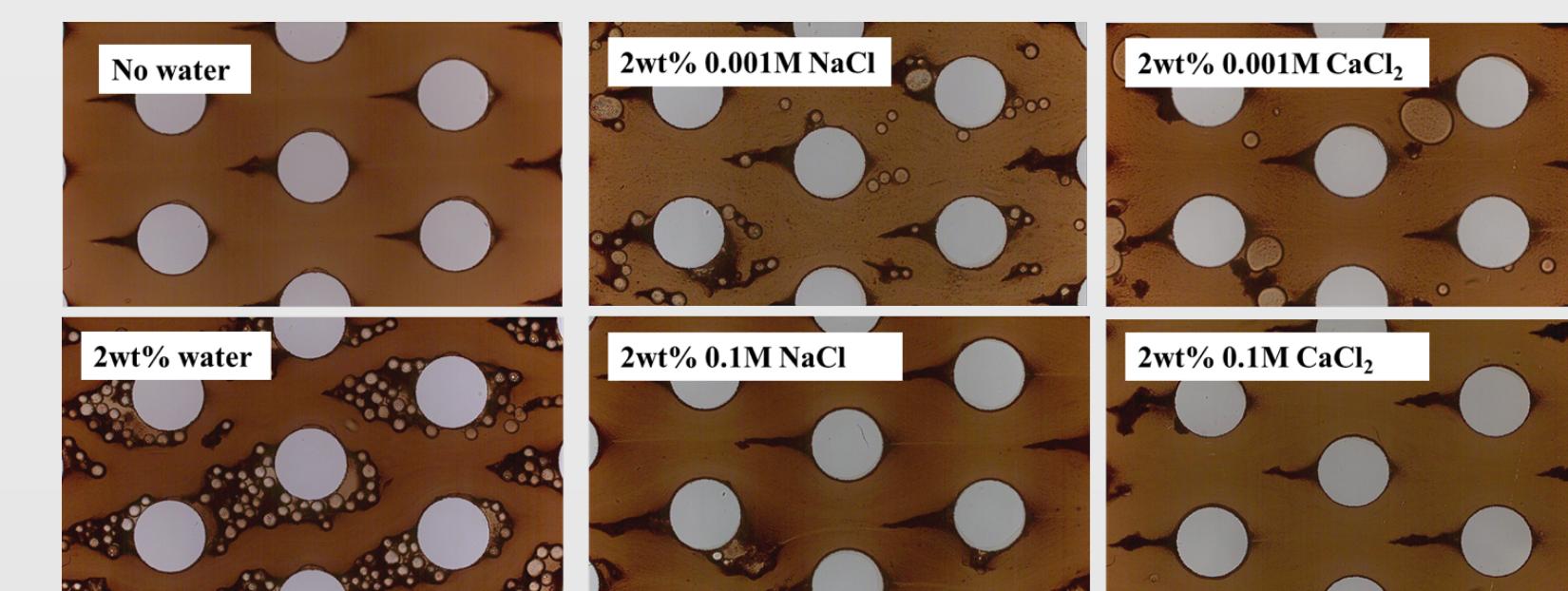


Figure 4: Asphaltene deposition inside the porous media with 2% of volume being water in addition to varying concentrations of sodium. Courtesy of Yu-Jiun “Nate” Lin.

Nunc tempus venenatis facilisis. Curabitur suscipit consequat eros non porttitor. Sed a massa dolor, id ornare enim:

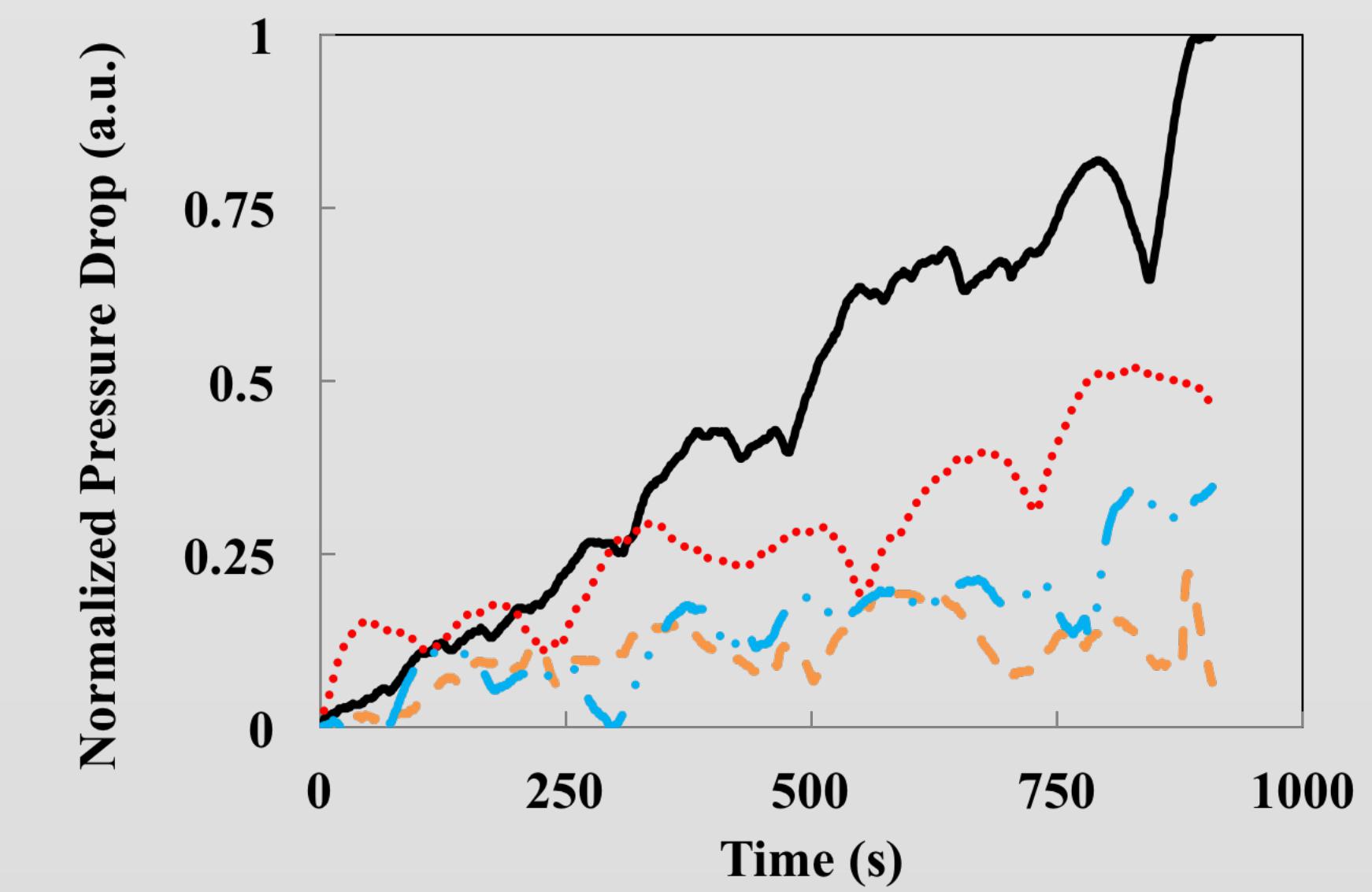


Figure 5: Experimental setup. Courtesy of Yu-Jiun “Nate” Lin.

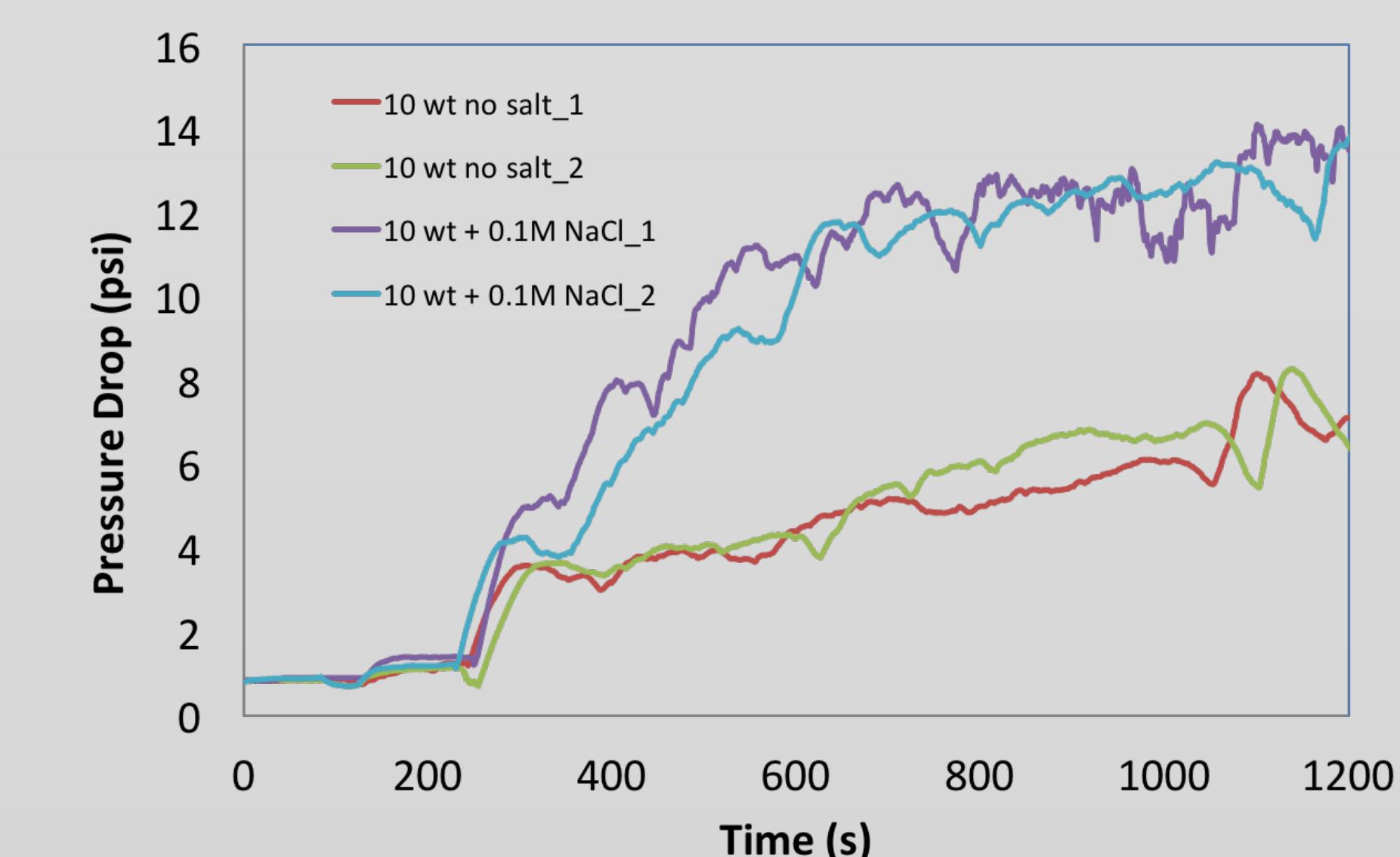


Figure 6: Experimental setup. Courtesy of Yu-Jiun “Nate” Lin.

Conclusion

- Nunc tempus venenatis facilisis.
- **Curabitur suscipit** consequat eros non porttitor.
- Sed a massa dolor, id ornare enim.

References

- [1] Kamran Akbarzadeh et al. Asphaltenes—problematic but rich in potential. *Oilfield Review*, 2007.
- [2] Lamia Goual. Petroleum asphaltenes. *Crude Oil Emulsions*, 2012.
- [3] Jiebin Bi et al. Interfacial layer properties of a polycyclic aromatic compound and its role in stabilizing water-in-oil emulsions. *American Chemical Society*, 2015.
- [4] Ling Zhang, Chen Shi, Qingye Lu, Qingxia Liu, and Hongbo Zeng. Probing molecular interactions of asphaltenes in heptane using a surface forces apparatus: Implications on stability of water-in-oil emulsions. *American Chemical Society*, 2016.
- [5] D. Gonzalez, G. Hirasaki, et al. Impact of flow assurance in the development of a deepwater prospect. *Society of Petroleum Engineers*, 2007.
- [6] Yu-Jiun Lin et al. Examining asphaltene solubility on deposition in model porous media. 2016.

Contact Information

- Email: hgducharme@gmail.com
- Phone: 281-450-7154