Contribution ID: **1052** Type: **Poster Presentation**

Drag Reducing Agents for Geothermal Applications

Wednesday, 24 May 2023 10:30 (1h 30m)

Drag reducing agents (DRAs) are molecules that are able to reduce the frictional losses in turbulent flows. Typical examples are high molecular weight polymers, or surfactants that form worm-like micelles. DRAs are widely used in industrial applications : for example they can be used to reduce the pumping requirements in long pipelines such as the Trans-Alaska pipeline (1), to increase the flow rate in fire-fighting systems (2), and to reduce operating costs in district heating networks (3).

The aim of the current work is to assess the viability of DRAs for geothermal energy systems, with the aim of reducing the pumping costs at both the production and injection wells. In particular, we want to know how these DRAs interact with the subsurface. For example, the DRAs being tested might have the ability to significantly reduce drag, but this benefit would be negated if they are then shown to cause injectivity problems in the reservoir.

In this work, a number of potential DRAs, both polymers and surfactants, were obtained and two sets of screening tests were carried out to identify the strongest candidates. Firstly, the DRAs were tested for their thermal stability at reservoir salinities and temperatures. Several of the DRAs showed precipitation and phase separation at the test conditions, and were therefor removed from the study. Secondly, high-shear rheometric tests were performed with the DRAs to determine if they can provide drag reduction in turbulent Couette flow. These tests allowed us to determine the optimal concentrations for each DRA, and how this optimal concentration varies as a function of temperature.

Following these screening tests, the most effective DRAs were flowed through natural porous media samples (Bentheimer sandstone) to test for injectivity problems. It was found that for slow flows, i.e. a low shear state, there was little injectivity decline, whereas for strong flows, significant injectivity decline could be seen at the inlet of the porous media for some of the DRA samples.

Finally, in ongoing work, the final candidate DRAs will be tested in a large scale flow-loop to confirm the scale of the drag reduction that could be observed in pipe flow. A preliminary flow-loop test has been carried out with a DRA from literature (4), and drag reduction of up to 75% was observed.

Participation

In-Person

References

1 E. D.Burger et al. (1980). Studies of Drag Reduction Conducted over a Broad Range of Pipeline Conditions when Flowing Prudhoe Bay Crude Oil. doi.org/10.1122/1.549579

2 H. Rubin (1972), Drag Reduction Application in Fire Fighting Systems, doi.org/10.1061/JSEDAI.0001364

3 A. Krope et al. (2010). Drag reducing surfactants for district heating. doi.org/10.1016/j.applthermaleng.2009.12.012

4 R.J.A. Driessen (2022). Scaling rules for DRAs in turbulent pipe flows. Internship report, TNO.

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

The Netherlands

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

This abstract is related to Energy Transition

Primary author: JONES, Sian (TU Delft)

Co-authors: Mr DRIESSEN, Ronald (TNO); Dr VAN NIMWEGEN, Dries (TNO); Dr SHOEIBI OMRANI, Pejman (TNO); Prof. ZITHA, Pacelli (TU Delft)

Presenter: JONES, Sian (TU Delft)

Session Classification: Poster

Track Classification: (MS01) Porous Media for a Green World: Energy & Climate