Numerical modeling of water-soluble solvents for enhancing oil recovery in heterogeneous chalk reservoirs - DTU Orbit (11/08/2019)

**Numerical modeling of water-soluble solvents for enhancing oil recovery in heterogeneous chalk reservoirs**

Dimethyl Ether Waterflooding (DEW) is a promising water-soluble solvent-based EOR technique. Here, we study DEW mechanisms by developing a mathematical model taking into account the swelling and viscosity reduction of oil. Our analyses show that the swelling and viscosity reduction of oil cannot explain the observed increased recovery of DEW in the published core flooding data. Therefore, we define the residual oil saturation as a linear function of DME concentration in the oil phase to fit the model to the experimental data.

After model validation against a 1D core flooding experiment, we utilize the model to study the effect of permeability heterogeneity and the injected DME slug size on the recovery of oil from a water-flooded chalk reservoir. We observe a sharp increase in the ultimate recovery when the DME slug size increases from 0.2 to 1.8 pore volume with a DME concentration of 10wt%. Since DME is an expensive agent, the optimal slug size requires an integrated economic evaluation. We calculate the increased Net Present Value (NPV) of DEW flooding in the heterogeneous chalk reservoirs compared to the conventional water flooding for two scenarios of well completions. By comparing the water breakthrough and DME induced recovery, we conclude that the most economical scenario for the DEW flooding is observed in the reservoirs with the lowest heterogeneity.

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