Correlating the rheological properties of Pickering emulsions with the enhanced oil recovery in porous media

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Abstract. Iron oxide nanoparticles are synthesized and stabilized by the reaction of polyphenol solutions, extracted from the leaves of plants, with ferric chloride hexahydrate solutions. Various types of Pickering emulsions are prepared from nanoparticle suspensions by mixing them with n-alkanes at ratio 2:1 with the aid of an ultrasound probe. The rheological properties (shear viscosity, loss and storage moduli) of emulsions are measured with steady-state and dynamic frequency sweep tests on a stress rheometer. The stability of emulsions is inspected by observing the phase separation, and measuring the drop size distribution with dynamic light scattering. The emulsions are tested as agents for the secondary imbibition in porous media by assessing their capacity to displace residual oil that has remained after a cycle of primary drainage (mixture of paraffin oil and n-decane displaces brine) and primary imbibition (brine displaces the residual oil). Displacement tests are conducted under constant flow rate in three types of porous media: (i) a transparent glass-etched pore network; (ii) a sandpack; (iii) a core plug of Bentheimer sandstone. In each test, the transient responses of the fluid saturation and the pressure drop across the porous medium are recorded, and the displacement growth patterns are interpreted by accounting for arguments from the single- and two-phase flow of non-Newtonian fluids in porous media [1-3]. Finally, the measured EOR efficiency and pressure drop, at each porous medium, is correlated with the morphological properties of the pore space, along with the shear viscosity parameters and visco-elastic properties of emulsions.

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References

1. C.D. Tsakiroglou, C.D., J. Non-Newt. Fluid Mech. **105**, 79 (2002).
2. C.D. Tsakiroglou, M. Theodoropoulou, V. Karoutsos, D. Papanicolaou, V. Sygouni, J. Coll. Interface Sci. **267,** 217 (2003).
3. C.D. Tsakiroglou, J. Non-Newt. Fluid Mech. **117,** 1 (2004).