

# AN EXPERIMENTAL STUDY OF PERMEABILITY REDUCTION DUE TO INVASION OF OIL DROPLETS AND SOLID PARTICLES IN POROUS MEDIA DURING OILY-WATER INJECTION

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## ABSTRACT

Re-injection of produced water is of increasing importance as water cuts continue to increase worldwide. It provides an environmentally acceptable solution to the disposal of produced water, and contributes to pressure maintenance when injection takes place in the reservoir itself. Injection can take place under matrix injection or fracturing conditions. In both cases, the performance of the injection well and the distribution of the injected water are strongly influenced by the build-up of formation impairment around the wellbore or the fracture face. Solid particles and small oil droplets dispersed in the injection water are deposited in the formation by a process of filtration, and therefore will cause this impairment. This paper presents results from an experimental study on formation damage associated with simulated produced oily water injection. Core flooding experiments were carried out with simulated produced oily water containing 200 to 1200 ppm crude oil and 600-1500 ppm solids (10  $\mu$ m mean diameter) dispersed in brine. The formation damage along the length of a core was investigated and a number of parameters contributing to permeability decline were evaluated. The results indicate that produced oily water containing oil droplets and solid particles can contribute to the permeability decline observed in the cores. The most severe decline occurred in the low flow rate of oily water injection and permeability declines are decreased by increasing injection flow rate. Oil droplets with a dimension significantly less than the pore throat diameter also led to permeability decline. The permeability alteration resulting from a combination of both oil droplets and solid particles is more severe than obtained from the systems individually.

**KEYWORDS:** water injection, formation damage, permeability decline, produced water re-injection (PWRI), oily water injection.

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