



Contribution ID: 520

Type: Oral Presentation

## Ion composition effect on spontaneous imbibition in limestone cores.

Thursday, 2 June 2022 15:00 (15 minutes)

Studies on low salinity oil recovery on mostly outcrop rock cores have accelerated in recent years. Detailed focus has been put on understanding competing underlying mechanisms behind observed improved oil recovery. The main aim of this work was to understand how the ionic composition of imbibing brine dictates the wettability change in limestone outcrop cores basing on spontaneous imbibition (SI) experiments. The cores used in the study had a substantial difference in the degree of heterogeneity, and can therefore be representative of different actual reservoirs. It was observed through improved oil recovery that complete dilution of synthetic seawater had almost no impact on improved oil recovery on limestone cores, with the brine used in the tertiary mode. However, selective dilution of synthetic seawater with respect to the NaCl content resulted in high improved oil recovery. In line with this observation, two other brines depleted in NaCl and enriched in the magnesium ( $Mg^{2+}$ ) and sulfate ( $SO_4^{2-}$ ) ions were used to test the impact of minimal NaCl on the magnesium ion on the wettability alteration process.

Both brines (SSW-2S4Mg and SSW-2S8Mg) resulted in improved oil recovery in the tertiary mode. Contact angle measurements after placing polished rock chips, cut and shaped from the same rock material, in brines at 96 degrees Centigrade, were in line with the observed improved oil recoveries. What was striking was that all contact angle measurements in synthetic seawater depleted in NaCl content were in the water wetting window, based on the *Anderson et al.* criterion. Zeta potential measurements at both 25 degrees Centigrade and 70 degrees Centigrade, also supported both SI and contact angle measurements.

In this work, also a new and better experimental procedure and set up ideal for conducting high-temperature spontaneous imbibition (SI) experiments have been proposed. The set-up mainly focuses on minimizing interrupting the SI process during the experimental period. We have also been able to test its flaws and ultimately updated it. All the SI experiments in this work were done using this proposed setup.

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### MDPI Energies Student Poster Award

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### Country

Norway

### References

- Anderson, W. G., et al. Wettability literature survey-part 1: rock/oil/brine interactions and the effects of core handling on wettability. Journal of petroleum technology 1986,38, 1-125.

## **Time Block Preference**

Time Block B (14:00-17:00 CET)

## **Participation**

Online

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