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A laboratory investigation of the effects of temperature, hardness, surfactants and alkaline on oil recovery from carbonate reservoirs using spontaneous imbibition tests

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More than 50% of the known petroleum reserves are stuck in carbonate reservoirs, which can be divided into limestone, chalk and dolomite. On average, the oil recovery from carbonates is below 30% due to low water wetness, natural fractures, low permeability, and inhomogeneous rock properties. Therefore, there is increasing interest to improve oil recovery from carbonate reservoirs, as we are challenged to make up depleted reserves. Although there is a great potential to improve oil recovery in carbonate reservoirs, the research in this area is very limited due to technical and economic challenges. Chemical enhanced oil recovery research in carbonate reservoirs has been focused on using such as surfactant and alkaline increase oil recovery or to change oil-wet to more water-wet to enhance water imbibition into matrix blocks. Wettability alteration results in spontaneous imbibition of water into oil containing matrix, thus driving oil out of the matrix. Wettability alteration has been formulated with surfactant adsorption, and relative permeability and capillary curves are modified based on the degree of wettability alteration. Many researches have been investigated in a lab scale like: How a wettability of reservoir rocks affected in oil recovery? and how wettability alteration can be controlled to maximize the oil recovery in limestone rocks? The objective of this study is to investigate the effects of temperature, hardness, surfactants and alkaline on oil recovery from limestone rock. In order to investigate the effect of these parameters, the limestone rocks were placed in the oven in brine to simulate realistic reservoir conditions. Then, they were aged in crude oil in the oven. After that, the solution with various compositions of surfactant, alkaline and hardness were tested by spontaneous imbibition test. The spontaneous imbibition test in this study was performed at 25°C and 80°C with different limestone rocks. The results show that, at high temperature, the oil recovery is higher than at low temperature. The hardness has various impacts on the wetting properties. SO−42 and $Ca^{2+}$are important in changing wettability on limestone surface and were proved by increase in oil recovery. Mg2+ ion effects were demonstrated by the very small increase in oil recovery. The alkalinity has increased oil recovery from limestone rocks.

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Comparison of different types of feed-stocks for hydrothermal liquefaction

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The recovery of biocrude from biomass is gaining interest because of its potential use in the sector of renewable energy systems. Hydrothermal liquefaction (HTL) is one of the prospective technologies to utilize biomass for biofuel production. Almost all biomass feed-stocks are feasible sources for biomass liquefaction with few exceptions in condition when technical, economical and environmental issues are properly addressed. This paper has made a comparative discussion of potential feed-stocks that can be used for HTL process. It has been found that liquefied biocrude of good yield could be obtained from different feed-stocks, except Jatropha cakes for which HTL experimental data is lagging. Depending on structural composition of feed-stock, bio-oil yield and heating values are as follows: Algae cakes (46% and 26 MJ/kg), Pinus sylvestris (34.9% and 24.6 MJ/kg), vegetable wastes (27.6% and 16.83 MJ/kg). These results show that algae cakes have comparatively better liquefaction result and thus has tremendous potential as a host for producing biocrude from biomass resources.

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