Investigating Al₂O₃ Nanofluid Based on Seawater and Effluent Water Mix for Water Injection Application; Sandstone

Authors : Meshal Al-Samhan, Abdullah Al-Marshed

Abstract : Recently, there has been a tremendous increase in interest in nanotechnology applications and nanomaterials in the oilfield. In the last decade, the global increase in oil production resulted in large amounts of produced water, causing a significant problem for all producing countries and companies. This produced water deserves special attention and a study of its characteristics to understand and determine how it can be treated and later used for suitable applications such as water injection for Enhance Oil Recovery (EOR) without harming the environment. This work aims to investigate the prepared compatible mixed water (seawater and effluent water) response to nanoparticles for EOR water injection. The evaluation of different mix seawater/effluent water ratios (60/40,70/30) for their characteristics prior to nanofluid preparation using Inductive Couple Plasma (ICP) analysis, potential zeta test, and OLI software (the OLI Systems is a recognised leader in aqueous chemistry). This step of the work revealed the suitability of the water mix with a lower effluent-water ratio. Also, OLI predicted that the 60:40 mix needs to be balanced around temperatures of 70 ºC to avoid the mass accumulation of calcium sulfate and strontium sulfate. Later the prepared nanofluid was tested for interfacial tension (IFT) and wettability restoration in the sandstone rock; the Al2O3 nanofluid at 0.06 wt% concentration reduced the IFT by more than 16% with moderate water wet contact angle. The study concluded that the selected nanoparticle Al2O3 had demonstrated excellent performance in decreasing the interfacial tension with respect to the selected water mix type (60/40) at low nanoparticles wt%.

Keywords : nano AL2O3, sanstone, nanofluid, IFT, wettability