

عنوان مقاله:

An Experimental Approach For Evaluation of Wettability Alteration by Nanoparticles During Water Flooding to Heavy Oils

محل انتشار:

هفتمین کنگره ملی مهندسی شیمی (سال: 1390)

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خلاصه مقاله:

It is well known that the displacement efficiency of EOR processes is mainly affected by wettability of porous medium; however, the role of nanoparticles on wettability alteration of pores surfaces has remained a topic of debate in the literature. Furthermore, a little is known about how the dispersed silica nanoparticles affect the microscopic/macroscale recovery efficiency of heavy oils during common immiscible processes such as water flooding. In this study, a series of injection experiments was performed on five-spot glass micromodel which is initially saturated with the heavy oil. Distilled water and dispersed silica nanoparticles in water (DSNW) at different values of weight percent were used as injected fluids. The macroscopic efficiency as well as fluid distribution in the pores and throats was monitored from analysis of continuously provided pictures during the experiments. Contact angles of the glass surfaces at different conditions of wettability were measured by using sessile drop method when the glass surfaces coated by heavy oil, distilled water and the solutions of DSNW. The results revealed that the silica nanoparticles caused enhancement of sweep efficiency during water flooding and this enhancement was intensified by increasing the silica nanoparticles percent in water. And also, ultimate efficiency for DSNW (0.1%w) flooding increased by a factor of 8.7% in comparison to distilled water flooding. This increment in oil recovery was reached to 26% by increasing silica nanoparticles weight percent from 0.1%w to 3%w. The distribution of DSNW solution during flooding tests in pores and throats showed strong water-wet condition after flooding with high concentration of nanosolution. The results of sessile drop experiments showed that coating with heavy oil, could make an oil-wet surface. While, coating with distilled water could partially alter the wettability of surface to water-wet and coating with high concentration of DSNW could make a strongly water-wet surface. The hydrophilic nature of selected silica nanoparticles is responsible for wettability alteration of the micromodel from oil-wet to water-wet. Results of this work disclose the effect of silica nanoparticles on wettability alteration of pores surfaces as well as on enhancement of microscopic/macroscale efficiency during DSNW flooding to heavy oils.

کلمات کلیدی:

Wettability Alteration, Dispersed Silica Nanoparticles, Heavy Oil Recovery, Five-Spot Micromodel, Water Flooding

