

Surfactant and Polymer-Nanoparticle Interaction with Heavy Crude Oil

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Abstract

Surfactant flooding has been proven to be effective in recovering large quantity of residual oil which is not possible to be recovered by primary and secondary schemes. Surfactants contribute towards enhanced sweep efficiency that brought forward with higher capillary number and thereby facilitate interfacial tension (IFT) reduction, wettability alteration, emulsion formation and better sweep efficiency to improve oil recovery. Surfactant adsorption characteristics have been extensively studied for various combinations of surfactants (ionic and non-ionic surfactants and natural surfactants) and reservoir core samples (reservoir rocks, sandstone and Berea cores). In order to determine the adsorption capacity of surfactant on Assam reservoir rock at constant temperature, four different adsorption isothermal models were applied. The interaction of polymer and silica nanoparticles with heavy crude oil to enhanced properties which are responsible for higher oil recovery was also studied. The stability of the nanoparticles in the xanthan gum polymer solution was identified by particle size and zeta potential analysis. The reduction in interfacial tension (IFT), emulsification of crude oil, creaming rate, rheology properties and wettability alteration of the system for polymer-nanoparticles synergy were investigated and based on which an optimum concentration of 5000 ppm xanthan gum and 0.3 % silica nanoparticles were obtained. The change in contact angle from 86.2 to 18.8° results in wettability alteration of the system from intermediate wet to water wet. The core flooding experiments performed resulted in oil recovery of 21% at 30°C and 19% at 80°C which clearly indicates the effective performance of silica nanoparticles at elevated temperature.

Keywords

Enhanced oil recovery, Surfactant, Adsorption, Polymer-nanoparticles.

Biography

Dr. Pankaj Tiwari is an Associate Professor in the Department of Chemical Engineering at Indian Institute of Technology Guwahati, India. He has received his PhD degree from the University of Utah, USA in 2012. His research area focuses on Biofuel Production, Pyrolysis, Enhanced Oil Recovery schemes, Reservoir Engineering, Multiphase Flow Phenomena.