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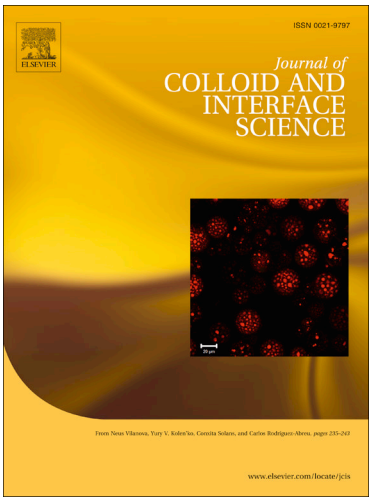

Regular Article

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Nanoparticle-enabled delivery of surfactants in porous media

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ABSTARCT

The adsorption of surfactants on the reservoir rocks surface is a serious issue in many energy and environment related areas. Learning from the concept of drug delivery in the nano-medicine field, this work proposes and validates the concept of using nanoparticles to deliver a mixture of surfactants into a porous medium. In this study, TiO_2 nanoparticles (NPs) are used as carriers for a blend of surfactants mixtures including anionic alkyl aryl sulfonic acid (AAS) and nonionic alcohol ethoxylated (EA) at the optimum salinity and composition. The transport of NPs through a core sample of crushed sandstone grains and the adsorption of surfactants are evaluated. By using TiO_2 NPs, the adsorption of surfactant molecules can be significantly reduced, i.e. half of the initial adsorption value. The level of surfactant adsorption reduction is related to the NPs transport capability through the porous medium. An application study shows that comparing to surfactant flooding alone, the total oil recovery can be increased by 7.81% of original oil in place (OOIP) by using nanoparticle bonded surfactants. Such work shows the promise of NP as an effective surfactant carrier, which has many potential applications in enhanced oil recovery (EOR) and environmental remediation.

Keywords: Nanoparticles, surfactant delivery, surfactant adsorption, enhanced oil recovery.