



Surfactant-modified native soil in the treatment of oil field (Nimr) produced water

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ABSTRACT

In this study, we investigated the possibility to use surfactant-modified and unmodified native sand (Oman) for the treatment of oil field (Nimr) produced water. Dodecyltrimethylammonium (DDTMA) bromide was used to modify the sand properties. In our approach, surfactant was added to the contaminated water and the resulting aqueous surfactant solution was forced to percolate through the column packed with native soil. Thus, in this approach, soil modification by the surfactant molecules occurs during the water treatment process. Rejections of the crude oil aromatic components were estimated using a new and simple approach based on the measured total fluorescence emission ratio A_p/A_0 , where A_p is the total fluorescence area of the permeate and A_0 the total fluorescence area of the untreated water. Our results from the packed column with unmodified native sand showed substantial rejection of aromatic hydrocarbons (~85%) only for the first individual 100 mL permeate sample collected. As the cumulative volume of permeate increases up to 1000 mL, the rejection decreases to less than 10%. When surfactant was added to the feed (contaminated Nimr water) at 10^{-4} M (below the surfactant CMC), complete rejection occurred only with the first individual 100 mL permeate sample collected, followed by a decrease in the rejection to about 45% rejection as the cumulative permeate volume reached 1000 mL. On the other hand, when the surfactant was added above its CMC (5×10^{-4} M and 1×10^{-3} M), all individual 100 mL (10 separate individual 100 mL samples) were practically free of aromatics (~100% rejection). Thus, complete rejections occurred only at and above the surfactant critical micelle concentration. This concentration-dependent rejection of the aromatics was associated to the concentration-dependence of the surfactant onto the substrate surface.

Keywords: Surfactant, Rejection, Surfactant-modified soil, Adsorption, Aromatic components

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