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Organic bases, carbon dioxide and naphthenic acids interactions. Effect on the stability of petroleum crude oil in water emulsions.

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ABSTRACT

Understanding the mechanisms that lead to the formation of petroleum crude oil in water emulsion is fundamental for the development of sustainable exploitation procedures and efficient oil spills remediation technologies. In this study we surveyed the effectiveness of different nitrogen-containing organic bases in promoting emulsification through the interaction with the naphthenic acid fraction present in crude oil. It was found that bulky secondary amines were the most effective, able to stabilize the emulsion at 10 wt% of oil content for more than 20 min, and the emulsion at 40 wt% for more than 5 hours. Interfacial tension measurements indicated that the interaction was effective even when naphthenic acids were dosed at very low levels (total acid number less than 0.3). It was also observed that a successive addition of carbon dioxide to the system readily induced the breaking of the emulsion, probably by affecting the equilibrium involved in the formation of the naphthenates stabilizing species. In the light of these findings, we tested polyethylene glycols bearing a terminal amino moiety as a new class of CO₂ responsive emulsifiers suitable for the petroleum industry.

Keywords: crude oil; O/W emulsion; CO₂; organic bases; naphthenic acids; responsive materials.

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