CO_2-foams stabilized by SDS-CAHS surfactant mixture

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ABSTRACT

Foam-assisted enhanced oil recovery is a cost-effective way of reducing gas mobility and improving sweep efficiency in heterogeneous reservoirs. In the case of Brazilian Pre-Salt oil reserves, this method can be combined with carbon capture and storage (CCS) methods, due to the large volumes of CO_2 in the produced gas. However, low stability of CO_2-foams due to coarsening and coalescence in the saline environment has been a drawback in the implementation of successful flooding strategies. The objective of the present work was to investigate the potential of using surfactant mixtures of sodium dodecyl sulfate (SDS) and cocamidopropyl hydroxysultaine (CAHS) to produce stable CO_2-foams in synthetic seawater brine, at 25 and 80 °C. The results showed that the foams produced from the mixtures were more stable than from individual surfactants, except near the equimolar ratio, where phase separation was observed. The most stable foam was obtained with SDS mole fraction (x_{SDS}) of 0.33 and 1wt% total surfactant concentration (Fig. 1). Rheological measurements showed that there is a linear correlation between CO_2-foam half-life and zero-shear viscosity of solutions. Viscoelastic behavior was observed in mixtures with best foaming stability, which was attributed to the formation of larger surfactant aggregates such as rod-like micelles in bulk, induced by the presence of inorganic salts. In addition, the viscosity of the foaming mixtures had a direct influence in the foam quality, which is relevant for foam applications in porous media and in CCS strategies.

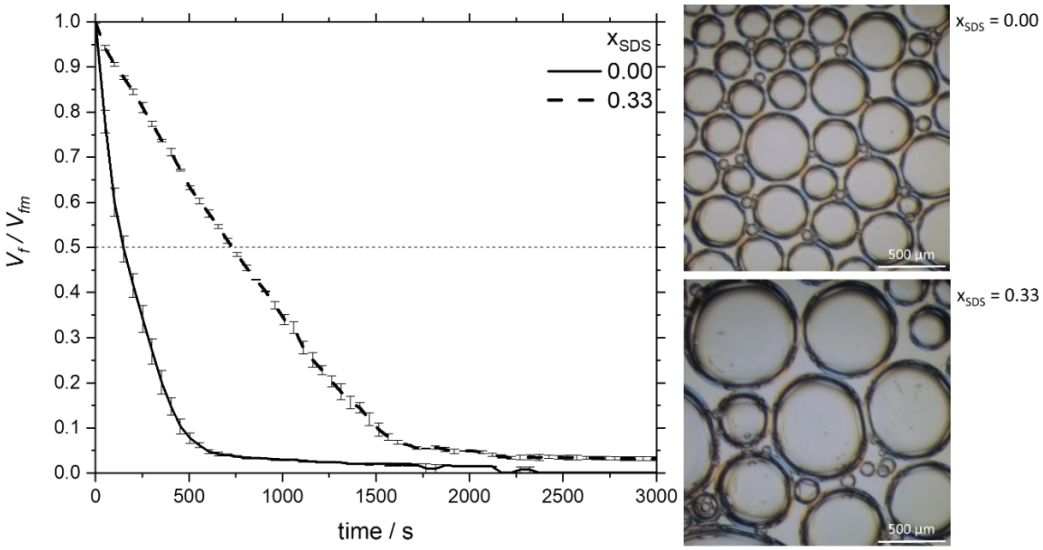

Figure 1: Time stability of CO_2-foams at 1wt% total surfactant concentration and their bubbles at 0 s.