

The effect of pressure on the phase behavior of surfactant systems: An experimental study

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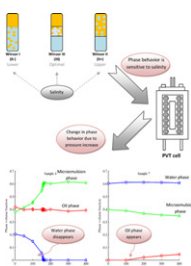
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HIGHLIGHTS

- ▶ We investigated the pressure effect on phase behavior of surfactant systems.
- ▶ Different water–oil ratios are investigated, while constant salinity and SAR.
- ▶ Formation of microemulsion phase is dependent on the pressure.
- ▶ It is observed that combined increase in pressure and temperature creates more pronounced influence on the phase behavior.

GRAPHICAL ABSTRACT



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ABSTRACT

Enhanced oil recovery is employed in many mature oil reservoirs to maintain or increase the reservoir recovery factor. In this context, surfactant flooding has recently gained interest again. Surfactant flooding is the injection of surfactants (and co-surfactants) into the reservoir, in order to create microemulsions at the interface between crude oil and water, thus obtaining very low interfacial tension, which consequently helps mobilize the trapped oil.

In this work a surfactant system, which has been thoroughly described at atmospheric pressure, is examined at elevated pressure. The effect of temperature is also explored. It was found that the phase behavior in the system water/sodium dodecyl sulfate (SDS)/1-butanol/heptane/sodium chloride was significantly changed by an increase in pressure. When an increase in pressure is combined with an increased temperature the phase behavior of the system is influenced to an even greater extent. It was concluded that at certain compositions of the surfactant system (near to the phase boundary found at atmospheric pressure) the increase in pressure changed the phase behavior (for example causing the system to move from two phases to three or vice versa). The sensitivity of the surfactant system depends very much on the overall composition as well as the magnitude of the pressure and temperature change.

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1. Introduction

Around half of the world's crude oil reserves remain trapped in reservoirs after conventional recovery methods have been applied. Enhanced oil recovery (EOR) is therefore increasingly applied in

order to increase the reservoir recovery factor. In the EOR technique known as surfactant (or chemical) flooding, the phase behavior properties inside the reservoir can be advantageously manipulated by injecting surfactants (and usually co-surfactants) into the reservoir. The phase behavior in these surfactant systems is the decisive factor determining the success of a chemical flood [1]. However, there are at present no equations of state that can adequately describe the phase behavior of such complex systems. It is therefore essential that the phase behavior is experimentally determined in

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