Anti-agglomeration in Cyclopentane Hydrates from Bio- and Co-surfactants

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Abstract :

Hydrate formation in subsea pipelines is a serious problem in gas and oil production for offshore fields. Current methods are mainly based on thermodynamic inhibitors to change bulk phase properties. Thermodynamic inhibitors, such as methanol, are very effective, but large quantities, sometimes as high as a 1:1 volume of alcohol/water, are required. Kinetic inhibitors generally in a 0.005−0.02 volume ratio of surfactant/water can either inhibit hydrate formation or reduce the rate of growth. In the sea bed, the subcooling for hydrates is around 20−25 °C because of the sea bed temperature of about 4 °C. The kinetic inhibitors are not effective at such a high subcooling. An effective method is the use of anti-agglomerants, which allow for hydrate formation in the form of small particles and prevent agglomeration of such particles. Rhamnolipid biosurfactant and methanol are used recently to demonstrate anti-agglomeration in tetrahydrofuran (THF) hydrates. In this work, we present data for cyclopentane hydrates to demonstrate that a mixture of rhamnolipid and methanol is the ideal combination for effective anti-agglomeration. The formation of cyclopentane hydrates is believed to be closely analogous to methane hydrate formation because of the low solubility of cyclopentanes in water and various aspects of crytallization.

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