

An Experimental Investigation on Rheology of Condensate Oil/tetrahydrofuran Hydrate Slurry

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ABSTRACT

In this paper, an experimental research on rheology of condensate oil/tetrahydrofuran hydrate slurry was carried out. The aim of this experiment was to determine the effect of original water fraction, shear rate, the viscosity of oil-water emulsion and concentration of tetrahydrofuran on the rheological behaviors of condensate oil/tetrahydrofuran hydrate slurry.

KEY WORDS: hydrate; rheology; slurry

INTRODUCTION

Offshore oil production lines frequently operate under high pressure and low temperature. At these conditions, the well fluid in the flowline, without protection, can easily form hydrates and wax solids. Once hydrates form in a pipeline, individual particles agglomerate together and form a plug in the pipeline preventing fluid flow^[1]. A lot of methods have been used to prevent hydrate formation, like injection of chemicals, methanol or glycol to the flowline. As the trend of oil and gas industry is currently moving into deeper production and colder water, the quantity of thermodynamic inhibitors required to prevent hydrate formation will become economically infeasible. Another method that is used is heating of the pipeline to keep the temperature in the flowline as high as possible. Another frequently used method is depressurization. However, the drawback for all these methods is that they are expensive, difficult and can often result in lost production.

In oil-dominated system, the injection of anti-agglomerants is an alternative technology on hydrate prevention in pipelines at deepwater production. This technology aims to eliminate the need for injection of chemicals and heating under normal operating conditions at seabed. Anti-agglomerants do not avoid hydrate formation, but prevent crystal agglomeration and, consequently, allow crystals to be transported as hydrate slurry. Hydrate crystals formed in water-in-oil emulsion would be transportable as a suspension, without the need for further chemical

injection. Studying the rheology of hydrate slurry is seen as one of the possible methods that may allow the prediction of hydrate transportation capabilities of oils under realistic production conditions. A better knowledge of its rheological behavior is essential to improve the design of pipelines for transporting oil and hydrate mixtures, since viscosity is a very important variable in pressure drop calculation^[2].

The main purpose of the work is to analyze the rheology behavior of the hydrate slurries formed from water-in-oil emulsions under the same pressure and temperature conditions.

EXPERIMENTAL SETUP AND EXPERIMENTAL MEDIUM

A NJD-1B concentric cylinder viscometer, made by Shanghai Changji geological instrument factory, is used to measure slurry viscosities. A diagram of this viscometer is shown in Figure 1.

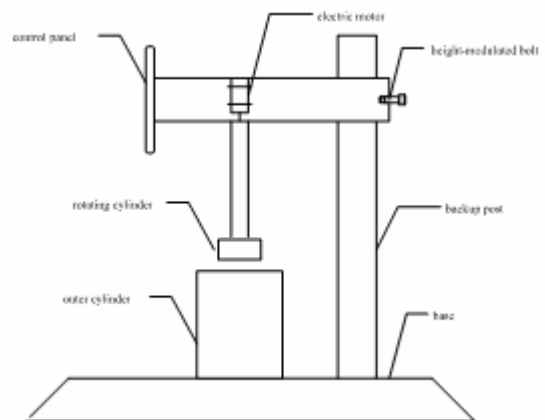


Fig.1 NJD-1B concentric cylinder viscometer

This viscometer has a double cylinder configuration and works with