TRANSPORTABILITY AND PLUGGING RISK FOR UNDER-INHIBITED NATURAL GAS HYDRATE SYSTEMS

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ABSTRACT

As oil and gas production moves further offshore and into deeper waters more attention must be given to managing gas hydrates. Traditionally gas hydrate formation has been avoided by adding sufficient amounts of chemical inhibitors (e.g. methanol or MEG). Hydrate inhibition chemicals are expensive and establishing an inhibitor supply line can also be technically challenging. Limiting use or complete removal of chemical inhibitors in the operation of multiphase transport pipelines is of interest to the petroleum industry.

This paper presents the experimental results and effects of operating conditions on hydrate transportability. Flow loop tests were performed to study what amounts of hydrates could be transported under various operating conditions and in various mixtures of oil, gas, and water. Fixed and well-controlled amounts of hydrate were transported for several hours, and the influence of hydrate formation on the frictional pressure drop was observed in the loop. The loop tests showed that between 10 and 35 vol % hydrates can be transported in the liquid phase. The blocking threshold depends on the nature of the liquid phase, such as the presence of a condensate phase or chemical inhibitor, as well as the operating conditions.

Blockages will occur for hydrate volume fractions greater than 0.35. Two types of blockages were seen. The first originates from hydrates apparently sticking to the pipe wall and forming plugs (denoted “hard” plugs) while the other type is the result of an increased bulk phase viscosity due to the dispersed hydrates to the point flow was not possible (denoted “soft” plugs). The findings may ultimately help pipeline operators define and deploy innovative hydrate management and transport strategies while reducing the use of chemical inhibition.

Keywords: gas hydrates, hydrate kinetics, hydrate transportability, plugging.