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H2S SCAVENGERS INJECTION: A NOVEL EVALUATION PROTOCOL TO ENHANCE THE INTEGRITY OF PRODUCTION LINES

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Abstract

The phenomenon of reservoir souring occurs when the concentration of hydrogen sulfide (H_2S) increases in the produced fluids. The origin of H_2S has generally been linked with secondary recovery operations. One common secondary recovery operation involves the injection of water, often seawater. Many oil operators have associated seawater breakthrough with subsequent souring. H_2S can also have geological origin (e.g. thermal decomposition of organic sulfur compounds which are present in some crude oils).

The corrosiveness of co-produced water from the oil reservoir will consequently change with reservoir souring. Though carbon dioxide can cause very severe corrosion (i.e., general and pitting) of steels, H_2S corrosion is more localized, and can cause cracking. Hence, increasing H_2S will not necessarily cause a linear increase in general corrosion rate, but rather induce sudden failures in susceptible materials.

One alternative to mitigate the effects of H_2S in oil and gas production facilities is the injection of H_2S scavenger chemicals at suitable points in the system. Liquid scavengers react with H_2S to form stable water- or oil-soluble reaction products.

The effects and performance of H_2S Scavengers at various operational parameters (i.e., type of crude, water cut, temperature, contact time, and flow pattern) are not completely understood. A laboratory testing protocol and experimental equipment was designed and constructed in order to: (1) evaluate the performance of H_2S scavengers under simulated multiphase flow field conditions, and (2) facilitate the selection of commercial products to be injected into oil lines through a gas-lift system and/or through umbilical lines.

This work presents field and laboratory data as well as a description of the basis of computational modeling developed for the control of H_2S in off-shore production fluids through the injection of liquid H_2S scavengers through gas lift or umbilical line. The ultimate goal of this chemical treatment is to control the corrosion of carbon steel risers for a reliable operation during the lifetime of the producing wells by controlling the levels of H_2S.

The major achievement of this work is the development of a testing and simulation approach to select the best chemical treatment and optimal doses minimizing the cost and uncertainties associated to field trials particularly when production conditions change.

Some technical contributions to the current state of the art are:

- ✓ An improved design of downhole chemical treatment protocols through gas lift or umbilical lines.
- ✓ An improved understanding of the impact of operational parameters in the efficiency of H_2S sequestration in production fluids.
- ✓ A unique testing apparatus and computer model for the study of H_2S scavengers' kinetics as a tool for the

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