New heat generation process for remediation of petroleum deposition

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Deposition is responsible for the loss of millions of barrels of production in the petroleum industry each year. Deposition can occur anywhere from the near-wellbore formation, to within wells, on downhole equipment, to flowlines, to surface processing equipment, and in storage tanks. Deposits can come from constituents within the petroleum, associated produced water, or combinations thereof. Paraffin, asphaltene, hydrate, and inorganic scale deposits are very common in the petroleum industry. Deposits or problems with other constituents such as naphthenates, diamondoids, sludge, schmoo, and emulsion blocks also occur.

In this presentation, a new heat generation process for the remediation of petroleum deposition will be discussed [1]. The process uses an exothermic reaction occurring within an organic solvent / dispersant fluid system. As such, it is particularly suited towards the removal of organic deposition; like asphaltene and paraffin deposition. It is especially beneficial in hard-to-access locations where the generation of heat directly at the deposit source would greatly aid deposit removal. These include locations such as in cold deepwater flowlines, near-wellbore regions of low bottomhole temperature wells, and tank bottoms.

In comparison to the nitrogen / heat generation process from the reaction of sodium nitrite with ammonium nitrate or ammonium chloride, there are some potential advantages of the new proposed remediation process. The nitrogen / heat generation process has been used over two decades within the petroleum industry. It was originally patented by Shell [2-3] for unloading gas wells, but has been used effectively for deposition remediation in numerous Petrobras SGN applications [4-5] and in some Baker Hughes N-Situ [6-7] applications. The process reactions are, however, carried out within an aqueous solution. Having an organic hydrocarbon solvent / dispersant fluid system as in the new proposed remediation system offers a potential advantage in contacting and solvating organic deposition. In addition, safety concerns with excess pressure generation are lessened from that in the nitrogen generation process.

The new remediation process uses the reaction of various terpene structures catalyzed with sulphuric or sulfonic acids. Terpenes are naturally occurring, biosynthesized structures containing repeating isoprene (C_5H_8) units. These structures contain reactive olefin functionalities with a relatively large heat of reaction. Compounds in the monoterpene class have two isoprene units. These include compounds such as limonene and pinene which are the primary constituents in some readily available, environmentally friendly solvents.

This presentation will discuss the terpene reactions and give examples of different laboratory experiments illustrating the potential of the proposed remediation process. Laboratory reactions have been carried-out generating temperatures up to ~200°C and above. Thoughts on full development of the process for commercial applications will also be given, including discussing specific potential applications and application methods.

References

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