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# Effectiveness of calcium sulfate scale inhibitors in spent hydrochloric acid/seawater system

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Many publications have reported the precipitation of calcium sulfate scale during HCl-based acid treatments. Dissolved calcium ions by acid solution will combine with sulfate ions from seawater (around 3,400 ppm) to precipitate calcium sulfate scale and cause severe damage on the permeability of carbonate reservoirs. The object of this study is to evaluate the effectiveness of 6 different types of scale inhibitors on the inhibition of calcium sulfate scale.

Scale inhibition efficiency was determined in both batch tests and core flood tests under different temperature conditions (77 to 250$^0$F). Calcium, magnesium, and sulfate ions, and scale inhibitor concentrations were analyzed in the samples from the batch tests and core effluent. In addition, the effect of different factors on the efficiency of each scale inhibitors were discussed, including pH, temperature, sulfate ion concentration and presence of magnesium ions.

Results show that application of scale inhibitors can successfully mitigate calcium sulfate scale formation up to 150$^0$F. At higher temperature (up to 250$^0$F), the rate of calcium sulfate precipitation increases and the effectiveness of all types of scale inhibitors decreased greatly. The effectiveness of phosphonate-based scale inhibitors are greatly reduced by high concentration of calcium ions in solution. At 250$^0$F, sulfonated polymer-based scale inhibitor was the most effective ones in various experimental conditions. However, the polyacrylic acid-based scale inhibitor was greatly affected by the concentration of magnesium ions. The findings in this study provide information for better calcium sulfate scale in acid stimulation conditions.

## Biography

Jia He is a Ph.D. candidate at Texas A&M University in petroleum engineering. His research interests include oil filed scale prediction and chemical treatments, $CO_2$ sequestration, cost effective acidizing treatments, and innovative acid fracturing fluids studies. He has published several SPE papers and journal papers. He holds a BE degree from Eastern China University of Petroleum and MS degree from Texas A&M University, both in petroleum engineering.

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