Slug Dosing Glutaraldehyde for Optimum Microbial Control

When it comes to protecting produced waters and drilling fluids from microbial contamination, how a biocide is applied can be just as important as biocide choice. Glutaraldehyde remains one of the most widely specified oilfield biocides because of its proven efficacy against some of the industry’s most rigorous biocide challenges. And while it performs well when used on a continuous feed basis, a recent study verifies that the performance and cost-efficiency of UCARCIDE™ Antimicrobials (glutaraldehyde-based products) can be optimized when they are slug-dosed into a system.

A biofilm was the chosen microbial challenge for the study. Not only is it one of the most difficult microbial challenges facing oilfield operators, but also since these sessile organisms are easier to prevent than remove, a low continuous feed approach is often the treatment mode of choice. A model biofilm, in the form of alginate beads, was prepared using produced water from an Alaskan oilfield. The beads contained sulfate-reducing bacteria and iron sulfide, in addition to corrosion and scale inhibitors, hydrocarbons and other contaminants. The use of beads formulated from actual produced water allowed examination of the biocide’s ability to penetrate the biofilm and its efficacy against planktonic organisms. UCARCIDE Antimicrobial products and THPS (tetrakis hydroxymethyl phosphonium sulfate) were the biocides chosen for the study.

During the study, both biocides were dosed at various increments totaling 50 ppm per hour and 100 ppm per hour. For example, the 50 ppm per hour treatment included applications of 100 ppm of biocide for 30 minutes; 50 ppm of biocide applied for one hour and 25 ppm of biocide applied for two hours. Similarly, the 100 ppm protocol included the application of 100 ppm of biocide for one hour; 50 ppm of biocide for two hours and 25 ppm of biocide for four hours.
Figure 1 shows the results of the 50-ppm per hour treatment against planktonic microorganisms, while Figure 2 provides the results of the same treatment on sessile organisms. Both confirm that greater biocide concentrations dosed for shorter periods of time result in significantly higher levels of penetration and kill.

Figures 3 and 4 present the results of the 100-ppm protocol on planktonic microorganisms and sessile organisms, respectively.

Again, the results show that efficacy improves as biocide concentrations increase and dosage times decrease. The lower levels of performance for THPS are most likely the result of the demand that was placed upon the biocide by the combined effects of the microorganisms, biofilm and iron sulfide. UCARCIDE Antimicrobials do not react with iron sulfide and therefore demonstrate greater efficacy against the microorganisms and biofilm.

As is evident, slug-dosing with UCARCIDE Antimicrobials can provide unrivaled advantages when compared to a low dose, continuous feed treatment approach. This slug-dose method can result in smoother operations and the potential for increased production efficiency for oilfield operations.
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