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Numerical Evaluation of Biocide Treatment against Sulfate Reducing Bacteria in Oilfield Water Pipelines

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A simple two-dimensional mathematical model capable of describing the interactions taking place in the bulk fluid and biofilm between sulfate reducing bacteria (SRB), substrates and biocide agents was used for the numerical evaluation of biocide treatment against SRB. The characteristics inherent to thick biofilms formed in large diameter oilfield pipelines were taken into account by assuming that the biocide treatment will remove little of the biofilm and not kill the SRB present in the biofilm. The evaluation model considered SRB disinfection/proliferation, and biocide deactivation within the bulk fluid, as well as many features of biofilm interactions with the bulk fluid such as mass transfer, live SRB detachment and biocide agent deactivation. These interactions are represented by simple coefficients as far as possible. Simulation results, using reported kinetic parameters for SRB, acetate and biocide agents such as chlorine and glutaraldehyde, showed that biocide treatments in oilfield water pipelines are sensitive to the disinfection rate coefficient and the biocide agent concentration as well as to the decay rate coefficient of the biocide agent in the bulk fluid, but are not sensitive to the biocide deactivation rate on the biofilm surface, nor to the SRB concentration in the biofilm. Various extreme conditions of biocide treatments were simulated using the proposed discretization method, which was adapted to take into account the biofilm interactions with the bulk fluid, to investigate the sensitivity of the numerical method and the suitability of the model developed to determine minimum effective biocide concentrations.

Keywords: [Sulfate reducing bacteria](#), [Biocide effect](#), [Biofilm](#), [Pipeline](#)

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