Numerical study of adsorption enhancement by nanoparticles scale inhibitor

ABSTRACT

This paper describes the numerical investigation on the adsorption () of nanoparticles (NPs) scale inhibitor (SI) using Eulerian Computational Fluid Dynamics (CFD) solver ANSYS/FLUENT® based on a scaled down flow model. The simulation were done to investigate theof normal and nanoscaled Calcium-phosphonate. The phosphonate used was 1-hydroxyethylidene-1, 1-disphosphonic acid (HEDP) SI in order to determine the enhancement in adsorption achieved by the nanoscaled SI. This was done by looking at the change in concentration of the SI particles throughout the simulation time. It was found that the two sizes (normal and nanostructured) of the SI particles result in different change in concentration, hence indicates that the two yields different adsorption to the active sites. For the normal SI, the concentration distribution throughout the column remains almost the same as its initial concentration () of 2000 ppm except for very narrow regions in the vicinity of the wall boundaries. This suggests that the rate of process (of the SI onto the wall) is very slow. Consequently, it will take longer time for the SI to be adsorbed to the column wall, hence indicates that it is less efficient. Meanwhile, the nanoscaled Calcium-HEDP SI rapidly shows a significant change in concentration. At 200 s its concentration has distributed evenly in the range of 1960 ppm to 2000 ppm. This shows a really high rate. The results from this study indicates that the nanoscaled Calcium-HEDP SI has better which shows that it is more efficient than normal-scaled Calcium-HEDP SI.

Keyword: Adsorption; Diffusivity; Nanoparticles (NPs); Scale Inhibitor (SI)