In-Situ Scale Inhibitor Interaction With Surface Area Of Porous Sandpack: A Numerical Approach.

Uche C. Anyanwu[1]

[1]Department of Engineering, Robert Gordon University, Aberdeen, AB10 7GJ, Scotland, UK

Abstract

ABSTRACT: Over the years, the most common method of preventing scale formation and blockage of formation pores in oil and gas systems is by squeezing of chemicals into the formation. Different experimental and simulation studies have been carried out to understand the interaction of the squeezed chemicals with the formation surface. In this study, COMSOL Multiphysics 5.3 was used to replicate the results of a literature study and further employed to simulate inhibitor isotherm change with porosity. The node, Transport of Diluted Species in Porous Media of COMSOL Multiphysics 5.3 software was used to simulate the adsorption and desorption isotherms of Methylenephosphonic acid scale inhibitor. In the online report, Linear Driving Force (LDF) model was applied in gProms to study the interaction of Methylenephosphonic acid inhibitor in a packed porous medium. In this present study, 3-D model was carried out and the result correlated with literature reported study. Langmuir adsorption equation was used to fit the adsorption and desorption profiles. There was a good fit between the literature reported isotherms and the COMSOL simulated result. Obtained results showed that scale inhibitor concentration was determinant to the amount of solute adsorbed as well as adsorption rate. Results of simulation showed that there was fast adsorption and shorter equilibrium time at inhibitor inlet concentration of 33.4mol/m3 than at 3.34mol/m3. The effect of porosity on adsorption and desorption behaviour of Methylenephosphonic acid was further examined. Porosity was found to affect adsorption and desorption characteristics of the scale inhibitor. Simulation was carried out by increasing the porosity from 5%, 30% and 40%. It was noted that as the porosity increased, the adsorption rate increased while desorption rate decreased.

Figures used in the abstract

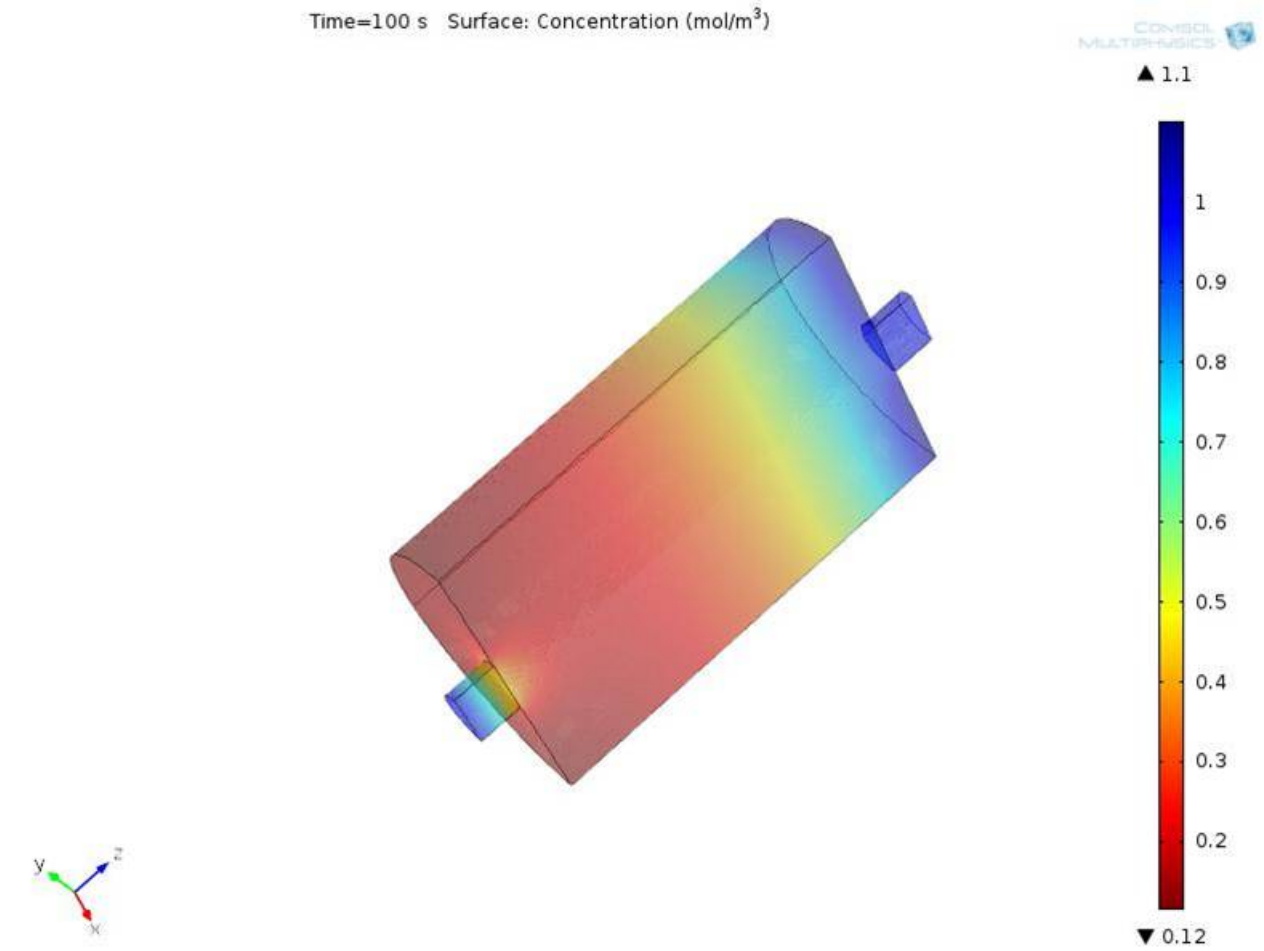

Figure 1 : 3-D Sandpack Geometry

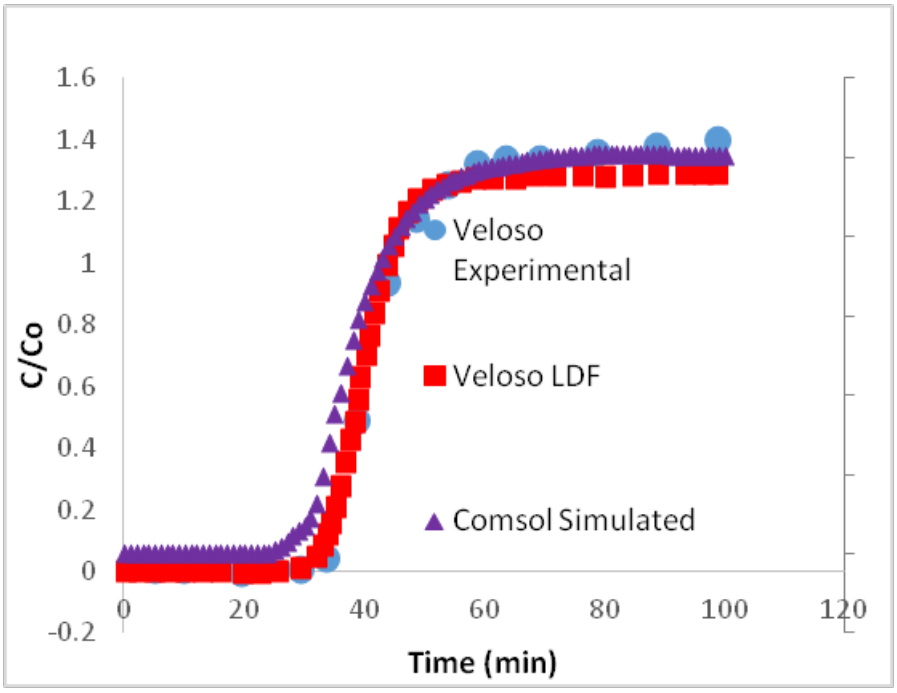

Figure 2 : Adsorption Profile Comparison

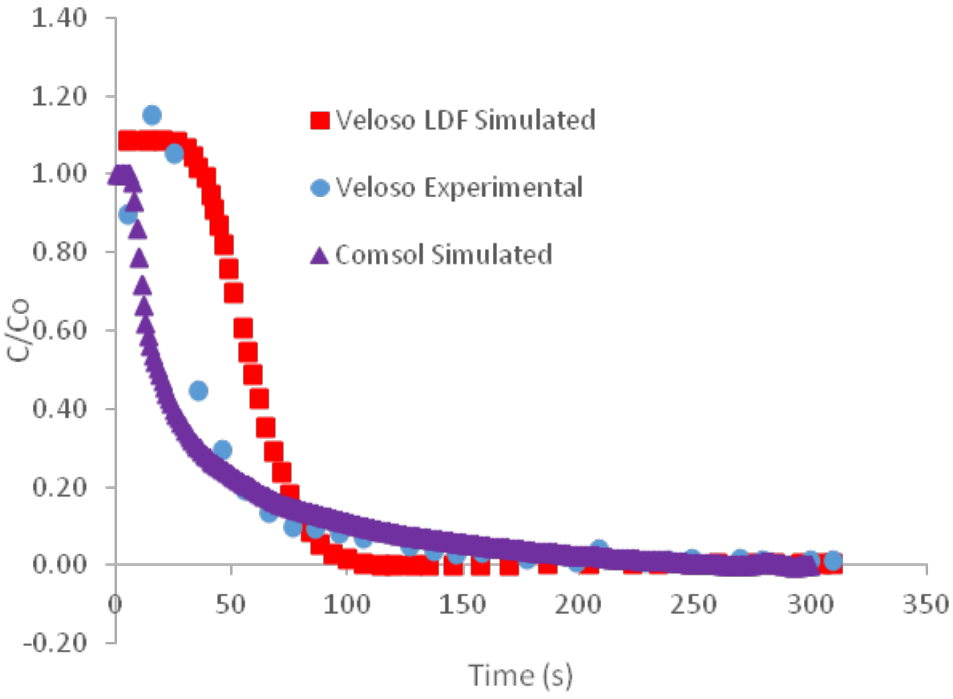

Figure 3 : Desorption Profile Comparison