

Development of an environmentally friendly water-based drilling fluid for Iran oil fields

Meisam Mirarab Razi, Seyed Meisam Sharifi, Hamid Saadati, seyed Nezameddin
Ashrafizadeh, Bahman Behzadi

Department of Chemical Engineering, Iran University of Science and Technology

Meysam_mirarab@chemeng.iust.ac.ir

Abstract

The objective of this study was to develop a water-based drilling fluid which is environmentally friendly. Three three-parameter rheological models, i.e., the Herschel-Bulkley, Robertson-Stiff and Sisko, were considered to describe the pseudoplastic behaviour of drilling fluid. All samples showed non-Newtonian behaviour even at the lower concentrations. Two statistical procedures, i.e., the coefficient of determination (R^2) and the sum of squared errors (SSE), were applied in order to select the best model describing the pseudoplastic behaviour of the high viscosity CMC solutions. The results exhibited that Robertson-Stiff model could more accurately fit the experimental data. Finally, the effect of the temperature and the concentration on the rheological parameters of Robertson-Stiff model, i.e., k , n , and γ_0 , was examined. The developed models for the parameters " k " and " n " could adequately estimate their value as a function of the temperature and concentration, but the model considered for the parameter " γ_0 " had not suitable accuracy where the coefficient of determination (R^2) obtained 0.594. Hence, lowess type method was applied in order to better predict the " γ_0 " values. Different amounts of span in terms of percentage were considered to select which span percentage is the optimum value based on the accuracy of the estimation and the calculation time. It was observed that span 10 % could precisely predict the " γ_0 " value where R^2 and SSE obtained 0.900 and 0.0693, respectively.

Keywords: Carboxymethyle cellulose; Rheological properties; Rheological models; Lowess fit type