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Investigation of Reservoir Permeability Impairment When Drilling with Nano Treated Drill-in Mud System

Emmanuel E. Okoro; Ikechukwu S. Okafor; Samuel E. Sanni; Tamunotonjo Obomanu; Tomiwa Oguntade; Oyinkepreye D. Orodu

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Abstract

A reservoir non-damaging Nano treated aqueous-based drilling fluid was proposed. The study was carried out to obtain a drilling fluid with rheological properties able to keep cuttings in suspension for

transport to the surface, minimize filtration and fluid loss. These rheological properties were also predicted using Artificial Neural Network (ANN) due to limitations of existing flow models in predicting Nano-based mud systems. Different concentrations of the Nanoparticles were added to these suspensions of water to act as filtration loss materials. A total number of 160 data were used to train the ANN which consists of both the input data and output data acquired from the experiment. The study shows good agreement between experimental data and the artificial neural network prediction of plastic viscosity (PV) and yield point (YP), for multiwall carbon nanotubes (MWCNT) formulated muds. The addition of different concentrations of MWCNT (0.5 – 3 g) as rheology modifier-additive was put to test in a field applicable aqueous mud system. The developed neural network has a Mean Absolute Deviation (MAD) of 0.61529, MSE of 0.57174, Root Mean Square Error (RMSE) of 0.75614 and Mean Absolute Percentage Error (MAPE) of 1.92331 for the predicted plastic viscosity and yield point which are all indicative of good levels of accuracy. It is important to explore the reservoir impairment mechanisms so as to improve and optimize the reservoir performance during the production of hydrocarbons. Having satisfied all the conditions, permeability was determined using Darcy's equation. A reduction in permeability within the range of 12 – 16 mD was recorded for the Nano treated water-based mud system.

Keywords:drilling fluid chemistry, drilling fluid selection and formulation, reservoir characterization, machine learning, drilling fluid management & disposal, formation damage, flow in porous media, fluid loss control, engineering, drilling fluids and materials

Subjects:Formation Damage, Drilling Fluids and Materials, Reservoir Characterization, Reservoir Fluid Dynamics, Formation Evaluation & Management, Information Management and Systems, Drilling fluid selection and formulation (chemistry, properties), Drilling fluid management & disposal, Flow in porous media, Neural networks