ARTIFICIAL NEURAL NETWORK MODELING OF VISCOSITY AND WAX DEPOSITION POTENTIAL OF NIGERIAN CRUDE OIL AND GAS CONDENSATE

BY

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ABSTRACT

Artificial Neural Network (ANN) based models were developed for predicting viscosity and wax deposition potentials of petroleum reservoir fluids as a preliminary measure to address the problem of loss of production associated with wax deposition.

Several ANN architectures were trained using supervised paradigms for viscosity modeling and unsupervised paradigms for wax deposition potentials. Input to the model for viscosity prediction was temperature and pressure data of the reservoir well, while wax deposition potential model regime. For viscosity prediction, Levenberg Marquardt (LM), Bayesian Regularization (BR), Brodyen , Fletcher, Goldfarb and Shano (BFG), Powelle-Beale Conjugate Gradient (CGB), Generalized Regression Neural Network (GRNN), Resilient Back-Propagation (RP), Scaled Conjugate Gradient (SCG), and Adaptive Gradient Descent (GDX) algorithms were used in two layers and three layers architectures with tan-sigmoid transfer function in hidden layer and linear transfer function at the output layer. Competitive layer and Probabilities neural networks algorithm were used in the wax deposition prediction model. Five Nigeria crude oil and gas condensate reservoir data were used to validate the models.

The correlation coefficient of viscosity algorithm are: LM (99.84%), CBG (99.76%), SCG (99.72%), BFG (99.75%), GDX (99.71%), GRNN (98.27%), BR (41.10%). The two layer networks trained with LM algorithm for viscosity with twenty six neurons in the hidden layer gave the best performance. The viscosity model developed with ANN has correlation coefficient of 99 81%, while classical regression techniques (CRT), developed had correlation coefficient of 95%, when both techniques were validated with blind data set. ANN competitive wax deposition model developed in this work

excellently identified crude oil and gas condensate potential to deposit wax in upstream and down stream facilities compared to CRT based mathematical model, when validated with Nigerian crude oil and Gas condensate.

The inherent problems of pipeline blockage by wax deposits would be minimized by the application of the predicting models during well development stage prior to production.