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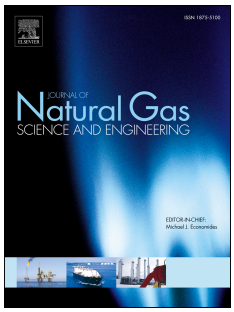

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A Novel Approach to Total Organic Carbon Content Prediction in Shale Gas Reservoirs with Well Logs Data, Tonghua Basin, China

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ABSTRACT

As a geochemical parameter for charactering source rock in shale gas reservoirs, estimation of total organic carbon (TOC) is a main task of geophysical and geochemical studies. TOC can be used to evaluate the hydrocarbon generation potential of source rocks. Artificial intelligence (AI) methods have been proposed recently to obtain TOC from well logs. This avoids expensive and time-consuming core analysis of geochemical experiments. However, the optimal combination (selected) of logs should be determined to get the highest accuracy TOC. We used a well-trained least square support vector machine model to select appropriate well log inputs for intelligent model based on mean impact values. We used a conventional 9 logs obtained from a shale gas well in Tonghua Basin, China, to test our method. The results were compared with 215 TOC values from core analysis. In addition, we tested three AI of models, including artificial neural network based on backpropagation algorithm (ANN-BP), least square support vector machine (LSSVM), and particle swarm optimization-least square support vector machine (PSO-LSSVM). For these three models, both selected logs and all logs are used for comparison. The TOC results, obtained from different calculations, showed that selected logs significantly improved the TOC accuracy in each AI model. By comparing different AI model, we found that PSO-LSSVM model outperforms the other two models. The TOC obtained from the PSO-LSSVM can benchmark with core analysis results.

Keywords:

Total organic carbon (TOC), PSO-LSSVM, Geophysical logs, ANN-BP, Mean impact value (MIV), Shale gas reservoirs