

A Model for Predicting Organic Compounds Concentration Change in Water Associated with Horizontal Hydraulic Fracturing

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Abstract : Horizontal hydraulic fracturing is a technology to increase natural gas flow and improve productivity in the low permeability formation. During this drilling operation tons of flowback and produced water which contains many organic compounds return to the surface with a potential risk of influencing the surrounding environment and human health. A mathematical model is urgently needed to represent organic compounds in water transportation process behavior and the concentration change with time throughout the hydraulic fracturing operation life cycle. A comprehensive model combined Organic Matter Transport Dynamic Model with Two-Compartment First-order Model Constant (TFRC) Model has been established to quantify the organic compounds concentration. This algorithm model is composed of two transportation parts based on time factor. For the fast part, the curve fitting technique is applied using flowback water data from the Marcellus shale gas site fracturing and the coefficients of determination (R²) from all analyzed compounds demonstrate a high experimental feasibility of this numerical model. Furthermore, along a decade of drilling the concentration ratio curves have been estimated by the slow part of this model. The result shows that the larger value of K_{oc} in chemicals, the later maximum concentration in water will reach, as well as all the maximum concentrations percentage would reach up to 90% of initial concentration from shale formation within a long sufficient period.

Keywords : model, shale gas, concentration, organic compounds

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