Investigating the influence of hydraulic fracturing fluid type and well age on produced water quality: chemical composition, and treatment and reuse challenges

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ABSTRACT

This study involves the analysis of produced water from three wells of different fracturing fluid types over a 63-d period. Total organic carbon concentration was higher in produced water samples from the wells fractured with the gel and hybrid fluids compared with the well fractured with the slickwater frac fluid. Total dissolved solids concentrations at each well increased with time from 18,000 to 30,000 mg/L. Liquid chromatography–mass spectrometry was performed to characterize the organic matter from different wells. Chemical equilibrium modeling was utilized to model the speciation of measured ions and to predict the precipitation of metal solids from blending produced water with a fresh groundwater source. Chemical coagulation was successful at reducing the turbidity of all produced water samples. Coagulation–flocculation jar testing was conducted on each sample to determine the variability in optimum dose as a function of fracturing and well age. The optimum dose for produced waters from wells fractured with gel fluids was determined about 25%–300% higher than that for wells fractured with slickwater fluids.

Keywords: Produced water; Hydraulic fracturing; Coagulation testing; Slickwater; Cross-linked gel; Liquid chromatography–mass spectrometry (LC-MS)

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