THE UNIVERSITY OF TEXAS PERMIAN BASIN
COLLEGE OF ENGINEERING

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TWEI: VIRTUAL WATER LECTURE SERIES

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Thursday, February 24th, 2022
10:00-11:30 am CST

Shankar Chellam

Professor & Holder of the A.P. and Florence Wiley Professorship III in the Zachry Dept of Civil & Environmental Engineering at Texas A&M University

Title: Fit-for-purpose coagulation of Permian Basin produced water for re-use in hydraulic fracturing

Abstract: Reusing produced water for hydraulic fracturing simultaneously satisfies challenges of fresh water sourcing and the installation/operation of an extensive disposal well infrastructure. Herein, we systematically and rigorously investigate produced water treatment for reuse during hydraulic fracturing. Highly saline and turbid produced water from the Permian Basin was treated by adding chlorine as an oxidant, FeCl3 as the primary coagulant, and a proprietary anionic polymer. This induced high rate sedimentation and generated "clean brine" by removing suspended solids and iron. Very high turbidity (~98%) and total iron (~97%) removals were achieved even with only 6 minutes of flocculation and sedimentation. This suggests the feasibility of our approach for field-scale implementation to make clean brine. Further, we investigated the physicochemical fundamentals of coagulation and sedimentation. First, flocs were imaged using an optical microscope and digitally analyzed to characterize their morphology. Second, sedimentation was videotaped on a mobile phone and analyzed for size and settling velocity on a computer. Third, the viscosity of the produced water was measured in the range 4 – 44 °C to establish its Newtonian behavior. Fourth, floc settling velocities were empirically modelled incorporating their fractal nature, average size, and the viscosity of the produced water using only a single fitting parameter. Finally, Fourier transform infrared spectroscopy and thermogravimetric analysis were used to examine chemical aspects of coagulation and destabilization. The presentation will conclude by introducing ongoing research including dissolved air flotation for suspended solids removal and thermal desalination to produce higher quality water for beneficial reuse.

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