

Rational Development of Green Carriers for Viscosity Modifiers in Fracturing Fluids

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Historically, petroleum distillates have been used as the carrier for viscosity modifiers in fracturing fluids. There is a growing effort to decrease the environmental impact of fracturing fluids by replacing the petroleum distillates with carriers that are more environmentally friendly. Several factors determine whether a green chemical can replace the carrier currently being used in the field. In addition to the relative cost of the green chemical and its perceived environmental impact, there are multiple performance factors, such as rate and level of viscosity modification, which must also be satisfied by the replacement chemical.

Battelle has used a combination of experimental and computational methods to evaluate the performance of candidate green solvents as potential petroleum distillate replacements. Measured and calculated physicochemical properties of the individual candidate solvents were used to perform initial screening. Properties of interest included the ability to suspend guar without swelling, and suitable viscosity of the neat solvent. The candidates with the most desirable properties were then down-selected for further testing.

The down-selected solvents were formulated with guar and hydroxypropyl guar to measure rheological properties of the suspension. Properties measured included pumpability under cold conditions and viscosity under high shear conditions. The formulations were then combined with water to understand the viscosity rate change of the aqueous solution and its viscosity under down-hole conditions. The results showed at least one candidate solvent which performed as well or better than the petroleum distillate control solvent. Additionally, the results showed the candidate solvents were able to control the rate at which hydroxypropyl guar increased viscosity in the aqueous solution.

The significance of this work lies in its incorporation of known and predicted properties of green solvent candidates to perform the initial down-selection of chemicals for more extensive testing. This proven approach can simplify and expedite the development process for new fracturing fluids and other drilling components which will have lessened environmental impact. Follow us to learn about our latest technologies.

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