CASE STUDIES: IMPACT OF HIGH SALT TOLERANT FRICTION REDUCERS ON FRESH WATER CONSERVATION IN CANADIAN SHALE FRACTURING TREATMENTS

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ABSTRACT
Tight low permeability shale reservoirs must be stimulated to produce commercially viable gas quantities. This requires large volumes of slick water frac fluids to be successfully pumped at high rates into the shale formations. Friction reducers (FR’s) are used for stimulating shale reservoirs mainly to overcome tubular friction pressure and establish high pumping rates.

Slickwater fracturing, also known as water frac, is the process where polyacrylamide type polymers are used to reduce tubular friction pressure. Currently, fracturing fluid volume and proppant requirements have increased significantly with the advent of horizontal shale stimulation.

Depending on the shale play, it is not uncommon to drill over 1,500 meters of lateral section to maximize Reservoir Stimulated Volume, SRV. Several commonly practiced technologies, such as multi-stage fracturing of horizontal wells have increased frac volume requirements per well to a point that has created concerns by regulatory agencies. At the same time, restrictions limiting fresh water usage and environmental concerns surrounding flowback fluids have created a demand for chemicals that perform in high concentration brines. Several water treatment methods are being used in the industry to remove impurities from flowbacks for reuse as frac water for fracturing. However, most treatments do not remove dissolved salts from the water requiring either development of a brine tolerant friction reducer or distillation to maintain high performance.

This study presents experimental and case studies of various cationic and anionic FR’s of similar molecular weight in high brine flowback conditions of Montney produced water and a Horn River source well. Actual produced water and fingerprint water analyses of Montney and Horn River shale reservoirs were used as a brine source to evaluate friction reducers. A dynamic friction loop flow apparatus was used as the main tool to evaluate the rheological properties and the friction reduction contributions of FRs in high concentration brine waters.

Field data collected for two case histories document the ability of the high brine tolerant friction reducers to perform at a level consistent with traditional products used in fresh water. This confirms the experimental data obtained from dynamic friction loop investigations. Results obtained from this study can be used to optimize slickwater frac treatments where produced water is used as the main source of frac water. This paper examines the following:

1. Comparison studies of new brine tolerant friction reducer with conventional FR’s used in the oilfield.
2. Experimental data illustrating the performance of newly developed FR’s in high concentration brine from post fracture flowbacks.
3. Cost advantage of using less polymer, while reducing fresh water and disposal of the flowbacks.
4. Case studies of wells treated with the new friction reducers show performance in brines similar to those achieved with conventional FR’s when used in fresh water.

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