CRITICAL EVALUATION OF BIOCIDE-FRICTION REDUCER INTERACTIONS USED IN SLICKWATER FRACS

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ABSTRACT

The practice of slick water fracturing has increased significantly with the advent of horizontal shale stimulation. Many technologies have evolved to improve the practice, including multi-stage fracturing of horizontal wells and simultaneous fracturing, both of which increase frac treatment volumes up to several million gallons of slick water per well. Recent incidents related to interaction of biocides and friction reducers have created concerns for the industry and compelled operators to adopt methods of using biocides with short half-lives, in order to minimize or eliminate biocide contamination in flowbacks reused as frac water. Concurrently, some biocides can crosslink polyacrylamide-based friction reducers, causing severe formation damage, production impairment, and flowbacks that contain crosslinked polymers, requiring further chemical treatment and increasing operational costs.

This study examines polymers and biocides, along with other additives (oxygen scavengers and scale inhibitors) commonly used in slick water fracturing, and identifies the parameters that could minimize the effectiveness of slick water frac treatments and potentially cause formation damage. To illustrate, this study incorporates a high molecular weight water-based emulsion polyacrylamide as the friction reducer, used in conjunction with various non-oxidizing biocides, with results reflecting positive, negative, or neutral impacts. Experimental results presented in this study are supported by utilizing a 20-gallon capacity friction loop with a Reynolds number of 150,000. Conventional bench top methods were also used. Results indicate that particular biocide-friction reducer systems exhibit significant performance deviations when standard brines or flowback water is used in shale slick water fracturing treatments.

Results obtained from this study provide operators a tool to avoid combinations of specific chemicals used in slick water fracturing. Awareness of additive interactions in specific frac fluids used can maximize the effectiveness of treatments, and avoid costly errors that may adversely impair production and jeopardized performance of the biocide. The integrity of the assets on location are thus affected by diminished biocide performance (Olliver et al, 2005). Therefore, any biocide chosen for slick water treatment should be pretested for compatibility with the friction reducers and other chemical additives, in order to insure an incident free operation from a chemical standpoint and minimize the potential for formation damage.

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