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Synthesis & performance evaluation of cellulose nanocrystals as a drilling fluid additive for fluid loss and its impact on the fluid rheological properties

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ABSTRACT

Drilling fluid/Mud constitute about 15% of the drilling process cost with a single well costing approximately $ 8.7million in 2013 according to the Petroleum Services Association of Canada. Common challenges experienced during drilling are fluid loss and the need to formulate a fluid with desirable rheological properties to withstand increasing temperature and pressure conditions. This investigation looks at using Cellulose Nanocrystals (CNCs) as an additive to reduce fluid loss and maintain or improve the fluids rheological properties. This involved the synthesis and characterisation of CNCs, CNC-Bentonite suspensions rheological properties and fluid loss tests. All rheological tests were measured using a Rheolab QC at 120°F for 6wt% Bentonite mud samples with 0, 0.1, 0.3, 0.5 and 0.8wt% CNCs concentration. It was discovered that the inclusion of CNCs into Water-Bentonite mud resulted in reduced fluid loss of significant amount within the range of 0.3-0.8% CNC concentration. Formulations with CNC concentration above 0.1wt% showed a significant increase in the mud's viscosity and gel strength. Test results indicated that CNCs can be used in drilling fluids as an additive for fluid loss control, as a viscosifier and a gel strengthening agent.