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Nanocrystalline Cellulose – Attapulgite / Sepiolite as water-based drilling fluids and their impacts on the oil drilling penetration rate.

ERA00: MSc RESEARCH REPORT

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ABSTRACT

Production of oil and gas from deep well that operate under high pressure and high temperature (HPHT) conditions require the use of smart or advanced drilling fluid with improved rheological and filtration properties that are cheaper, eco-environmentally friendly, biodegradable and applicable for reducing the drilling cost. Due to the limitation of the use of Bentonite (BT) in harsh conditions of HPHT, Attapulgite (ATT) and Sepiolite (SEP) are used through unconventional hydrocarbon resources, such as shale gas, shale oil, deep water, and artic reservoirs. Nanotechnology demonstrated promising solutions to address such issues in the oil and gas industry. As many researchers investigated the improvement of the drilling fluids through the application of nanotechnology, success brought hope. In this study, the effect of the incorporation of cellulose nanocrystals (CNCs) at different concentrations into ATT and SEP water-based drilling fluids (ATT/SEP-WDFs) and the variation of temperature were investigated to evaluate the improvement on the rheological and filtration properties of cellulose nanocrystals into attapulgite water-based drilling fluids (CNC/ATT-WDFs) and cellulose nanocrystals into sepiolite water-based drilling fluids (CNC/SEP-WDFs) in fresh-water (FW) and sea-water (SW). Herschel-Bulkley's (HB) rheological model was applied to analyze quantitatively the fluid properties. Results showed that the incorporation of CNC at various concentrations into ATT/SEP-WDFs in freshwater and seawater improves the rheological and fluid loss properties and fluid thermal stability. When incorporating CNCs at lower concentrations into ATT/SEP-WDFs in freshwater and seawater, results showed improved carrying capacity of the cuttings, wellbore stability, fast penetration rate, high yield stress during the aging period, low viscosity at a high shear rate, and excellent shear-thinning behaviors.