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Abstract:

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Synthesis and Characterization of Substituted-Ammonium Humic Acid Fluid Loss Additive for Oil-Based Drilling Fluids
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Keywords: Substituted-ammonium humic acid, synthesis, fluid loss additive, oil-based drilling fluid

Abstract: Using widely distributed and cheap lignite as starting material, humic acid was modified by C₁₈alkylamine, and a new kind of humic acid acetamide was prepared. The optimal reaction conditions of the humic acid acetamide polymer were obtained through laboratory tests as follows: the ratio of humic acid and C₁₈alkylamine was 1:1.5, the reaction temperature was 150°C, and the reaction time was 16~18 h. The new product was characterized by IR, and the results showed that this substituted-ammonium humic acid was successfully prepared by reacting parts of carboxyl group of humic acid with C₁₈alkylamine. HTHP filtration experiments demonstrated that the substituted-ammonium humic acid had good fluid loss properties. As a result, this substituted-ammonium humic acid polymer is an excellent fluid loss additive, and it could meet the requirement of drilling operation under extreme condition.

Introduction: Oil-based drilling fluids are used for drilling oil-gas wells which cannot be effectively drilled with traditional water-based drilling fluids because of such complicated problems as dissolving of sludge, gelation at high temperature and high pressure, and the effect of contamination from salt, gypsum and cement resulting in high viscosity, gelation and high fluid loss^[1]. Meanwhile, additional fluid loss control for oil-based drilling fluids is desirable, which can be obtained by the use of high-efficiency fluid loss agents^[2].


Compared with common asphalt, humates or lignitic materials is a better fluid loss additive for oil-based drilling fluids^[3-5]. Here, we report a convenient method to prepare a new type of humic acid acetamide polymer for oil-based drilling fluids, which has good fluid loss control capacity. It can reduce the leakage and loss of drilling fluids, and prevent invasion into formation, which can play an important role in ensuring drilling fluids good performance and surface stability.

Materials and methods:
Materials: Lignite, industrial grade; C₁₈alkylamine, diethylhexylcarbodiimide (DCC), dimethyl formamide (DMF), sodium hydroxide and hydrochloric acid are purchased from Beijing Chemical Works. All chemicals, reagents, and solvents are used as received from commercial sources without further purification.
Methods: The humic acid acetamide polymer is synthesized by a two-step process: (1) the extraction of humic acid from lignite; (2) the preparation of humic acid acetamide by reacting humic acid with C₁₈alkylamine with amine and groups.

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Using widely distributed and cheap lignite as starting material, humic acid was modified by octadecylamine, and a new kind of humic acid acetamide was prepared. The optimal reaction conditions of the humic acid acetamide polymer were obtained through laboratory tests as follow: the ratio of of humic acid and octadecylamine was 1:1.5, the reaction temperature was 150 °C, and the reaction time was 16~18 h. The new product was characterized by IR, and the results showed that this substituted-ammonium humic acid was successfully prepared by reacting parts of carboxyl group of humic acid with octadecylamine. HTHP filtration experiments demonstrated that the substituted-ammonium humic acid had good fluid loss properties. As a result, this substituted-ammonium humic acid polymer is an excellent fluid loss additive, and it could meet the requirement of drilling operation under extreme condition.

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