Preparation and Characterization of Bentonite Modified Fatty Imidazolinium as Solid Component of Drilling Mud

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Abstract

The research is aimed to produce bentonite modified fatty imidazolinium as a solid component of drilling mud. Three fatty imidazolinium iodide compounds have been succeeded to be synthesized are cationic surfactants with vary in different R substituents. They are 2-cis-oleic-imidazolinium iodide (surf1) which R = cis-ω-9-$CH_3(CH_2)_7$-CH-CH-$(CH_2)_6$-CH_2-, 2-stearic-2-imidazolinium iodide (surf2) with R = $CH_3(CH_2)_{15}$-CH_2-, and 2-palmitic-2-imidazolinium iodide (surf3) with R = $CH_3(CH_2)_{13}$-CH_2-. The cationic surfactant compounds have been synthesized utilizing microwave assisted organic synthesis method, in which the power of microwave used is 800 W. The synthesized products were characterized using infra red spectroscopy (FTIR) and proton nuclear magnetic resonance (^{1}H-NMR). Physicochemical properties characterized using thermal gravimetry/ differential thermal analysis (TG/DTA). Based on the cation exchange capacity (CEC) value of the bentonite, the surfactant compounds are used as modifier for the bentonite yield bentonite modified palmitic-imidazonium (Pal-Imz/NaMMT), bentonite modified stearic-imida-zolinium (Stear-Imz/NaMMT), and bentonite modified cis-oleic-imidazolinium (cis-Ole-Imz/NaMMT). The functional group analysis toward bentonite modified fatty imidazolinium resulting were determined using infra red spectroscopy (FTIR) in order to ensure the modification success. Thermal stability of the products were characterized using thermal gravimetry/ differential thermal analysis (TG/DTA), X-ray diffraction for measuring d-spacing, and rheological analysis to determine flow properties of the drilling mud. The result of thermal analysis of the cationic surfactants show the sequences of thermal stability of three surfactants cationic; surf2 (decomposed at 375,5^{o}C) > surf3 (decomposed at 368,5^{o}C) > surf1 (decomposed at 361,6^{o}C). By the addition of 0.5 CEC of cationic surfactants yield thermal stability up to 406,9^{o}C for Pal-Imz/NaMMT, 441,9^{o}C for Stear-Imz/NaMMT, and 441,8^{o}C for Ole-Imz/NaMMT. Rheological analysis characterization toward cis-Ole-Imz/NaMMT using Saralin 200 V as a base oil result the yield point 2 lb/100ft^2; plastic viscosity, 6 cP; gel strength, ½ lb/100ft^2; oil/ water ratio, 71/29; and electrical stability reaches 424 volt. In general, based on the result of this work, the solid component of the drilling mud based cis-Ole-Imz/NaMMT is potential to applied in drilling industry.

Keywords: Fatty Imidazolinium, Oil Base Mud, Rheology, and Thermal Stability