

IMPROVING RHEOLOGICAL PROPERTIES OF PACITAN WHITE BENTONITE BY ADDING SODIUM CARBONATE AND SODIUM CARBOXYMETHYLCELLULOSE FOR DRILLING FLUID MATERIAL

Muhammad Ardiansyah Iqbal
18/423127/PA/18210

ABSTRACT

Modification of Pacitan white bentonite (PWB) with sodium carbonate (soda ash, SA) and sodium carboxymethylcellulose (Na-CMC) for drilling mud material has been conducted. The research objectives were to investigate the effect of the addition of soda ash on the bentonite swelling and ion exchange properties of PWB and the effect of the added Na-CMC on the rheological properties of soda ash-activated bentonite. Soda ash-modified bentonite (PWB-SA) was made by adding sodium carbonate into the PWB with the variation of 0; 3; 6; 9; and 12%(w/w). The swelling index was measured with an ASTM (D5890) method. The CMC modified PWB-SA (PWB-SA-CMC) was made by adding Na-CMC into the PWB modified with 6% (w/w) SA. The variation of Na-CMC used were 0; 1; 1.9; 2.9; and 3.9% while using 6% (w/w) PWB-SA as the fixed variable and the variation of soda ash used were 0; 3; 6; 9; and 12% (w/w) with 3.9% Na-CMC as fixed variable. The viscosity of PWB-SA-CMC was measured with the Fann VG meter at 600 and 300 r/min. The cations released during the swelling index measurement were determined with AAS, and the samples were characterized with FTIR, XRF, and XRD.

The obtained result showed that the 6%(w/w) addition of soda ash to PWB was the optimal composition for the maximum swelling index (16 mL/2 g) due to the cation exchange that occurred between sodium ion and the balancing cations in the interlayer space. Carboxymethyl cellulose has a carboxylate group that interacts with the clay due to the formation of a solvation layer between the negative charges of the polymer and the positive charges present along the edges of the clay particles in the bentonite, which causes the widening of the interlayer space and increases the viscosity. The optimal composition of the CMC modified PWB-SA, resulting in a maximum viscosity of 38 cP from dial reading at 600 r/min, a YP/PV ratio of 0.92, and meets the API 13A specification, was 3.9% of Na-CMC and 6% Na₂CO₃ (w/w).

Keywords: bentonite, drilling mud, sodium carboxymethylcellulose, soda ash

***PENINGKATAN SIFAT REOLOGI BENTONIT PUTIH PACITAN DENGAN
PENAMBAHAN NATRIUM KARBONAT DAN NATRIUM
KARBOKSIMETILSELULOSA UNTUK BAHAN PEMBUATAN LUMPUR
PENGEBORAN***

Muhammad Ardiansyah Iqbal
18/423127/PA/18210

INTISARI

Modifikasi bentonit putih pacitan dengan soda abu (Na_2CO_3) dan natrium karboksimetil selulosa sebagai lumpur pengeboran telah dilakukan. Tujuan dari penelitian ini meliputi penentuan komposisi kimia, gugus fungsi, kristalinitas, unsur dari PWB dan efek dari penambahan soda abu terhadap swelling BWP, serta mempelajari pengaruh penambahan Na-CMC terhadap sifat reologi PWB yang diaktivasi soda abu. PWB-SA dibuat dengan penambahan soda abu kepada PWB dengan variasi 0; 3; 6; 9; dan 12% (b/b). Pengukuran swelling indeks dilakukan dengan mengacu kepada metode ASTM(D5890). PWB-SA-CMC dibuat dengan penambahan soda abu dan Na-CMC kepada PWB. Variasi Na-CMC yang digunakan adalah 0; 1; 1,9; 2,9; dan 3,9% dengan 6%(b/b) PWB-SA sebagai variabel tetap, dan variasi soda abu 0; 3; 6; 9; dan 12% (b/b) dengan 3,9% Na-CMC sebagai variabel tetap. Viskositas PWB-SA-CMC diukur dengan Fann VG meter pada pembacaan 600 dan 300 r/min. Sampel dikarakterisasi dengan FTIR, XRF, XRD, dan AAS.

Hasil yang diperoleh dari metod swelling menunjukkan bahwa penambahan soda abu 6% menghasilkan PWB-SA dengan swelling indeks yang optimal 16 mL/2g dikarenakan terjadinya pertukaran ion antara ion Na^+ dan kation penyeimbang di ruang interlayer. Karboksimetil selulosa memiliki gugus karboksilat yang berinteraksi dengan lempung melalui pembentukan lapisan solvasi antara muatan negatif dari polimer dengan muatan positif didalam partikel bentonite sehingga menyebabkan pelebaran pada ruang *interlayer* dan meningkatkan viskositas. Komposisi PWB-SA-CMC optimal yang menghasilkan viskositas 38 pada pembacaan 600 r/min dan rasio YP/PV 0,92 yang dimana telah memenuhi API 13A diperoleh dari penambahan soda abu 6% (b/b) dan 3,9% Na-CMC.

Kata kunci: bentonit, lumpur pengeboran, natrium karboksimetil selulosa, soda abu