



Effects of Sediment Composition on the Rheological Parameters of Mud Slurries

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The Bingham model is used to describe the rheological properties of viscous sediment-water mixtures, which contains two rheological parameters: the Bingham yield stress τ_B and Bingham viscosity μ_B . Thirty-one sets of experimental data of mud slurries were collected to analyze the dependence of the rheological parameters of mud slurries on their sediment concentration C_v and sediment composition in the present study. The results showed that the both the rheological parameters τ_B (dyne/cm²) and μ_B (centi-poise) of mud slurries (having sediment size less than 1 mm) exponentially increases with the increase of C_v , i.e., $\tau_B = A_1 \exp(B_1 C_v)$ and $\mu_B = A_2 \exp(B_2 C_v)$. The coefficients B_1 and B_2 are about 0.20 and 0.18, respectively, with minor variation for the slurry samples collected in this study. However, the values of the coefficients A_1 and A_2 significantly varies with the content of fine sediments, particularly for the size less than 0.02mm. The present study developed the relation of the coefficient A_1 (A_2) and $P_{0.02}$ ($P_{0.01}$), in which $P_{0.01}$ and $P_{0.02}$ denote the content of fine sediment having size less than 0.01 mm and 0.02 mm, respectively. They are $A_1 = 0.0014 \exp(0.095 P_{0.02})$ and $A_2 = 0.03 \exp(0.13 P_{0.01})$. In addition, the effects of gravels on τ_B and μ_B of gravel-mud-slurries were also experimental studied. The gravels used in experiments have diameters (D_g) of 5, 10, 16, and 24 mm, respectively, and the content of gravels (C_{vg}) in the gravel-mud slurries varies from 7% to 20%. The result shows that at the same sediment concentration, the gravel-mud slurry has larger content of fine sediments has higher values of τ_B and μ_B . The dependence of τ_B and μ_B on C_v , C_{vg} and D_g are also evaluated in this study. We can estimate the values of τ_B and μ_B for a gravel-mud mixture, providing the data of C_v , C_{vg} and D_g

for the mixture are available.