Effect of the interaction between clays and cations on froth rheology in flotation

1. Data Conversion

The transformation of such data imposes specific requirements on the experimental setup used. **Stickland** et al. [1] deduced that the influences attributable to a rigid boundary could be mitigated provided that the ratio of tube to vane radius was at least three times, thus enabling the treatment of the material as partially sheared, or in other words, as having an infinite geometry. Similarly, in the study of froth rheology, **Li** et al. [2] partially sheared the froth rheology by using a configuration of tube to vane radius ratio of 3.3. It is noted that in the present study, the radius ratio of the column to the vane was 3.13. Consequently, it is presumed that an infinite configuration can be considered in the context of this study. In the case of an infinite medium geometry, the relationship between the shear rate and the angular velocity was established as follows [3]:

$$\dot{\gamma} = \frac{2\omega}{n} \tag{1}$$

where $\dot{\gamma}$ is shear rate, ω is the angular velocity of the vane and n is the local gradient of a log-log plot of torque versus angular velocity which is a function of vane speed.

For shear stress, **Dzuy** et al. [4] indicate that the computation of shear stress was exclusively dependent on the vane geometry, as depicted in Equation 2:

$$\tau = \frac{T}{2\pi R^3(\frac{H}{R} + \frac{2}{3})} \tag{2}$$

where τ is shear stress, T is torque, H represent the height and R symbolize the radius of the vane.

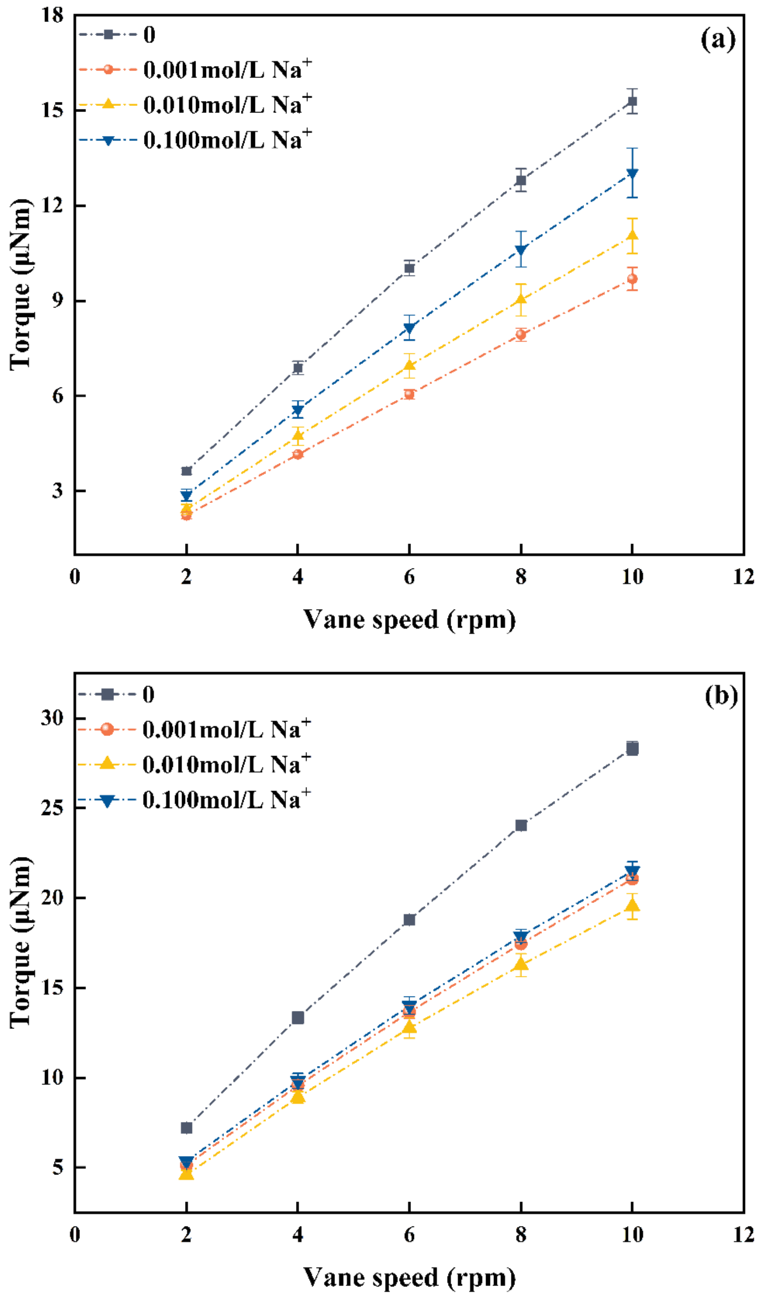
To more accurately characterize the flow behavior of the froth, the Herschel-Bulkley model (Equation 3) was employed to fit the converted rheological data in this study[5].

$$\tau = \tau_y + \mu \times \gamma^n \tag{3}$$

where τ_y is the yield stress, n represent the flow index and μ represent the consistency index. Varying values of n are indicative of distinct fluid properties. $n > 1$ indicates that the material exhibits dilatant flow; $n < 1$ indicates that the material exhibits pseudoplastic or plastic flow; $n = 1$ suggests that the material exhibits a Newtonian flow or Bingham flow.

2. Raw data

2.1 Torque values measured under different concentrations of Na^+



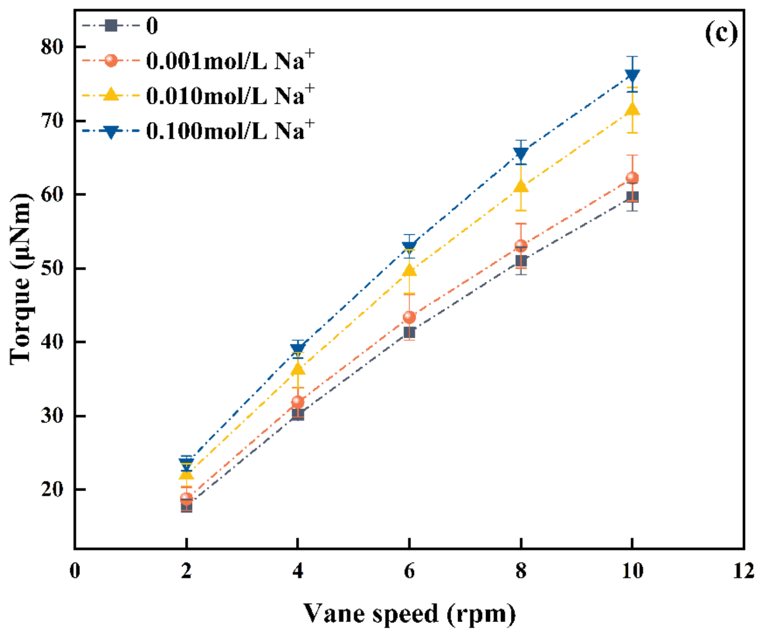
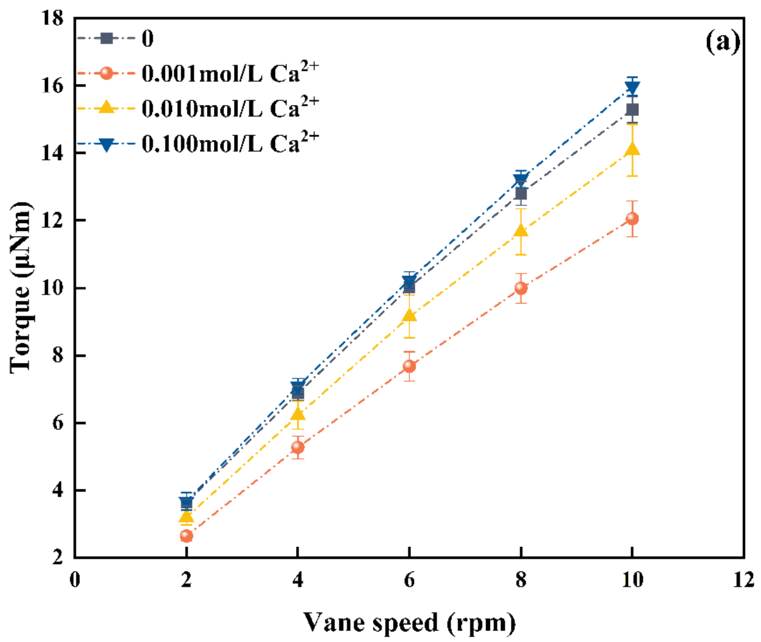


Fig. S1 Torque value vs vane speed under different concentrations of Na^{+}

（a-montmorillonite, b-kaolinite and c-talc）

2.2 Torque values measured under different concentrations of Ca^{2+}



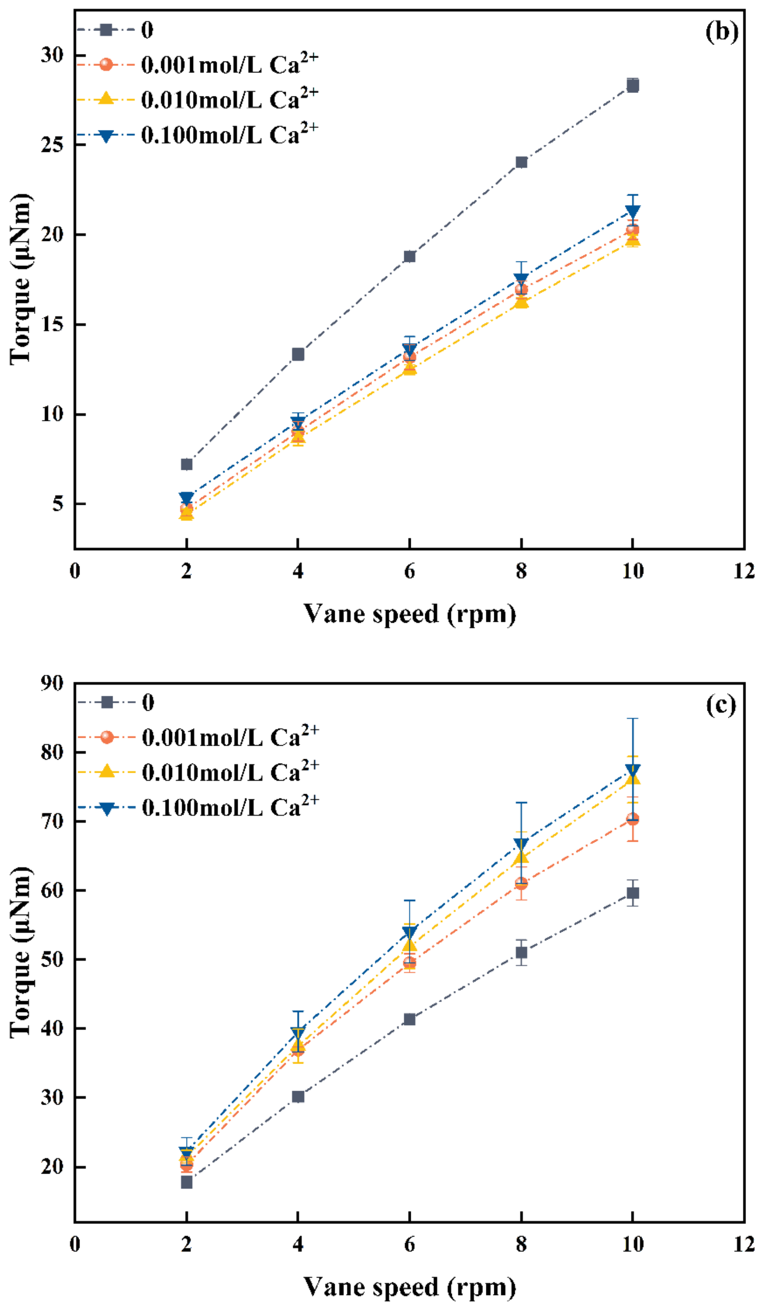


Fig. S2 Torque value vs vane speed under different concentrations of Ca^{2+}

（a-montmorillonite, b-kaolinite and c-talc）

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