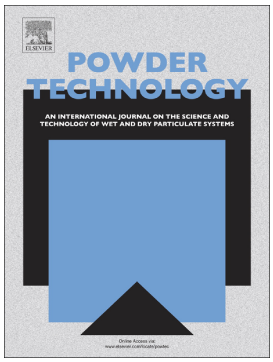

DLVO theoretical analyses between montmorillonite and fine coal under different pH and divalent cations

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DLVO theoretical analyses between montmorillonite and fine coal under different pH and divalent cations

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Abstract

In this work, DLVO theoretical analyses between montmorillonite and fine coal under different pH and divalent cations through measuring zeta potentials under corresponding conditions were conducted. The zeta potential of coal dramatically decreased from 8.60 to -46.96 mV as the slurry pH increased from 2.87 to 9.99. Conversely, in the same pH range, zeta potential of montmorillonite slightly changed from -24.68 to -37.46 mV, which showed that slurry pH had little effect on the total surface charge of montmorillonite. DLVO theoretical analyses showed that a total negative DLVO interaction energy between coal and montmorillonite over the whole separation distance was obtained at pH 2.8. Meanwhile, the energy barrier went up with the rising pH. At neutral pH, the addition of divalent cations (Ca^{2+} and Mg^{2+}) both dramatically decreased the zeta potential values of coal and montmorillonite, resulting in a reversal of DLVO interaction energy from positive (repulsion) to negative (attraction). The compressing ability of Ca^{2+} to electrical double layer of coal was stronger than that of Mg^{2+}, but conversely to montmorillonite. Overall, through zeta potential measurement, it was indicated that the solution pH and divalent cations both decided the interaction between fine coal and montmorillonite through controlling the electrical double layer force. The DLVO calculation results showed that DLVO theory was in good agreement with the reported flotation phenomena and thus was competent to predict the interaction between montmorillonite and fine coal particle in aqueous suspension.

Keywords: slime coatings; zeta potential; DLVO theory; slurry pH; divalent cation

1 Introduction