# Boron Adsorption by Clay Minerals Using a Phenomenological Equation[1]

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**Abstract:** Boron adsorption by Ca forms of montmorillonite, illite, and kaolinite was determined as a function of pH and boron concentration in solution. Data from batch experiments were compared with results computed for each clay according to fitted adsorption coefficients (maximum boron adsorption and affinity constants related to the binding energy). The agreement between calculated values and experimental results indicates that a phenomenological equation can be used to predict boron adsorption on clays as a function of both of these variables. For the solution-to-clay ratios examined, the water content does not affect the boron-surface interaction as expressed by the above adsorption parameters. Because the affinity of clays for $B(OH)_4^-$ is much stronger than for $B(OH)_3$, the adsorption maximum was obtained only under alkaline conditions at approximately pH 9.0 to 9.7. It is suggested that the pH of maximum adsorption is a function of the ratios of affinity coefficients of the three species $B(OH)_3$, $B(OH)_4^-$, and $OH^-$ competing for the same adsorption sites. The adsorption coefficients indicate that in some cases the difference in the amount of adsorbed boron between montmorillonite and kaolinite could be either small or large, depending on the circumstances. The main factor that would affect this difference is the total amount of boron in the suspension. Estimated value of the adsorption maximum was 2.94, 11.8 and 15.1 μmole/g for Ca-kaolinite, Ca-montmorillonite, and Ca-illite, respectively.

**Key Words:** Adsorption • Boron • Illite • Kaolinite • Montmorillonite