
Adsorption and Oxidation of Benzidine and Aniline by Montmorillonite and Hectorite

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Abstract: Quantitative measurements are made of the adsorption of benzidine and aniline from aqueous hydrochloride solutions by Na-, Li-, and Ca-montmorillonite and of the displaced inorganic cations. From these data, the ionic states of the adsorbed organic species are determined. Under conditions of controlled pH, the adsorption of benzidine increases as the pH increases, and involves mainly divalent species at $\text{pH} < 3 \cdot 2$, and increasing proportions of monovalent and neutral species at $\text{pH} > 3 \cdot 2$. With aniline, monovalent and neutral species are adsorbed, and hydrogen ions also appear to participate in the reactions.

Color developments of benzidine and aniline complexes of montmorillonite and hectorite are considered qualitatively in relation to the adsorption data, to various experimental conditions including the nature of the inorganic exchangeable cations, the pH, and the presence or absence of oxygen in the system, and to relevant previous work. It is hypothesized that the blue color of the benzidine complex is due to semiquinone formation by oxidation on montmorillonite by the clay itself, and on hectorite by dissolved oxygen or H_2O_2 , and that the yellow color under acid conditions arises from reversible formation of quinoidal cations from semiquinones. The color developments of the aniline complex are due probably to oxidation of aniline by atmospheric oxygen.

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