
Surface Charge Characterization of Layer Silicates by Competitive Adsorption of Two Organic Divalent Cations*

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* Paper No. 3392 of the Journal Series of the North Carolina State University Agr. Exp. Sta., Raleigh, N. C. 27607.

Abstract: Diquat²⁺ (1,1' -ethylene-2,2' -dipyridinium ion) and paraquat²⁺ (1,1' -dimethyl-4,4' -dipyridinium ion) were competitively adsorbed by Na-saturated kaolinites, smectites and expanded and collapsed vermiculites. The relative preference for one or the other cation varied with the surface charge densities of the adsorbents and the location of the adsorption site, i.e. internal or external. Minerals with high surface charge exhibited preference for diquat whereas minerals with low surface charge preferred paraquat. Expanded vermiculites preferentially adsorbed diquat on internal surfaces. Collapsed vermiculites generally showed a preference for paraquat. Smectites and kaolinites preferentially adsorbed paraquat.

Surface charge densities of the layer silicates vs. the relative preference for diquat revealed two linear relationships, one for internal adsorption and one for external adsorption. Internal adsorption was characterized by a strong preference for paraquat on low-charged smectites, a relative decreasing preference for paraquat with higher-charged smectites, and a strong preference for diquat on high-charged expanded vermiculites.

Preferential adsorption for paraquat by kaolinite was quite similar to adsorption of paraquat on the external sites of vermiculites. There was no apparent relationship between competitive adsorption and surface charge density of kaolinite.

Clays and Clay Minerals; October 1971 v. 19; no. 5; p. 295-302; DOI: [10.1346/CCMN.1971.0190505](https://doi.org/10.1346/CCMN.1971.0190505)

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