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# Adsorption of Uranium from Solutions by Montmorillonite; Compositions and Properties of Uranyl Montmorillonites

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**Abstract:** Wyoming montmorillonite, <2- $\mu\text{m}$  particle size, saturated with Na, K, Mg, Ca, and Ba ions, was reacted with uranyl nitrate solutions in the concentration range 1– 300 ppm uranium. With constant amounts of clay and solution volume, the adsorption isotherms of uranyl ions on the clay followed Langmuir-type curves with increasing concentration of uranium. The maximum adsorption derived from linear Langmuir plots corresponds to the exchange capacity of the clay. Experiments with solutions of constant volume and constant ionicity, but with variable proportions of uranyl and other cations, showed that uranyl ions were strongly preferred by the clay to  $\text{Na}^+$  and  $\text{K}^+$ , but less strongly than  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$ , and  $\text{Ba}^{2+}$ .

Chemical analyses of uranyl montmorillonites prepared with nitrate solutions, 0.05 M and  $\text{pH} \sim 2.0$ , gave interlayer cations  $(\text{UO}_2)_{0,094}\text{H}_{0,12}$ . Addition of NaOH to the uranyl nitrate solution to increase the pH to 4.0 gave a montmorillonite with interlayer cations  $(\text{UO}_2)_{0,083}\text{Na}_{0,12}\text{H}_{0,04}$ . A fully exchanged uranyl montmorillonite was prepared with 0.05 M uranyl acetate solution,  $\text{pH} \sim 4.0$ , followed by further treatment with  $1.25 \times 10^{-5}$  M solution,  $\text{pH} \sim 4.5$ . The resulting interlayer composition was  $(\text{UO}_2)_{0,19}(\text{H}_2\text{O})_{1,15}$  which corresponds with the hexahydrate ion,  $[(\text{UO}_2)-6\text{H}_2\text{O}]$ . X-ray powder diffraction and thermal data are recorded for the fully exchanged uranyl montmorillonite.

**Key Words:** Adsorption • Cation exchange • Interlayer cations • Montmorillonite • Uranium • Uranyl montmorillonite

*Clays and Clay Minerals*; February 1981 v. 29; no. 1; p. 10-16; DOI: [10.1346/CCMN.1981.0290102](https://doi.org/10.1346/CCMN.1981.0290102)  
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