



Mercury adsorption by montmorillonite and vermiculite: a combined XRD, TG-MS, and EXAFS study

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Abstract

Synchrotron-based extended X-ray absorption fine structure spectroscopy (EXAFS), X-ray diffraction at room and high temperature, thermal analyses combined with mass spectrometry of evolved gas, and chemical analyses contributed to assess the influence of mercury on montmorillonite and vermiculite layers.

The adsorbed Hg amount was higher for montmorillonite (Hg=37.7 meq/100 g) than for vermiculite (Hg=28.0 meq/100 g). The basal spacing for the Hg treated samples was 15.2 (montmorillonite) and 14.5 Å (vermiculite). Thermal and evolved gas spectrometry analyses suggest that Hg was released at $T \approx 230$ °C and at 600 °C for montmorillonite, but at 550, 800 and 860 °C for vermiculite.

The effect of temperature on Hg release is also apparent when the basal spacing at 230 °C for montmorillonite ($d_{001}=10.3$ Å) is compared to that for vermiculite ($d_{001}=11.8$ Å).

EXAFS analyses provide qualitative evidence that oxygen atoms occupy the first coordination shell of Hg in both clay minerals. The best fit between observed and calculated spectra is obtained when montroydite is assumed as a reference model compound.

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