

MONTMORILLONITE SURFACE AS A CATALYST FOR THE FORMATION OF SAT METAL TETRA (P-SULPHOPHENYL) PORPHYRINS

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Abstract

The adsorption of the water-soluble tetra(p-sulphophenyl)porphyrin (TPPS) compound on Fe(II), Fe(III), Cu(II), Co(II), Ni(II), Zn(II), Cd(II), Sn(IV) and UO_2^{2+} metal ion-exchanged montmorillonite (MMT) facilitated the formation of the SAT metal-TPPS MMT complexes of these cations (where SAT indicates sitting atop, ie the metal is above the porphyrin plane and is bound to external ligands in this case the MMT surface). All the resulting powder samples have a brown-orange colour due to the presence of the metal-TPPS-MMT complexes of these cations. Heating the solid powder samples caused demetallation and changed the colour of the powder from brown-orange colour of the metal-TPPS-MMT complex to the green colour of the diacid porphyrin on the clay. When such samples were exposed to the open atmosphere where they could absorb water vapour, the brown-orange colour appeared again due to the remetallation. The cation remained in the vicinity of the TPPS molecule upon demetallation, which makes the metallation-demetallation process reversible. The TPPS has been found to be adsorbed only on the external surface, and can be intercalated using sodium ions in solution with the compound to open the clay lattice. The reactions were monitored using visible absorption spectra, diffuse reflectance spectra, Mössbauer spectroscopy and X-ray diffraction.

Keyword

Adsorption, montmorillonite, porphyrin, demetallation, metallation