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Nanoclay fractions in the drinking water resource of Lake Konstanz

M. KATCHEBESIBO, U. WACHTER AND J. FELSCHE

Department of Chemistry, University of Konstanz, Germany (juergen.felsche@uni-konstanz.de; mathias.katchebesibo@uni-konstanz.de)

In a systematic study of the < 2 µm fraction of nanoparticles in the hypolimnon of the Lake Konstanz using ^{27}Al-MAS-NMR spectroscopy, we found a clay phase which was not previously detected by XRD because of the <<100 nm size of its nanoparticles. Modelling of the dominate 2D-character of the platey clay nanoparticles shows that a TOT-monolayer clay particle of 1.4 nm in thickness and < 50 nm wide does not sediment at 4°C water temperature. We call this critical size the "Schwebstoff" clay fraction (*schweben = not moving downwards* in German). At sizes > 100 nm, the TOT-type monolayer alumosilicate clays show a butterfly-type movement. In non-Stokes behaviour, the stop and go movement is clearly determined by the specific density and the c/a-morphology of the individual clay phases. Reference clays SAz-1 and IMt-1 of the Clay Mineral Society were used in the experiments to confirm the preliminary results on the given natural colloids.

There is some evidence that the latest results in the application of the asymmetric flow field flow fractionation (AF^4)- method to characterize colloid particles in drinking water resources need some revision because of the stochastic, butterfly-type movement of clays in dynamic water regimes.

We report the latest results on nanoclays from joined experimental XRD-, SEM/TEM-, SAXS-, MAS-NMR-, STA- and AF^4 - data.

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A new environmental friendly route for the fabrication of iron oxide ultrafiltration membranes using ferroxane nanoparticles

J. ROSE[1,2], M.M. CORTALEZZI[2,4], G.F. WELLS[2,4], J-Y. BOTTERO[1,2], A.R. BARRON [3,4] AND M.R. WIESNER[1,4]

[1] CEREGE, IFR PMSE 112, Europole Méditerraneén de l'Arbois BP 80, 13545 Aix en P^{ce} Cedex 04, France (rose@cerege.fr)

[2] Environmental and Energy Systems Institute, Rice University, 6100 Main Street, Houston, TX 77005, USA

[3] Department of Chemistry, Rice University, 6100 Main Street, Houston, TX 77005, USA

[4] Center for Biological and Environmental Nanotechnology, 6100 Main Street, Houston, TX 77005, USA

Ferroxane nanoparticles, obtained from reaction of lepidocrocite (FeOOH) and acetic acid at room temperature, were applied to the fabrication of ceramic membranes. Ferroxanes are produced using a new environmentally benign process. We have demonstrated that the reaction between lepidocrocite and acetic acid (AA) in water results in the formation of carboxylate-FeOOH nanoparticles called ferroxane-AA analogous to aluminum-based alumoxanes. From EXAFS at the Fe-K edge we have deterimned that the structure of the ferroxane particles consists of an FeOOH core part with the structure of the lepidocrocite (γ-FeOOH). FTIR proved that ferroxanes are coated with AA. The size of these ferroxanes is 0.3 µm composed of nanodomains of 20-30 Å with a γ-FeOOH structure. Ferroxane derived membranes were prepared and characterized by nitrogen adsorption/desorption isotherms, scanning electron microscopy (SEM), and atomic force microscopy (AFM). Permeability and molecular weight cut off measurements were conducted on asymmetric ferroxane-derived membranes. The average pore size was determined to be 24.11 nm and the BET surface area was 75.6m^2/g. Permeability was measured for membranes with one, two, and three coatings, to determine the effect of thickness of the ferroxane layer on the membrane hydraulic resistance. The MWCO of the ferroxane-derived membranes was 150,000 Da, which falls in the ultra-filtration range.