COMPARISON OF TWO ADSORPTION MECHANISMS FOR SMALL SIZED MOLECULES ONTO ZEOLITES IN VIEW OF UREMIC TOXIN REMOVAL

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The adsorption properties of zeolites for uremic toxins have been investigated in view of selective removal of such molecules from physiological solutions at 37°C. These investigations were performed in order to explore alternative methods to blood purification by dialysis in case of renal failure. Two zeolite structure types have been retained, each of them showing selective adsorption properties for creatinine (a free soluble uremic toxin molecule) and p-cresol (a partially protein bound uremic toxin molecule), respectively. MFI type zeolites, anhydrous Silicalite 1 and Na-ZSM-5 were synthesized and employed for the adsorption of p-cresol. Two modified commercial MORdenite type zeolites (different Si/Al ratios) were used containing Na+ and H+ as charge compensating cations. Adsorption isotherms- and microcalorimetric measurements in pure water, in physiological buffer solution (D-PBS) as well as in D-PBS containing Bovine Serum Albumine in physiological concentrations, were performed. While affinity for p-cresol vs. the MFIs is mainly modified by the cation presence in the void system, spectroscopic investigations (MAS-NMR), XRD with Rietveld refinement, and Monte-Carlo simulations confirmed a physisorption mechanism. Concerning MOR, only the H+-Mordenites show high and selective chemisorption for creatinine (confirmed by MAS-NMR), however, influenced by the composition of the liquid. Both adsorption mechanisms are compared and discussed in detail.

Keywords: uremic toxin removal, zeolites, adsorption