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EDITORIAL NOTE

This special issue of *Clay Minerals* includes papers presented at the 9th International Conference on the Occurrence, Properties and Utilization of Natural Zeolites (Zeolite 2014), which was held from 8–13 June 2014 in Belgrade, Serbia. The conference was organized under the auspices of the International Natural Zeolite Association (INZA), formerly the International Committee on Natural Zeolites (ICNZ). The publication of an issue devoted to zeolites reflects an attempt to broaden the scope of the journal to include additional topics beyond mainstream clay science. Twenty manuscripts were submitted for possible publication in the special issue, of which 12 were finally accepted and one is still under review. The papers represent the latest investigations on mineralogical and physicochemical characterization of these unique, low-cost materials and their potential applications as cement additives, as adsorbents for removal of ammonium cations, pathogens, heavy and toxic elements (Sr, Zn, Ni, Cu, Cd, Pb, As and Hg), anions (chromates) and dyes (Methylene Blue and reactive black 5) from aqueous solutions, as well as carriers for pharmaceutical active ingredients (e.g. ibuprofen). All of the papers bar two focused on natural zeolites and reflect the wide spectrum of environmental applications of these minerals.

Ferronato *et al*. examined the ability of clinoptilolite to detoxify wastewater before discharging it into the waterbody, using static-flow and laminar-flow experiments. The pathogenic microorganisms, ammonium and heavy metals were reduced substantially, highlighting the capacity of this zeolite for water remediation. Krajišnik *et al*. studied the ability of clinoptilolite modified with benzalkonium chloride and cetylpyridinium chloride surfactants to adsorb and release ibuprofen. The amount and type of surfactant used for the zeolite modification influenced the drug sorption, while release was controlled by a combination of diffusion and ion exchange.

Kowalak *et al*. synthesized phillipsite from a high siliceous aluminosilicate mixture supplemented with Zn cations, both in the presence and absence of Methylene Blue (MB). Synthesis in the presence of MB resulted in a substantial amount of the dye being incorporated within the zeolite; the MB content being several times greater than that absorbed from solution by either a natural phillipsite or the synthetic phillipsite. Wdowin *et al*. used synthetic faujasite-group zeolites (Na-X) derived from coal fly ash to adsorb mercury compounds from flue gases. The removal of mercury depended on the sorbent texture (powder or granulate), the exhaust gas flow rate, the contact time and the temperature of the experiment. Maximum mercury adsorption was observed for the granulated material.

Dimowa *et al*. carried out a structural investigation of a Zn^{2+}-exchanged clinoptilolite-rich tuff from Bulgaria with Rietveld refinement. The Zn^{2+} cations were located in specific sites (Zn1, Zn2 and Zn3) within the channels of the clinoptilolite. Positron Annihilation Lifetime Spectroscopy confirmed the results of the structural refinement. Lihareva *et al*. investigated sorption of Sr^{2+} by a natural clinoptilolite from Bulgaria using batch experiments and determined the rate of adsorption and the equilibrium model. High uptake of Sr^{2+} from low saline groundwater simulated solution, as well as fast kinetics, confirmed that this zeolite could serve as an efficient permeable barrier for groundwater remediation.

Nadaroglu *et al*. investigated the ability of a laccase-modified natural clinoptilolite to remove a dye, reactive black 5 (RB5), from aqueous solutions and determined the equilibrium and kinetics of the adsorption. The laccase-modified natural zeolite could be employed as a successful alternative to expensive, commercial adsorbents. Narin described the non-isothermal dehydration kinetics of a Turkish clinoptilolite-rich natural zeolitic material using thermogravimetric data. The investigation showed constant activation energy within the temperature range 30–200ºC. The activation energy values were smaller than the activation energy for vaporization of bulk water, suggesting that diffusion of water was controlling the dehydration rate.

Nuić *et al*. applied the BDST (Bed Depth Service Time) model to the uptake of binary Pb + Zn solutions on fixed beds of a clinoptilolite-rich tuff from Serbia. The calculated parameters of the BDST model were used successfully in the

prediction of breakthrough time and might be used to optimize the design and performance of a fixed-bed scale-up with natural zeolite, for removal of Pb and Zn from aqueous solutions without additional experimentation. Szala et al. compared the adsorption of chromate by a natural clinoptilolite from Ukraine with a synthetic Na-P1 zeolite produced from F-class fly ash, both of which were modified with different amounts of HDTMA and ODTMA surfactants. The amount of Cr(VI) adsorbed decreased with increasing pH within the range pH 2–7. The synthetic organo-zeolite, Na-P1, was a more effective adsorbent of Cr(VI) than the organo-clinoptilolite.

Ugrina *et al*. studied the kinetics of zinc and cadmium uptake by iron-modified clinoptilolite and reported that ion exchange is the main mechanism for Zn and Cd uptake, intra-particle diffusion being the rate-limiting step. Desorption of Zn and Cd was more efficient from sodium salt solutions. Finally, Cornejo *et al*. investigated the effects of addition of either a mordenite tuff, a mixture of heulandite-clinoptilolite (HEU-CLI), mordenite itself or a calcareous siltstone on the allite (C3S), bellite (C2S), calcium hydroxide (CH) and calcium silicate hydrate (C-S-H) components of cement. They examined the consumption of CH due to the pozzolanic reaction and the carbonation over time of air-cured blended-cement pastes. The effects of the additives on the compressive strength of the final products were also determined successfully.

These papers reflect the wide variety of applications of zeolites and underline the importance of these minerals in environmental remediation.

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