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Sorbents of heavy metals based on combination of low rank coals and chitosan

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The study has been aimed at development of cheap sorbents of toxic heavy metals and radionuclides based on low rank, low energetic coals in combination with chitosan for use in treatment of both waste and drinking water and construction of active geochemical barriers. Sorbents based on lignite and naturally oxidized lignite (oxihumolite, leonardite) were prepared, both raw and impregnated with chitosan from its solution in oxalic acid. The sorbents were characterized by chemical and structural analyses. Their sorption performance for Co, Cu, and Cd was tested in equilibrium sorption experiments with respect to pH. The sorption efficiencies were calculated from the amount of metal retained by the sorbent, which was determined by instrumental neutron activation analysis in the short time irradiation mode with epithermal neutrons (in a Cd shielding). Although chitosan provides only surface coating of the coal sorbents, its presence has affected significantly their sorption performance. At identical pH values, the sorption efficiencies of the chitosan coated coals were higher than those of the raw coals for all three metals, and this difference was increasing with pH. The chitosan coating obviously stabilizes coal in basic solution and inhibits leaching of humic substances and their complexes with the metals from coal into solution. Besides fixing metal humates within the sorbents, chitosan may positively affect the sorption efficiency also by its buffering action against the hydroxide addition.

Primary authors: MIZERA, Jiří (Nuclear Physics Institute, Academy of Sciences of the Czech Republic); HAVELCOVÁ, Martina (Institute of Rock Structure and Mechanics, Academy of Sciences of the Czech Republic)

Co-authors: KRAUSOVÁ, Ivana (Nuclear Physics Institute, Academy of Sciences of the Czech Republic); BORECKÁ, Lenka (Institute of Rock Structure and Mechanics, Academy of Sciences of the Czech Republic); MACHOVIČ, Vladimír (Institute of Rock Structure and Mechanics, Academy of Sciences of the Czech Republic)

Presenter: MIZERA, Jiří (Nuclear Physics Institute, Academy of Sciences of the Czech Republic)

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