BEHAVIOUR OF PLUTONIUM IN AQUEOUS SYSTEMS CONTAINING HUMIC SUBSTANCES

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The migration of plutonium in aqueous systems is of importance in connection with the safety assessment of high level nuclear waste repositories. Humic Substances (HS) play an essential role in the migration of radionuclides due to their ability to form complexes and to their reducing behaviour.

For the redox speciation of plutonium, Gorleben ground water containing HS was analyzed by online coupling of capillary electrophoresis to inductively coupled plasma-mass spectrometry. Pu(VI) is reduced by humic rich Gorleben ground water to Pu(IV) and Pu(III) and therefore we have focused our studies on the complex formation of trivalent and tetravalent plutonium with HS. The time dependence of the plutonium complexation with Aldrich humic acid was investigated and the complex formation constants of Pu(IV) at different pH values were determined. Different concentrations of plutonium (10^{-6} to 10^{-8} M) and Aldrich humic acid (0.01 to 25 mg/l) were applied. For the determination of log(ß) values the method of ultrafiltration was used.

Ultra-trace amounts of plutonium can be detected by coupling capillary electrophoresis with the highly selective and sensitive resonance ionization mass spectrometry (RIMS). The obtained results will briefly be presented.

EVALUATION AND COMPENSATION OF ION-EXCLUSION EFFECTS DURING GEL-PERMEATION FRACTIONATION OF HUMIC SUBSTANCES

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Size-exclusion chromatography (SEC) is a powerful technique for determination of the molecular weight (MW) distribution of humic substances (HS). However, SEC of HS in aqueous phase is likely to give rise to artifacts. Ionic exclusion is a non-size exclusion effect arising from repulsive interactions between the charged analyte and the partially charged gel matrix. To compensate for ionic exclusion, modification of eluent is needed. The objective of this research was to evaluate the magnitude of ionic exclusion effects during gel-permeation fractionation of HS and to determine the conditions providing compensation for ionic -exclusion effects. SEC-fractionation of HS was conducted with eluents of different ionic strength varying from 0.01 up to 0.13 M. SEC analysis was performed on Abimed system including HPLC pump, autosampler, and UV detector. The column was packed with Toyopearl TSK

HW-55S gel. Phosphate buffer at pH 6.8 was used as a mobile phase. For six humic materials tested, it was found that the relationship of partition coefficient versus ionic strength of the eluent reached plateau at 0.06 M. However, polystyrenesulfonates used as calibration standards experienced very substantial sorption at the given ionic strength that made them non-applicable for molecular weight calculation. Recommendations on the optimum SEC fractionation conditions for humics analysis were worked out.

PHYSICO-CHEMICAL COMPOSITION OF LAKE BOTTOM SEDIMENTS IN RELATION TO FOREST CATCHMENT MANAGEMENT

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The aim of this work was to determine the influence of forest catchment management on properties of lake bottom sediments and elemental composition and spectral properties of extracted humic acids. The four lakes located in the Drawa National Park (N-E Poland) were studied. This study shows that there is significant influence of forest catchment (*Pinus sylvestris* or *Fagus sylvatica*) on properties of organic matter in sediments and on properties of humic acids. The content of pigments in littoral and profundal bottom sediments differs in relation to catchment management. Cluster analysis performed for sediment and humic acids parameters divided the samples into four clusters, reflecting the origin of sediments.

APPLICATION OF HIGH-VOLTAGE PLASMA TECHNOLOGY FOR PROCESSING OF ORGANIC MATTERS

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High-voltage plasma technology falls into a class of high technologies and is based on utilization of different interconnected nonlinear dynamic effects and physical phenomena. Plasma filament with high temperature, powerful shock waves, pulse electromagnetic and X-radiations, ultrasound, turbulization of flows occur in a fluid under high-voltage discharge.

Circuit designs and performance data of three types of high-voltage plasma installation are presented (one of them is intended for production of artificial manure from peat). Main units of experimental line for production of artificial manure as well as a sequence of main operations on processing of peat are listed. The results of hotbed agricultural experiments are discussed. Substantial acceleration of extraction of sea-buckthorn oil is achieved. Quantitative output of useful substances from flowers of a calendula, valerian, seaweed was about 88–95% (this value exceeds the useful output of many well-known extractions