Eu(III) complexation with humic acid and similar ligands in natural waters

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Humic materials play very important role in the transport and sorption of metal ions in the environment, i.e. in seawater and fresh waters. Namely, as the nuclear energy industry still exsits in a great extent in the environment, fission products and actinide elements, such as europium, americium etc, could be released from the reactor operation, reprocessing plants and reprocessed waste disposal. Furthermore, concentrations of europium (III) in marine and fresh waters are frequently larger than predicted by the solubility products with hydroxide and carbonate concentrations normally present. Naturally occuring organic materials (humic and fulvic acid) are responsible for higher concentrations of these dissolved elements because of the complexation process. The interaction of europium(III) with humic acid (1-3) is very significant in the first place because it has properties which are comparable in a great extent with other characteristic radionuclides, i.e. americium(III) and plutonium(III). The strenght of the Eu(III) complexation with humic acid can be used as an example of the environmental behaviour of the actinides, as well.

Determination of Eu(III)-humate complex, as well as Eu-thenoyltrifluoroacetonate (TTA) and Eu-salicylate complexes by square-wave voltammetry was performed. The complexes are strongly adsorbed at the mercury drop electrode surface.

The main difference between them is the fact that the Eu-humate complex cannot be accumulated at the electrode surface, so it is not suitable for the analysis of lower contents of europium. Complexes of europium with 2-thenoyltrifluoroacetone and salicylic acid accumulate at the electrode surface so that low concentration levels of europium can be detected. With TTA, the concentration level of 5×10^{-9} mol/L of europium at pH = 6.6 was reached. With salicylic acid as a ligand the concentration level 10^{-8} mol/L of europium at pH = 5.3 was obtained. Europium - humate complex was determinated at pH = 5.0 and lowest europium concentration level reached was about 5×10^{-7} mol/L of europium.

It is interesting that the electrochemical process of these complexes proceed by totally different mechanisms what is the characteristic of europium in the various aqueous solutions and in the presence of various ligands.

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The influence of macrozooplankton on the fatty acid composition of particulate matter collected by sediment traps

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Zooplankton can affect significantly particulate matter vertical fluxes and modify the suspended and sedimenting particle composition (NOJI, 1991). In 1991, during a sediment trap experiment, carried out in the northeastern Adriatic sea, 25 km off Rovinj, the influence of macrozooplankton, probably mostly actively swum into traps (free swimmers), on fatty acid and hydrocarbon composition of entrapped material was investigated. Analyses were performed on total samples, samples free of macrozooplankton and isolated macrozooplankton (>1 mm in length), collected monthly from 25 April to 5 August 1991.

Zooplankton total fatty acid concentrations gradually decreased from 25/4 to 23/7, significantly influencing the total samples concentrations (Tab. 1). Fatty acid composition of the zooplankton caught from 25/4 to 21/6, in addition to the highest fatty acid concentration observed, contained high proportions of PUFA, which partly exceeded or were in the same ranges observed in healthy growing zooplankton (MORRIS, 1971). In this period the microphytoplankton densities, probably the main zooplankton food source, were the highest in the investigate period. Related to this, fatty acid composition indicated diatoms as one of the most important source of sediment trap zooplankton free fraction. Other sources were also microzooplankton and fecal pellets, indicated by domination of shortchain alkanes and PR/C_{17} ratio higher than one. From 21/6 to 23/7 zooplankton fatty acid concentrations decreased, PUFA proportion reached minimal values, and reversal of the PR/C_{17} ratio occurred in zooplankton samples, while in the rest of material the ratio remained above one. These results indicated prevailing of starving conditions for zooplankton. In fact, microphytoplankton densities were significantly reduced in the water compared to the previous periods (Tab. 1). Moreover, in this period large mucilaginous aggregates massively appeared, additionally subtracting food from zooplankton.

The results have shown that fatty acid composition of the sediment trap material significantly depends upon macrozooplankton composition.

It should be claimed out that beside the quantity of the free swimmers in sediment traps, very important factor is the physiological condition of the zooplankton. The need of separated analyses is shown.

Table 1. Fatty acid concentration (c), percentage composition of saturated (sat.), monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA), PR/C_{17} ratio and microphytoplankton fraction density (>20µm, on 20 m depth, mF), in the total (T), zooplankton free (ZF) and zooplankton (Z) samples.

Sampling	intervals	c (mg/g)	Sat.	MUFA	PUFA (%)	PR/C_{17}	mF $10^4/dm^{-3}$
T	25/4-	2.65	41.7	31.8	26.4	4.6	5.1
ZF	14/5	0.81	55.2	30.1	14.2	6.2	
Z		15.31	28.8	32.9	38.3	2.6	
T	14/5-	3.61	46.4	37.5	16.1	5.8	27.5
ZF	21/6	0.59	35.8	42.4	21.7	5.2	
Z		12.19	25.3	28.7	45.9	5.5	
T	21/6-	0.87	78.6	18.4	3.1	1.4	0.81
ZF	8/7	1.16	88.9	9.7	1.3	3.6	
Z		5.14	65.8	28.5	5.7	0.7	
T	8/7-	2.52	49.0	22.0	28.9	1.8	0.66
ZF	23/7	4.63	45.9	36.3	17.8	4.2	
Z		2.29	67.9	26.5	5.6	0.5	
T	23/7-	1.20	35.9	28.9	34.5	1.5	2.50
ZF	5/8	2.63	39.2	32.1	28.6	2.6	
Z		4.81	55.9	28.9	15.1	1.0	

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