THE CONCENTRATION OF ACTIVE AND INACTIVE STRONTIUM IN SOME DANUBE RIVER SAMPLES

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INTRODUCTION

The present knowledge in radioecology has clearly proved that the level of radioactivity is not only deciding factor in an ecosystem. The physico-chemical state in which particular radionuclides are found is important for the uptake of radioactive substances into organisms. Among the radionuclides arising in uranium fission process, from the nuclear power plants, ^{90}Sr and ^{89}Sr are of a particular importance for man because of their radiotoxicity.

Strontium, being a chemical element with similar properties to those of the calcium, is metabolised by the food chains identically with calcium. Therefore, the presence of inactive and active strontium in the effluents and their possible interactions in environment are of a special radiological interest.

This paper deals with some results of strontium concentration as well as concentration factors for inactive and active strontium for some fish species in Danube river. The samples are colected during 1981.

EXPERIMENTAL

Inactive strontium in the water residue (after evaporation), sediment and fishes is determined by nondestructive neutron activation analysis by using the γ-counting system which consisted of the 40 cm^3 Ge(Li) semiconductor crystal (FWHM 2 2,1-1332 keV, peak : Compton = 29 : 1, eff. 7,2%) attached to a 4096-channel pulsehight analyser.

The quantities of strontium are calculated relatively, using standard solution which contained 5×10^{-5} g of strontium per 100 λ .

Radioactive strontium is measured after several separation procedures (1,2). $^{90}SrCO_3$ in equilibrium with its daughter ^{90}Y (3) is detected in the β-low-level counting anticoincident system with gas-flow detector. Background rate was about 1 cpm, and eff. for ^{90}Sr was 20-24%. The activity of ^{90}Sr is calculated from the ratio of ^{90}Sr activity in the sample and ^{90}Sr activity in the standard (150,92 mBq ^{90}Sr/ml solution). Corrections for the efficiency as well as for chemical yield were applied.

RESULTS AND DISCUSSION

The results of total strontium, active strontium and concentration factors for some Danube fishes and Danube sediment are presented in Table 1. The concentration factors were calculated from the formula:

$$CF_{Sr} = \frac{\text{gram strontium/gram fresh fish}}{\text{gram strontium/ml water}} , \quad \text{or}$$

$$CF_{^{90}Sr} = \frac{\text{mBq } ^{90}Sr\text{/gram fresh fish}}{\text{mBq } ^{90}Sr\text{/ml water}}$$

TABLE 1.

Specie	total strontium		spec. activity ^{90}Sr		$\frac{g_{Sr}/g\ f}{g_{Sr}/ml\ w}$	$\frac{mBq\ ^{90}Sr/g\ f}{mBq\ ^{90}Sr/ml\ w}$	$\frac{mBq\ ^{90}Sr}{mg\ Sr}$
	our results	lit.(4) values	our results	lit.(4) values			
Barbus barbus	1.37 (5)*	1.5 (5) 1.1 (5)	0.21*	0.55 0.46	73	110	15.2
Acipenser ruthenus	2.39 (5)	1.4 (5) 1.3 (5)	0.26	0.39 0.47	128	137	10.9
Abramis brama	3.26 (5)	1.1 (5) 1.3 (5)	0.44	0.57 0.39	173	233	13.5
Stizostedion lucioperca	1.75 (5)	1.1 (5) 1.9 (5)	0.26	0.39 0.72	94	135	14.6
Silurus glanis	4.06 (5)	-	0.59	-	217	312	14.5
Cyprinus carpio	6.27 (5)	-	1.05	-	336	557	16.7
Sediment	1.63 (3)**	-	13.58**	-	8727	7185	8.3
Water	1.87 (7)***	2.0 (7)	1.89 (3)***	37	-	-	10.1

* 1.37 (5) = 1.37×10^{-5}; for fish results in g/g freshweight or mBq/g freshweight
** for sediment results in g/g dry or mBq/g dry
*** for water results in g/ml or mBq/ml

Our results confirm the literature data (4,5) that sediment concentrations of the total strontium and the active ^{90}Sr are several times greater than those in the water. This can be explained with the fact, that the adsorption of strontium depends on the physico-chemical state of the sediment (6). Therefore, sediments are suitable and very sensitive indicators (static indicators) of long-term radioactive waste discharges. Fishes, that are living in the aquatorium are dinamic indicators of pollution, and they are the last link in the food chain towards man. Comparing the results for the fishes, we observed that concentration factors for Silurus glanis and Cyprinus carpio are much higher than the other fish species. This fishes, which are living near bottom can be used as a selected indicator organism for the radioactive pollution of the environment.

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