HEAVY METAL AND RADIOACTIVITY IN BIOTA AND SEDIMENT SAMPLES COLLECTED FROM ÜNYE IN THE EASTERN BLACK SEA

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Abstract

The heavy metal (Cd, Co, Cr, Cu, Ni, Pb, Zn, Fe and Mn) and radionuclide (^{137}Cs, ^{238}U, ^{232}Th, and ^{40}K) concentrations were determined in macroalgae, mussel, sea snail, fish and sediment samples collected from Ünye region at the eastern Turkish coast of the Black Sea. In general, as regards the influence of the collection site on the whole metal accumulation, Ünye is considered to be more polluted than other region of the Black Sea. The measured radionuclide concentrations are within the range of the values cited in previous work concerning the Turkish Black Sea coast.

Key-words: radioactivity, heavy metal, Black Sea

Introduction

The coastal area of Ünye in the eastern Black Sea is nearly 35 km long. The famous beaches of the Black Sea were located in this area. Since 2000, nutrients exceeded the algae requirements that caused eutrophication. In this area, insufficiently treated sewage, municipal waste combustion and agricultural runoffs are the main sources of the chemical pollution. At the same time, a fertilizer plant and a coper smelter located 50 km west of Ünye. Several papers have been published concerning heavy metal levels in biota and sediment samples of Turkish Black Sea coast (1-4). It is well known that many anthropogenic radionuclides entered into the Black Sea after Chernobyl accident. Nowadays, the anthropogenic radionuclide in the Black Sea marine environment originated from rivers of the Chernobyl contaminated regions and from nuclear power plants in countries around the Black Sea. Of late, the study of natural radionuclides in the Black Sea has received increasing attention. Some papers have been published concerning anthropogenic and natural radionuclides in biota and sediment samples collected from Turkish Black Sea coast (3,5-6). However, no data on the heavy metal and radioactivity levels of biota and sediment samples in Ünye area have been published. The objectives of this study are to examine the concentrations of selected heavy metals (Cd, Co, Cr, Cu, Ni, Pb, Zn, Fe and Mn) and ^{137}Cs, ^{238}U, ^{232}Th and ^{40}K radionuclides in biota and sediment samples collected from Ünye coastal area in 2001.

Materials and methods

The macroalgae species (*Cystoseira barbata, Ulva lactuca*) were harvested from the sea at low tide. The algae samples were washed in seawater at the sampling station and transfered to the laboratory. In the laboratory, they were rinsed in sea water to remove contaminating materials. Lastly, algae were rinsed in distilled water. Then they were dried at 85 °C to constant weight and homogenized. The mussel (*Mytillus galloprovincialis, Venus gallina*) and sea snail (*Rapan venosa*) and fish (*Trahurus trahurus, Sarda sarda, Psetta ssp.*) samples were stored on ice in an insulated box and transferred to the laboratory. Prior to metal analysis, all the soft part and muscle tissue for each sea snail and all the soft part of each mussel was dissected. The muscle samples of the fish were prepared from the tail part of the fish. The samples were pooled and freeze-dried for 10 days to a constant weight. About 4 cm of the top of sediment samples collected within the same 3-5 m reach at each sampling site using a Lenz Bottom Sampler. The collected sediment was sieved in the field and the <63 and <500 μm size fractions were kept for heavy metals anaysis.The heavy metal concentrations were determined by atomic absorption spectrophotometer (Varian, Model Spectra AA 100/200). The collected sediments were sieved and the <500 μm size fraction was kept for radionuclide analysis. The gamma isotopic analyses were carried out using a Canberra S-45 4K MCA spectrometer. Other procedures of the two methods were similar to that previously described (3,6).

Results and discussion

The range of the heavy metal concentrations in biota and sediment samples are shown in Table 1. In present study, Cu in macroalgae, Pb in mussel and Zn in sea snail samples are higher than were found in the same species collected from the other coastal parts of the Black Sea. At the same time,Co, Cr, Cu, Ni, Pb, Fe and Mn concentrations in the sediment samples at the present study were higher than other areas of the Turkish Black Sea coast (3). The radionuclide levels in the tested biota and sediment samples are shown in Table 2. The ^{137}Cs concentrations in the biota samples were found to be below the lower limit of detection. The ^{137}Cs and natural radionuclide concentrations in the sediment samples are lower when compared with the result of the other parts of the eastern Black Sea (6).

Table 1. The range of the heavy metal concentrations in biota and sediment samples (μg g^{-1} dry weight).

Metal	Algae	Mussel	Sea snail	Fish	Sediment
Cd	0.8-2.7	2.5-5.8	0.5-12.3	<0.02	<0.02
Co	<0.5	3.0-3.2	<0.5	<0.05	22.5-86.2
Cr	1.1-2.4	4.1-4.7	<0.06-1.8	<0.06	39-245
Cu	19.-26	12-29	67-70	4-6	47-111
Ni	4.2-6.7	4.9-7.8	<0.1	<0.1	36.5-79.2
Pb	<0.1	4.5-7.9	3.5-6.7	<0.1	<0.1-52.9
Zn	76-350	98-255	53-147	21-34	68-148
Fe%	0.1-0.2	01-04	0.1-0.2	0.03	4.2-29.6
Mn	30-80	63-65	7-14	2-3	907-2830

Table 2. Radionuclide concentrations in biota and sediment samples (Bq kg^{-1} dry weight).

	^{137}Cs	^{238}U	^{232}Th	^{40}K
Macroalgae	<3	<13	<7	543±297
Mussel	<3	<13	<7	<170
Sea snail	<3	<13	<7	<170
Turbot	<3	<13	<7	655±353
Bonito	<3	<13	<7	280±162
Sediment-1	22±7	39±21	47±16	686±128
Sediment-2	17±7	56±17	39±14	530±118
Sediment-3	9±6	33±13	35±13	599±100

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