

RADIOACTIVITY CONCENTRATIONS IN THE SURFACE SEDIMENT AND MUSSEL SAMPLES FROM THE BOSPHORUS AND THE GOLDEN HORN, TURKEY

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Abstract

It is well known that sediment and mussel samples are commonly used for monitoring of radioactivity levels in marine ecosystem. In the present study, radioactivity concentrations of ¹³⁷Cs, ⁴⁰K, ²³²Th, ²³⁸U and ²¹⁰Po were measured in sediment and mussel (*Mytilus galloprovincialis*) samples. The results of the present study were compared with the similar studies.

Keywords: Bosphorus, Mollusca, Radionuclides, Sediments

Introduction

Nowadays, the natural radioactivity levels in Turkish marine environment are gradually increased by the fossil fuel industry, phosphate industry and the using of fertilizers. On the other hand, anthropogenic radionuclides are decreased in the biota samples of the Turkish marine environment in the course of time [1]. Some papers have been published concerning anthropogenic and natural radionuclides in biota and sediment samples collected from the Bosphorus strait [2, 3].

Materials and Methods

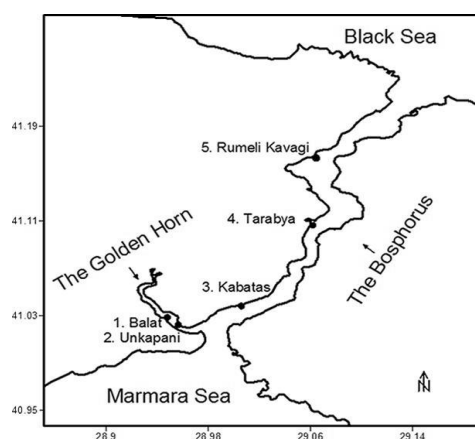


Fig. 1. Study area and sampling stations

The surface sediment samples were collected using a Van Veen grab sampler in the stations. The size fractions (< 63 and > 63 µm) of each sediment samples were dried at 85 °C to constant weight and homogenized prior to analysis. The mussel samples were cleaned any external material, dissected and then dried at 85 °C to constant weight and homogenized. The measurements of ²³²Th, ²³⁸U, ⁴⁰K and ¹³⁷Cs activities were carried out using a gamma multichannel analyzer equipped with a HPGe detector (Canberra 2020). The concentrations of ²¹⁰Po in the samples were measured with an alpha spectrometer. Other procedures of the two methods were similar to that previously described [4, 5].

Results and Discussion

²¹⁰Po concentrations were not measured for the >63 µm fraction of sediment samples in all stations. In Balat station, >63 µm fraction of sediment could not be obtained for radioactivity measurements. ¹³⁷Cs concentrations in the mussels collected from the sampling stations were generally found to be at the similar level. The activity concentrations in mussel samples of the Bosphorus are slightly lower when compared with that of the previous study carried out in the same site during the period of 2004-2006 [6]. In a previous study, ¹³⁷Cs activity content significantly increased with the decreasing grain size [7]. ¹³⁷Cs concentrations determined in the <63 µm sediment fraction in the Bosphorus are significantly higher than those previously reported in this region [2, 4]. On the other hand, ¹³⁷Cs activity levels are significantly lower in the Bosphorus and the Golden Horn when compared with the eastern Black Sea sediment at the similar grain size.

Tab. 1. Average radionuclide concentrations (Bq kg⁻¹ dry weight) in sediment and mussel samples of all sampling stations.

| Sampling Stations | ¹³⁷ Cs | ⁴⁰ K | ²³² Th | ²³⁸ U | ²¹⁰ Po |
|----------------------------|-------------------|-----------------|-------------------|------------------|-------------------|
| Sediment < 63 µm | | | | | |
| Balat | - | - | - | - | - |
| Unkapanı | 5.05 ± 0.29 | 355 ± 18 | 12.4 ± 0.7 | 14.1 ± 0.8 | - |
| Kabatas | 5.30 ± 0.30 | 362 ± 19 | 18.1 ± 1.0 | 19.3 ± 1.0 | - |
| Tarabya | 1.61 ± 0.13 | 344 ± 17 | 10.7 ± 0.6 | 7.9 ± 0.4 | - |
| Rumeli Kavagi | 27.50 ± 1.40 | 639 ± 32 | 12.0 ± 0.7 | 11.6 ± 0.7 | - |
| Sediment > 63 µm | | | | | |
| Balat | 40.5 ± 2.2 | 501 ± 26 | 22.0 ± 0.9 | 16.5 ± 0.8 | 113 ± 7 |
| Unkapanı | 33.4 ± 1.9 | 410 ± 22 | 20.9 ± 0.9 | 15.5 ± 0.9 | 230 ± 11 |
| Kabatas | 14.9 ± 1.0 | 341 ± 19 | 20.0 ± 0.9 | 16.9 ± 0.8 | 63 ± 6 |
| Tarabya | 35.7 ± 2.3 | 493 ± 26 | 29.2 ± 1.3 | 20.5 ± 1.2 | 128 ± 7 |
| Rumeli Kavagi | 46.0 ± 2.6 | 630 ± 33 | 14.8 ± 0.7 | 10.8 ± 0.7 | 49 ± 3 |
| Mussel | | | | | |
| Balat | 1.05 ± 0.23 | 348 ± 18 | 0.8 ± 0.06 | <LLD | 65 ± 4 |
| Unkapanı | 1.35 ± 0.20 | 352 ± 18 | 0.9 ± 0.05 | <LLD | 42 ± 4 |
| Kabatas | 1.23 ± 0.18 | 330 ± 17 | 2.3 ± 0.12 | 0.7 ± 0.07 | 87 ± 7 |
| Tarabya | 1.31 ± 0.26 | 310 ± 16 | 1.9 ± 0.10 | 0.9 ± 0.09 | 142 ± 15 |
| Rumeli Kavagi | 1.20 ± 0.25 | 304 ± 16 | 1.4 ± 0.08 | <LLD | 166 ± 17 |

LLD, Lower limit of detection

The highest concentrations of ²¹⁰Po in mussel and sediment samples were found as 166±17 and 230±11 Bq kg⁻¹ in R. Kavagi and Unkapanı stations, respectively. ²¹⁰Po activity concentration in the R. Kavagi mussel has not changed significantly during the past ten years [3]. On the other hand, ²¹⁰Po level in the Golden Horn sediment is higher than the Black Sea sediment [1].

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