

²¹⁰PO, ²¹⁰PB, ¹³⁷CS AND HEAVY METAL CONCENTRATIONS IN MUSSELS, FISH SPECIES, SEDIMENTS AND SEA WATER IN DIDIM, TURKISH COAST OF AEGEAN SEA

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Abstract

Intense agricultural activities with dense use of fertilizers and Menderes river and streams carrying industrial and agricultural residues into the sea cause additional pollution in Didim region. In this study, concentrations of ²¹⁰Po, ²¹⁰Pb, ¹³⁷Cs and heavy metals (Zn, Cu, Fe, Cd, Mn, Ni, Pb, Cr) have been measured in mussels (*Mytilus galloprovincialis*), sediments, fish species and sea water collected from Didim (Aegean Sea) monthly.

Keywords: Aegean Sea, Bio-Indicators, Pollution, Radionuclides, Metals

²¹⁰Pb ($t_{1/2} = 22$ years) and ²¹⁰Po ($t_{1/2} = 138$ days) are decay products of ²³⁸U, and their main source in the environment is atmospheric radon. Both radioisotopes have a strong affinity for particles, but have different binding mechanisms. ²¹⁰Pb adsorbs on particle surfaces whereas ²¹⁰Po is considered as an important source of the natural radiation received internally by marine organisms [1,2]. The main source of ¹³⁷Cs in marine environment can be attributed to worldwide fallout deposition from atmospheric nuclear weapons testing (1941-1981) [3]. In the literature, there is no data for ¹³⁷Cs for Didim coastal area. Most of the particle-reactive radionuclides released into the aqueous phase eventually reach the sediments. The accumulation, retention and transport of particle reactive radionuclides is strongly associated with sediment and sedimenting particles [4]. Marine organisms are commonly used as environmental matrices in chemical and radioactive monitoring programmes because they accumulate persistent pollutants at concentrations orders of magnitude above those in the water [5]. In our project supported by IAEA, there were significant differences in ²¹⁰Po and ²¹⁰Pb concentrations in mussel samples due to the stations. Therefore, this research has been emphasized on Didim station which is located on the western coast of Turkey and indicated in Figure 1. ²¹⁰Po, ²¹⁰Pb, ¹³⁷Cs and heavy metals (Zn, Cu, Fe, Cd, Mn, Ni, Pb, Cr) concentrations of marine samples are measured monthly to determine the sources of marine pollution in this area. For mussel (*Mytilus galloprovincialis*) samples and fish species, in order to minimize the effect that size (age) exerts on the radionuclide concentrations; specimens of standard size in groups were selected. Sediment samples were taken by bottom-grap. Each sample is oven-dried to constant weight and was sieved before analysis. After applying chemical procedure with some acids, polonium was spontaneously plated onto a copper discs. Measurements of ²¹⁰Po were realized through its 5.30 MeV alpha particle emission, using ²⁰⁹Po (4.88 MeV alpha emission, $t_{1/2} = 109$ a) as the internal tracer [6,7]. ²¹⁰Po was measured by alpha spectrometry using a Passivated Implanted Planar Silicon detector (Ortec Octete Plus PIPS detector). The samples were then stored at least 6 months to allow decay of ²¹⁰Pb and subsequent radioactive growth of ²¹⁰Po. The ²¹⁰Pb activity was calculated from the ingrowth of ²¹⁰Po, assuming zero initial ²¹⁰Po activity. ¹³⁷Cs concentrations were measured by HPGe dedector (model of Tennelec, 184 cm³ p-type coaxial). Heavy metal concentrations (Zn, Cu, Fe, Cd, Mn, Ni, Pb, Cr) were measured by ICP-OES (Perkin-Elmer 2000 DV). Concentrations of ²¹⁰Po and ²¹⁰Pb in mussels were in the range of 34±9 and 2303±383 Bq kg⁻¹ (dry weight); non-detectable and 64±6 Bq kg⁻¹ (dry weight), respectively. Among the fishes, small pelagic plankton feeding fish like sardine (*Sardine pilchardus*) tend to accumulate more ²¹⁰Po. ²¹⁰Po and ²¹⁰Pb concentrations in the sediment samples varied between 24±5 and 126±6 Bq kg⁻¹; 18±3 and 59±4 Bq kg⁻¹. The values of Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn in mussel, sediment and fish (except Cd in fish) samples found lower than the acceptable limits. The levels of ¹³⁷Cs concentrations in mussels, sediment, fish species and sea water samples were found relatively low.



Fig. 1. The map of sampling location.

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