

Application of $\Delta^{14}\text{C}$ and $\delta^{13}\text{C}$ to trace sources of organic carbon in Baltic Sea sediments

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Content

Radioactive and stable isotopes have been widely used to trace the origin and fate of organic carbon (OC) in the environment. They were applied to identify sources of OC in the marine environment. Microbial communities responsible for biodegradation of different origin organic contaminants can produce specific biomarkers. The application of carbon isotopes in combination with compound-specific analyses and microbial biomarkers is promising tool since specific microbiological degradation can occur in the contaminated sediments, which can lead to assimilation of toxic compounds and their degradation products. Releases of specific microbiologically-derived lipids into the environment with carbon isotopic composition unusual for the given area can serve as an indicator of contamination of the marine environment. The $\Delta^{14}\text{C}$ and $\delta^{13}\text{C}$ of total organic carbon (TOC) in surface (0-3 cm) bottom sediments as well as in humic acids, lipid and phospholipids (PL) fractions isolated from the bottom sediment samples collected in the Curonian Lagoon and in the open Baltic Sea were investigated. The $\delta^{13}\text{C}$ measurements of phospholipid – derived fatty acid methyl esters were carried out with Finnigan Trace GC ultra gas chromatograph, combined with Thermo Finnigan Delta plus Advantage stable isotope spectrometer. The column used for the fatty acid methyl esters measurement was a Supelco SPTM-2380 capillary column with 0.25 mm internal diameter, 30 m in length and of 0.2 μm film thickness. Measurements of $\Delta^{14}\text{C}$ in sediments and in different classes of organic substances were carried out by using a 1.0MV HVE Tandetron AMS. The phospholipid-derived fatty acid biomarkers and a different end-member (EM) mixing model approach were applied to estimate the relative contribution of the marine and terrestrial input to OC in the coastal and open sea surface sediments, assess a possible effect of petroleum hydrocarbon HC contamination on radiocarbon signatures and to elucidate a probable leakage of chemical warfare agents (CWA) at the CWA dumping site in the Gotland Deep. The most depleted values of the $\Delta^{14}\text{C}$ of the TOC and the total lipid fraction were detected at the CWA dumping site. Application of EM mixing-model-analysis and measurements of total petroleum hydrocarbons (THCs) allowed estimation of OC sources (terrestrial, marine, fossil and THC) in studied sediments. The compound-specific method was applied to estimate the possible effect of CWA on depleted $\Delta^{14}\text{C}$ and $\delta^{13}\text{C}$ values.

About the Presenter

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She has graduated from the University of Vilnius, Department of Chemistry, (M.Sc., Chemistry of natural compounds). She received her Ph.D. degree in chemistry from the University of Vilnius (Physical and chemical characteristics of radionuclides in the environment) in 1993. Presently, she is a head of laboratory at the Center for Physical Sciences and Technology in Vilnius. She has been involved and leading a number of national and international projects devoted to environmental radioactivity and waste management. She has published over 100 papers in peer-reviewed journals (48 in international). She has been a principal supervisor of 7 PhD students.

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