DISSOLVED INORGANIC IODINE IN THE ROGOZNICA LAKE (EASTERN ADRIATIC COAST)

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Abstract

The speciation of iodine in the water column of the Rogoznica Lake was studied during the period 1998-2000. This small, eutrophicated salt lake, where anoxic conditions mostly prevail only in the deeper layers, has undergone a complete anoxia in September 1997. Elevated concentrations of iodide in the deeper layers (up to 2.4 μmol L^{-1}), and iodate in the oxic part of the water column (up to 0.53 μmol L^{-1}), were maintained for almost two years. The biogeochemical renewal processes that affect the concentration of both iodate and iodide within the water column seem to be slow in comparison to those that govern the speciation of iodine.

Key words: iodate, iodide, anoxia

Results

As a result of the geomorphologic isolation, higher biological activity and a stable conditions within the stratificated water column, the processes affecting the distribution of the dissolved iodine in natural waters, where the hypoxic and anoxic conditions are intermittently or permanently present, are found to be more intensive as compared to those occurring in the oceans. The Rogoznica Lake, situated at the Gradina Peninsula, in the eastern part of the Adriatic coast (43°32' N, 15°58' E), belongs to such a marine sub-environment. The lake water is enriched with nutrients [1, 2], inorganic and organic iodine species [3], dissolved organic carbon, surface-active substances and phytoplankton biomass [4]. The hypoxic and anoxic conditions are induced by a high primary production and consequent oxygen depletion. These are accompanied with the formation of a reduced sulphur species that are found to be present in significant quantities[1, 5].

In October 1997, complete oxygen depletion and the presence of the hydrogen sulphide were obtained within the entire water column of the Rogoznica Lake [2]. Due to the remineralisation processes, the concentrations of nutrients were extremely enhanced along the entire water column and remained high for a few months.

According to the data obtained in our work, and the results that refer to the renewal processes of nutrients, it seems that the nutrient-like behaviour and a biophilic nature of iodine can be confirmed. During the period investigated, the iodate and iodide concentrations (determined by voltammetric methods) varied between <0.025-0.53 μmol L^{-1} and 0.11-2.40 μmol L^{-1}, respectively. The relative ratios of iodate to iodide were significantly lower while the concentrations were higher than those found in seawater.

The average specific inorganic iodine concentrations (a sum of iodate and iodide normalized to salinity 35.00) in the seawater samples from the nearby Soline Bay (0.44 μmol L^{-1}, 1998-1999 and 0.42 μmol L^{-1}, 1993-1994) are comparable to those obtained for the oxic seawater (0.35-0.49 μmol L^{-1}) [6].

According to the concentration range of the specific inorganic iodine in the water samples from the Rogoznica Lake, there is a significant difference between samples collected during 1998-1999, and those collected in 2000. Although the specific inorganic iodine concentrations were high during 2000, varying between 0.46 μmol L^{-1} and 0.76 μmol L^{-1}, these values are low in comparison to the period of 1998-1999 (within the range from 0.56 up to 2.27 μmol L^{-1}). The data of the specific inorganic iodine in 46 water samples collected at various depths in the Rogoznica Lake during 1993-1994 were between 0.44 μmol L^{-1} and 0.78 μmol L^{-1}, which indicates that the period 1998-1999 was exceptional. The data obtained after the acute anoxic event suggest that the sequential processes including the eutrophication, mass mortality of the phyto- and zoo-plankton populations and other organisms (as a result of the oxygen depletion), and the release of bio-accumulated iodine to the water phase via the chemical or remineralisation processes, caused the enhancement of the concentration of iodate and iodide in the water phase. Both iodine vertical profiles, as well as the redox conditions in the deeper layers, suggest that these processes are mainly responsible for the production of iodide. However, assuming that the reducible redox conditions in September 1997 might have caused a complete or at least a partial iodate reduction in the upper layers, and that the results obtained confirmed the enhanced concentration of iodate in July and October 1998, the processes that might produce iodate are relatively fast and worth considering. Whether these processes refer to the photochemical reactions, biologically mediated processes or some alternative mechanism that overcomes the activation energy and the kinetic barrier of the iodide oxidation to iodate, they play a significant role in the speciation of the dissolved inorganic iodine in the Rogoznica Lake.

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