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AOX AND TOC OCCURRENCE LEVELS IN SURFACE WATER AND SEDIMENTS OF DANUBE RIVER

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Introduction

Surface water is a complex matrix that can contain a variety of organic compounds. A significant amount of these micropollutants reach the surface waters mainly after the discharge of effluent from wastewater treatment plants into receiving rivers. Although many of these chemical pollutants are regulated by environmental legislation, standardized methods for their detection and quantification in various environmental matrices accounts for only a small amount compared to their real number. Organic micropollutants pose a danger to both the aquatic environment and human health, especially in the context in which surface water sources are used for drinking purposes, but also after the consumption of various aquatic species. Moreover, these substances can have harmful effects on aquatic ecosystems, many of which possess toxic, mutagenic, endocrine disruptive and bioaccumulative properties. By transfer along the food chain, they can reach also into human food.

In this context, global parameters such as AOX (adsorbable organic halogens) and TOC/DOC (total organic carbon/dissolved organic carbon) can be effective indicators that provide clues about the presence of hazardous chemical components in aquatic environment. AOX include a wide range of chemical compounds that contain at least one halogen atom in their molecule (chloride, bromide or iodide, but without fluoride) such as polychlorinated biphenyls (PCBs), DDT, polychlorinated dibenzo-dioxins and dibenzo-furans (PCDDs / DFs). The parameter measured for total organic matter evaluation is quantified as either total organic carbon (TOC) or dissolved organic carbon (DOC). The value of the TOC / DOC parameter provides a global information on the total organic matter content in surface water and sediment. This abstract presents the results obtained for AOX and TOC/DOC parameters in water and sediments from the Danube River.

Materials and methods

The surface water and sediment samples were taken along the Danube river, from the sampling points: Bazias (S1), Eselnita (S2), Gruia (S3), Zimnicea (S4) and Giurgiu (S5). The preparation and analysis of the samples was done in accordance with the standard methods SR EN ISO 9562:2005 and SR EN 16166:2013 for AOX and SR EN 1484:2001 for TOC/DOC.

Results and conclusions

In surface water samples, the AOX concentration values were lower than 100 µgCl/L. According to German classification system, river water can be considered slightly

polluted, if the AOX concentration is less than 5 µgCl/L, moderately polluted for AOX concentrations between 5–20 µgCl/L, heavily polluted for values between 20–40 µgCl/L and highly polluted for concentrations higher than 40 µgCl/L. With the exception of the S4 surface water sample, the concentration level of AOX was above 40 ug/L, which indicates a fairly high pollution in the studied areas. As can be seen in Figure 1a, the TOC values (2.27-2.81 mgC/L) were much higher than those of AOX, which means that in the analyzed samples there are many organic pollutants that do not contain halogen atoms in the molecule. However, the variation in AOX concentration appears to follow a similar trend to that of TOC variation (Figure 1b).

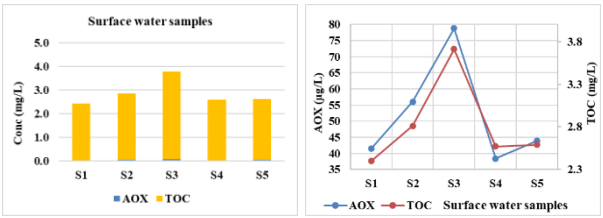

Figure 1. AOX and TOC distribution pattern in surface water (a) and comparison between AOX and TOC in surface water for the same treatment locations (b)

For sediment samples, the concentration levels determined for AOX and DOC proved to be comparable (Figure 2a). Values in the same concentration range can be explained by the presence of a large number of hydrophobic halogenated organic compounds (log Kow>3) in the aquatic environment and by their high adsorption capacity on solid sediment particles. Similar to surface water samples, and in the case of sediment samples, the variation of the AOX concentration is closely followed by the DOC concentration (Figure 2b).

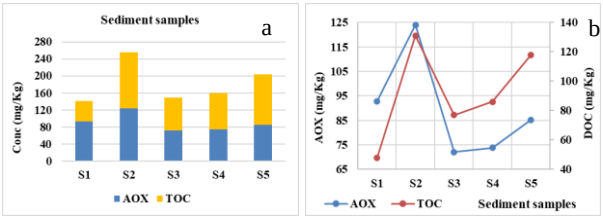

Figure 2. AOX and TOC distribution pattern in sediment (a) and comparison between AOX and TOC in sediment for the same treatment locations (b)

The preliminary results obtained confirm the need to start a comprehensive study on the detection and identification of specific organic pollutants present in the Danube River (surface water and sediment), as well as the determination of negative effects they have on the aquatic organisms (plants, invertebrates and fish).