In-Depth Investigation of Organic Micropollutant Burden in the Dnipro River Basin During Wartime Using HRMS-Based Workflows

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Anthropogenic activities significantly contribute to the introduction of organic micropollutants such as priority pollutants and emerging contaminants into the environment. Man-made environmental disasters, such as oil spills and the destruction of infrastructure during wartime, significantly increase the chemical burden on the environment. Thus, systematic monitoring after ecological disasters is of utmost importance. On 6 June 2023, an explosion destroyed the Nova Kakhovka dam in southern Ukraine, causing an ecological disaster. The collapse resulted in a massive release of water, sediments, and, subsequently, organic micropollutants into the Black Sea through the Dnipro River, potentially impacting these ecosystems [1,2].

The present study aims to investigate the occurrence of organic micropollutants in the Dnipro River basin and the Black Sea following the collapse of the Nova Kakhovka dam. In this framework, surface water, seawater, groundwater, and sediment samples were collected during a monitoring campaign conducted immediately after the dam breach and the ensuing flood. The analytes were extracted from the environmental matrices using generic sample preparation protocols, whereas the instrumental analysis included complementary chromatographic techniques and ionization modes, coupled with high-resolution mass spectrometry (LC-ESI-QToF MS and GC-APCI-QToF MS). The post-acquisition data treatment consisted of two steps. First, wide-scope target screening was conducted to investigate the presence of more than 2,500 organic micropollutants from various categories, such as pharmaceuticals, per-and polyfluoroalkyl substances (PFAS), industrial chemicals, and plant protection products, and their transformation products (TPs). Second, suspect screening was performed for 95,000 environmentally relevant organic micropollutants [3–5]. Afterwards, the post-disaster sampling campaign results were compared with data from previous sampling campaigns, conducted in 2019 and 2020. In total, 146 organic micropollutants from various chemical classes were identified in the water and sediment samples. The nitroaromatic explosive 4-Nitrotoluene was present in all analyzed water samples and in 7 out of the 8 sediment samples. The comparative analysis of pollutant levels in the area revealed a discernible upward trajectory, with notable shifts observed in Plant Protection Products and Industrial Chemicals.

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