Mass Event Influence on Micropollutant Composition And Loads Before And After Treatment In The Coastal Waste Water Treatment Plant

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During summer events and festivals, coastal cities undergo a significant population change. This sudden rise in population leads to an increase in pollution reaching the coastal wastewater treatment plants (WWTPs). The pollutants include nutrients, organic micropollutants, such as hormones, pharmaceuticals, phthalate esters (PAEs), etc., and their metabolites. Delivery of these pollutants to the sewer network alters the composition of wastewater normally produced and discharged to the coastal environment. Various active pharmaceutical ingredient (API) residues: hormones, painkillers, antibiotics, and psychiatric drugs such as antidepressants, have already been discovered in different environmental compartments of the Baltic Sea [1]. Due to ineffective wastewater treatment technologies, a significant amount of hazardous substances can enter the ecosystem by discharged effluent [2].

In this study, we have used advanced analytical techniques to measure organic micropollutants (plasticizers, hormones, polycyclic aromatic hydrocarbons (PAHs), and pharmaceuticals) together with the nutrients (TP, TN) and general quality parameters (SPM, DOC, BOD, COD) in wastewater (before treatment) and effluents (after treatment) discharged into the coastal zone of the Baltic Sea. We have selected eight PAEs, three estrogens (17β estradiol [E2], 17α-ethinylestradiol [EE2], estrone [E1]), two psychiatric medicines (Venlafaxine and Carbamazepine), and sixteen PAHs.

The wastewater was measured before and after treatment before, during, and after the Sea Festival, to follow the population dynamics at the biggest coastal WWTP in Lithuania (Klaipeda) with an expected population rise of more than 3 times [3]. Results determined that nutrient and background pollution increased in wastewater during the festival. However, WWTP of Klaipeda was able to retain this pollution efficiently (79.1 - 99.7%), thus preventing the discharge to the coastal area of the Baltic Sea. Hormones, PAHs, and PAEs levels were found to be higher in wastewater samples during the Sea Festival as compared to the pre-festival period. The loads of hormones and PAEs reached a peak on the last day of the event (23rd of July). The concentration of both estrogens, E1 and E2 in the effluent exceeded the predicted no-effect concentration (PNEC) of 4 and 0.4 ng L^{-1}, respectively [4]. Loads of both psychiatric medicines in effluent samples were similar to or higher than wastewater, pointing to the inefficiency of the treatment method. Similarly, to estrogens, the PNEC of 90 and 500 ng L^{-1}, for Venlafaxine and Carbamazepine, was exceeded in the effluent samples [5] [6]. Micropollutant composition shifted from complete PAEs dominance in wastewater to equal contribution by pharmaceuticals and PAEs in effluent, especially on the second day of the Festival.

Generally, the levels of PAHs, PAEs, and hormones in wastewater, and PAEs in effluent were affected by the event. In addition, the determined retention efficiency by WWTP was higher for these micropollutants than for pharmaceuticals. The change in micropollutant composition at wastewater and effluent, which was not related to the Sea Festival, but with selective removal by WWTP, was noted. In addition, effluent estrogen and pharmaceuticals concentration in effluent exceeded the environmental risk threshold up to several times.

References

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