Spatio-Temporal Distribution, Environmental Risk Assessment, and Potential Sources of Pharmaceutical Active Ingredients Commonly Found in the Zala River

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Abstract:

The spatio-temporal distribution of concentration and environmental risk levels of the 3 most frequent Pharmaceutically Active Compounds (PhACs) - caffeine, carbamazepine, diclofenac - in water matrices worldwide were investigated in River Zala in related to the local spas and WasteWater Treatment Plants (WWTPs). According to international comparison, the concentration of diclofenac was very high (up to 2530 ng/L), and this PhAC presented high environmental risk level in the most cases. Concentration of only diclofenac showed correlation with number of medical treatments in spas depending on time. The reason for this can be related to the fact that the spas in the investigated area have thermal waters, which have a beneficial effect on arthritis and rheumatic pain. Diclofenac is used typically for this kind of health problems. Further surprising result that in the main tourist season (summer) elevated concentrations of the 3 PhACs were not detected which can be explained by the strong and lasting UV radiation, furthermore the microbial activity and composition of activated sludge depending on temperature. Summarized, our data suggest that the local WWTPs should be reviewed, additionally necessity of treatment of used thermal water should be considered for sustainability.