Sandmeyer Award Lecture 2024: Advanced wastewater treatment by ozonation for abatement of micropollutants from municipal wastewater effluents

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The contamination of the aquatic environment by synthetic organic compounds is a major problem for the ecosystem and potentially human health if water resources are used for drinking water and food production. Many anthropogenic activities lead to the discharge of organic micropollutants to aquatic systems by point or diffuse sources, including industries, agriculture, traffic and urban water management. The Eawag team has shown early on by a rigorous assessment of fluxes of organic chemicals that municipal wastewaters are an important source of synthetic organic compounds in receiving water bodies with diverse impacts on aquatic organisms. This was the starting point of an Eawag-based research initiative to develop concepts for mitigation of wastewater treatment plant effluents to protect aquatic ecosystems from an important source of contaminants. Based on this research, selected municipal wastewater treatment plants in Switzerland are currently been upgraded with an additional polishing step, either ozonation or activated carbon treatment to reduce the discharge of micropollutants to the aquatic environment. This talk will focus on the options and limitations of ozonation.

There are five factors which need to be considered to assess ozonation processes for micropollutant abatement in wastewaters: (i) reaction kinetics, which control the efficiency of the process, (ii) elucidation of the formation of transformation products by experimental and theoretical approaches, (iii) formation of oxidation by-products from the matrix (e.g., bromate, carbonyl compounds), (iv) biological effects after ozonation, resulting from transformation products and/or oxidation by-products, (v) biodegradability of transformation products during post-treatment.

In this talk, basic chemical principles of ozonation related to micropollutant abatement and result from pilot- and full-scale applications for advanced wastewater treatment will be shown.