Tackling Micropollutants in the Environment by Benign Design – an Important Building Block of Sustainable Chemistry and the Protection of Water Resources

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Protection of water resources is sustainable development goal #6 of the United Nations. Several thousand chemicals including biocides, pharmaceuticals, personal care products, pesticides, surfactants and others as well as micro plastics are introduced into the aquatic environment - most of them as an unwanted side effect of proper use. (Advanced) effluent treatment can remove some to some extend from effluents. In case of heavy rain events most of the wastewater circumvents treatment plants and is directly introduced into the aquatic environment. Increasingly leaking of wastewater into ground water is observed due to damaged piping. In many countries proper effluent treatment is not available. Compounds present in effluents or in the aquatic environment are often not completely mineralized by biological, oxidative or reductive treatment or by natural processes. Instead often unwanted products of incomplete mineralization and undetermined chemical structure, fate, and toxicity are generated. Such transformation products may be even more toxic than their respective parent compounds. Research has demonstrated the presence of these micropollutants in the aquatic environment all over the world. Furthermore, testing and risk assessment is becoming more and more complex, expensive, and time consuming.

Therefore, molecules of the future that can end up in the environment at the end of their life have to be designed for rapid and complete mineralization after their introduction into the environment whilst keeping the properties and functionality needed for their application. Integrating methods and tools from the fields of environmental chemistry, environmental microbiology, analytical chemistry, computational chemistry, and sustainable chemistry allows for this. It will fundamentally contribute to the solution of one of mankind's most pressuring problems worldwide by reducing the introduction of organic water pollutants into the aquatic system and will contribute extensively to the SDGs. The conceptual approach as well as some successful examples will be presented.