



## **Advanced wastewater treatment for removing micropollutants now and in future**

### ***Policy Brief for HELCOM of the project Improving quality of BSR waters by advanced treatment processes (AdvIQwater)***

The urban wastewater directive (UWD) demands removing 80% of selected marker compounds.

**State of the Art:** Today the UWD means implementing activated carbon treatment or ozonation or a combination of both. Both are ready to be implemented but have different profiles that will imply different preferences will develop in different regions. Cost of energy and activated carbon, residual TOC in the pretreated water, bromide concentrations will drive differences. Advanced wastewater treatment with GAC and ozone will increase the costs for wastewater treatment by 30%. Both technologies are increasing the primary energy consumption by 30-50% which is reflecting the sustainability. Decreasing energy intake will be a major need for innovation.

**Future technologies** that could help to increase sustainability.

**Advanced Oxidation Processes (Photocatalysis):** Photocatalytic degradation assisted with generation of peroxides with high oxidation potential provides a great opportunity for micropollutants removal in water. Photocatalytic utilising a renewable energy sources has the potential as a green technology to generate reaction oxygen species for efficient degradation of active pharmaceutical ingredients that are resistant to classical degradation processes. The most important challenges are related to mass transfer and economy of photocatalyst production. In this regard, research focused on production of the catalytic material from waste, such as biomass or metals recovered from spent batteries, could provide promising solutions for the economical aspect. Further improvements in reactor design related to uniform distribution of advanced oxidants within reactor volume and the combination of photodegradation with biological process is another field for research.



**Biofilms (MBBR):** These technologies can in principle supply similar services as ozone/GAC and there is little indications for any compound that cannot be treated. However, the needed contact time and thus the reactor size is getting economically prohibitive. Improvements in biological process control and surface area/volume are needed and merit further research efforts.

**Biofilters (porous medium columns):** This technology is also able to provide a lot of services, especially for smaller communities 1-1000 persons. However, the systems are prone to clogging making them though operational, more service demanding. More research efforts are needed in the hydrological and process of stability as well as in normalising design of implementations.