Breaking down carcinogenic bromate using existing wastewater infrastructure.

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Micropollutants have gained attention and concern in recent years over the impact that they have on the natural environment when they are released within our wastewater. Micropollutants are pollutants from human activities that accumulate in small concentrations, but which have a disproportionately large impact on the environment. Of particular concern are pharmaceutical residues, which originate from the increased use of a wide variety of pharmaceutical drugs, and are injected into the water cycle through sewage and domestic wastewater. The increased levels of micropollutants leads to decreased river health, and also contributes to the increasing levels of antibiotic-resistant bacteria in existence.

One of the leading technologies to remove micropollutants is ozonation, which breaks down molecules, including micropollutants and pharmaceutical residues, through its strong oxidizing action. However, the downside of this catch-all approach is the production of undesirable by-products, which may be worse for the natural environment than the micropollutants which the ozone is aimed at. One such by-product of concern is bromate, which is formed when bromide is exposed to ozone. Bromate has been shown to be carcinogenic and have toxic impacts on the aquatic environment and the natural fauna living in natural water bodies. As such, bromide is one of the compounds which, if present, rules out ozonation as an option for micropollutant removal.

Bromide originates from the sea and is carried inland as sea spray and aerosols. A survey of southern Sweden's wastewater plants showed that bromide was present in all wastewater streams tested, generally within an acceptable range, but that plants closest to the coast had higher concentrations than those inland. Particular individual plants had higher concentrations of bromide than would be naturally occurring, indicating that contamination from nearby industries are likely to be contributing bromide.

Recent research at Lund University has shown that bromate can be removed from wastewater using microorganisms found in existing wastewater treatment processes. Plastic carriers taken from existing operational units at wastewater treatment plants were observed to be able to efficiently reduce bromate back to bromide, once nitrate was no longer available as a primary source of energy. This finding means that it is likely that existing infrastructure at wastewater treatment plants could therefore be used to control bromate concentrations by simply extending the time that the water remains within the plant. The results observed in laboratory test work indicated that 100% removal of bromate was achieved, using wastewaters from a variety of treatment plants, and using bacteria acclimatised to both methanol and ethanol denitrification systems. This finding means that bromide in incoming wastewater might not have to be a deterrent to wastewater treatment plants looking to implement ozonation.