Effects of ozonation pretreatment on natural organic matter and effluent derived organic matter. Possible implications on the formation of disinfection by-products

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The presence of organic matter in surface water, wastewater and reclaimed water is related to water quality, and effective treatability. Variations regarding the concentration and characteristics of natural organic matter in surface water are usually observed. Moreover, pollution of surface waters through discharges of wastewaters can occur. Lately, there is a lot of discussion about indirect or direct reuse of treated water as an alternative to water scarcity. Indirect reuse occurs through the augmentation of drinking water supplies with urban wastewater treated to a suitable level, followed by an environmental buffer (e.g., rivers, dams, aquifers, etc). Dissolved organic matter (DOM) is the key parameter in the formation of disinfection by-products (DBPs). Ozonation pretreatment, a process usually employed in water and wastewater treatment, can affect the precursors of DBPs and subsequently the concentration and profile of various classes of ozonation and chlorination DBPs [1-5].

The aim of this study was to investigate the impact of ozonation to: a) the fate of organic matter of different origin i.e. natural organic matter (NOM), humics (HU) and effluent derived organic matter (EfOM) and, b) the formation of various classes of disinfection by-products. For this purpose, ozonation experiments were employed in water samples containing different concentrations of dissolved organic matter i.e. river water, river spiked with humic acids at various concentrations, river water mixed at various proportions with influent and effluent wastewater from a wastewater treatment plant. Samples were ozonated under various experimental conditions regarding the contact time (1-10min), O_3/DOC ratios (0.2-1.0 mgO_3/mg C) and pH values. Samples were further chlorinated in order to obtain the formation potential of various classes of chlorinated by-products. Carbonyl compounds, as ozonation DBPs, were determined by EPA method 556. THMs, HHAs and chloral, as chlorination DBPs, were determined by employing EPA methods 551.1 and 552.2. Moreover, the concentrations of DOC and BDOC as well as UV-Vis absorbance and fluorescence intensity were determined.

In this study the characteristics of NOM and EfOM as well as changes after ozonation and chlorination experiments are presented. The formation of ozonation and chlorination by-products with respect to performance of ozonation process under various experimental conditions is shown. Finally, possible implications of this process on the concentration and reactivity of DBPs precursors are discussed.

References

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