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Pre-treatments to control bromate formation during ozonation

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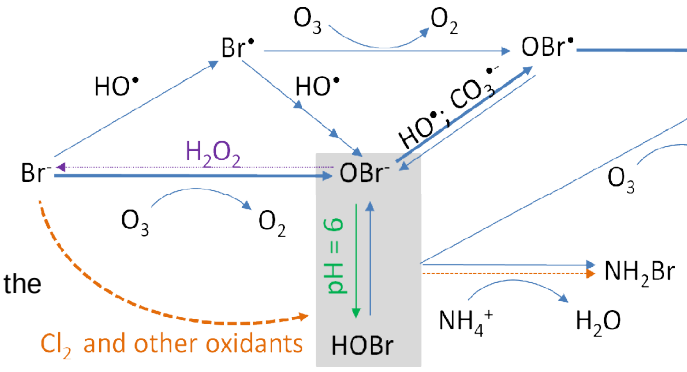
EXECUTIVE SUMMARY

With O_3 treatment being one of the most efficient and affordable oxidation processes used in drinking water and wastewater treatment, it has been used for the many applications including the removal of colour, taste and odour, the removal of emerging micropollutants and for disinfection purposes. On the other hand, its usage for drinking water production is limited by the formation of the carcinogenic bromate (BrO_3^-) if natural bromide (Br^-) concentrations are significant. Current water quality standards have set the provisional BrO_3^- concentration to 10 εg/L. Based on the above, this study compared several pre-treatment methods for inhibiting bromate formation during ozonation of tap water, from the DTU campus. These include pH-depression, H_2O_2 addition, NH_4^+ and Cl_2/NH_4^+ addition and other oxidants based on the ñCl_2/NH_4^+ additionò Besides bromate formation, each pre-treatment was evaluated for its ability to inhibit atrazine and carbamazepine removal by ozone. The presentation will present the required O_3 dose to remove of atrazine in the tap water from the DTU-campus, as well as the bromate concentrations formed; the kinetics of O_3 decomposition and contaminant removal in the tap water at pH= 6, 7, and 8; and the effect of each pre-treatment on bromate formation. To the best of our knowledge, this is the first study that has compared all these different pre-treatments for the same water matrix and additionally we will present several new pre-treatment methods.



Scheme 1: Summary of the reactions that govern bromate formation during ozonation, with the bold lines indicating the main pathway and effect of the different pre-treatments in inhibiting BrO_3^- formation.

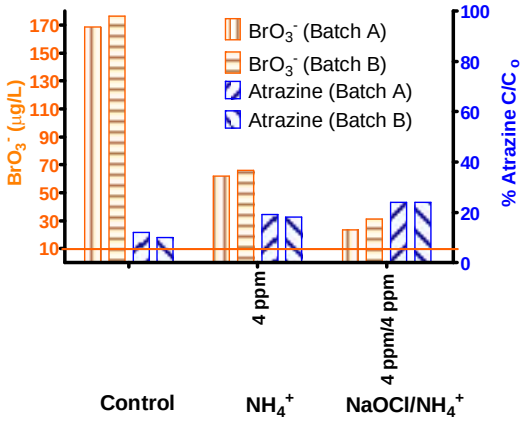


Figure 1: Reproducibility of pre-treatments for BrO_3^- formation and ATR removal. Experimental conditions: NH_4^+ = 4.0 mg/L; Cl_2 = 4.0 mg/L; O_3= 3.5 mg/L; pH = 7.0.