Pre-treatments to control bromate formation during ozonation

Antoniou, Maria; Andersen, Henrik Rasmus

Published in:
Book of Abstracts

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

Citation (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Pre-treatments to control bromate formation during ozonation

M. G. Antoniou (Post-doc)*, H. R. Andersen (Assoc. Professor)*

*Technical University of Denmark (DTU), Department of Environmental Engineering, Miljoevej, Building 113, 2800 Kgs. Lyngby, Tel: +45 45251583; email: hran@env.dtu.dk

EXECUTIVE SUMMARY

With O₃ 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 (BrO₃⁻) if natural bromide (Br⁻) concentrations are significant. Current water quality standards have set the provisional BrO₃⁻ concentration to 10 μg/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, H₂O₂ addition, NH₄⁺ and Cl₂/NH₄⁺ addition and other oxidants based on the fCl₂/NH₄⁺ addition. 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 O₃ dose to remove of atrazine in the tap water from the DTU-campus, as well as the bromate concentrations formed; the kinetics of O₃ 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 BrO₃⁻ formation.

Figure 1: Reproducibility of pre-treatments for BrO₃⁻ formation and ATR removal. Experimental conditions: NH₄⁺ = 4.0 mg/L; Cl₂ = 4.0 mg/L; O₃= 3.5 mg/L; pH = 7.0.