Small scale electrochemical disinfection system with specially coated electrodes

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Abstract
Drinking water disinfection systems play a crucial role in preventing the spreading of waterborne diseases. If classified by their functioning principle, these methods can be divided into three groups, i.e. chemical, physical and physical-chemical methods, being electrochemical systems included in the physical-chemical group. For the case of electrochemical systems the disinfecting species are produced by the implementation of an electric current. Factors which determine their efficacy include concentration of ions, such as chloride, in the water, the applied current (density), and the electrode material. In this study, a small scale electrochemical disinfection system with two types of Mixed Metal Oxides (MMO) electrodes (further mentioned as *cell a* and *cell b*) coated with ruthenium and iridium in different proportions, were tested regarding their disinfection efficiency on different microorganisms, e.g. *E.coli, S. epidermidis, R. terrigena* and bacteriophage MS2, formation of DBP, e.g. THM, and durability. The system was composed by two parallel disinfection cells able to treat (continuously) $2m^3 \cdot h^{-1}$ of contaminated inlet. Total disinfection (>log 6) for bacteria (*E.coli, S. epidermidis, R. terrigena*) was achieved at 250 $A.m^{-2}$. The disinfection degree of bacteriophages was log 3 for cell a, and log 5 for cell b. Both cells produced free active chlorine and bound chlorine at concentration levels as high as 0.5 – 3 mg/L and 0.6-3 mg/L respectively, for the above mentioned current density. Physical chemicals analysis have shown possible presence of ozone (0.1-0.8 mg/L) and indicated that outlet electric conductivity and pH remained rather stable. THMs analysis showed the presence of some such compounds, however in concentration levels below the WHO guideline values. The durability test showed good performance of the cells within the experimental period. Inductively coupled plasma MS (ICP) performed to verify the presence of platinum group metals and titanium in the outlet indicated their presence in concentrations below $10\mu g.L^{-1}$.

Keywords
Electrochemical disinfection; oxidant production; *E.Coli*; *S. epidermidis*; *R. terrigena*; MS2 bacteriophages