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Influence of operating conditions and wastewater-specific parameters on the electrochemical bulk disinfection of biologically treated sewage at boron-doped diamond (BDD) electrodes

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ABSTRACT

The aim of this study was to investigate an electrochemical process for bulk disinfection of biologically treated sewage. The influence of operating conditions (current density and flow rate) on the electrochemical formation of free chlorine in the sewage was determined. Furthermore, the effect of wastewater-specific parameters on the inactivation of *Escherichia coli* was studied. The disinfection capacity is primarily influenced by the concentration of electrochemically produced free chlorine. The production rate of free chlorine is independent of the flow rate within the range of 25–125 $L\,h^{-1}$. The investigations have also shown that the electrochemical disinfection of *E. coli* in secondary effluents with BDD electrodes proceeds effectively at an electric charge input of 0.1–0.15 $Ah\,L^{-1}$ corresponding to an energy expenditure of 2.0–2.6 kWh m^{-3}. The electrochemically generated concentration of free chlorine ($c = 0.4$–$0.6\,mg\,L^{-1}$) is sufficient for an *E. coli* reduction of four log levels under the following conditions: after-reaction time of 15–20 min, $T > 6$°C, pH < 8.5 and DOC < $22\,mg\,L^{-1}$. The formation of organic by-products (AOX, THMs) was marginal to moderate. The inorganic by-products chlorate ($1.2\,mg\,L^{-1}$) and perchlorate ($18\,mg\,L^{-1}$) were produced in considerable concentrations.

Keywords: Electrochemical disinfection; Wastewater reclamation; *E. coli*; Boron-doped diamond electrode; Electrochemical oxidants; Disinfection by-products

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