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## Evaluation of Anammox Biocathode in Microbial Desalination Coupled with Wastewater

### Treatment

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### ABSTRACT

This study presents the use of an autotrophic microorganism, Anammox bacteria, as a sustainable biocatalyst/biocathode in microbial desalination cells (MDCs) for energy-positive wastewater treatment. We report the first proof of concept study to prove that anammox mechanism can be beneficial in MDCs to provide simultaneous removal of carbon and nitrogen compounds from wastewater while producing bioelectricity. A series of experiments were conducted to enrich and evaluate the anammox mechanism and the process performance in continuous, fed-batch mode conditions. The coulombic efficiency of MDCs and the nitrite and ammonium removal of the wastewater increased in successive batch studies. A maximum power density of  $0.092 \text{ W m}^{-3}$  (or a maximum current density of  $0.814 \text{ A m}^{-3}$ ) with more than 90% of ammonium removal was achieved in this system. We derived the Nernst potential for the nitrite reduction in the anammox biocathode chamber and compared with the experimental values. Sequential removal of carbon and nitrogen compounds in anode and cathode chambers respectively was also evaluated. Further, the inhibition effect of high nitrogen concentrations and the variations in microbial community profiles, especially, anammox presence was evaluated at different carbon and ammonia concentrations. Experimental studies and microbial community analysis are presented in detail.

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