DEAMMONIFICATION NITROGEN REMOVAL, ORP AIDED OPERATION BENEFITS ON MFC TECHNOLOGY

Ivar Zekker[1]
G. D. Bhowmick[2]
Ergo Rikmann[1]
Anni Mandel[1]
Taavo Tenno[1]
Toomas Tenno[1]
Hans Priks[1]
M. M. Ghangrekar[3]
Arunabha Mitra[2]

[1] Institute of Chemistry, University of Tartu, Estonia
[2] Department of Agricultural and Food Engineering, Indian Institute of Technology Kharagpur, India
[3] Department of Civil Engineering, Indian Institute of Technology Kharagpur, India

Abstract
Sidestream wastewater was used to maintain autotrophic nitrogen removal in mobile pilot-scale (3 m^3 process tanks) reactor configurations -deammonification in biofilm. Biofilms were developed after adaption of biomass on carriers with undiluted liquid effluent of municipal wastewater treatment plant biogas facility. The highest total nitrogen removal rate (TNRR) was achieved in the deammonification biofilm reactor (0.33 kg-N m^{-3} d^{-1}). Time-based and concentration-based (optimal dissolved oxygen (DO) concentration was 0.3-0.8 mg O_2 L^{-1}) aeration control proved reliable when reject water characteristics were relatively stable. The biofilm from deammonification biofilm reactor was then tested in microbial fuel cell (MFC) technology in order to understand the exo-electrogenic behavior of it. Two MFCs with the biofilm (Test) and another one with septic tank mix consortia as control (Control) were observed to be capable of generating continuous bio-energy with operating voltage of 262 ± 17 mV and 163 ± 18 mV for Test and Control, respectively. Test (9.5 W.m-3) showed almost two times higher volumetric power density than Control (4.9 W.m-3) with lower internal resistance of 161 Ω than that of Control (386 Ω). The coulombic efficiency was also found to be higher in case of Test (27.5 ± 1.7 %) than Control (17.7 ± 1.9 %), demonstrating the applicability of ANAMMOX in MFC to achieve efficient wastewater treatment as well as higher energy recovery from MFC. Proper ORP range for biofilm ANAMMOX operation was -200 mV-0 mV.

Keywords: MFC, denitrification, pilot-scale, ORP, coulombic efficiency

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