



ISTCONF

5<sup>th</sup> International Conference on  
Innovation in Science and Technology

Barcelona – Spain

7 - 9 December, 2018

1                   **INNOVATIVE ANAMMOX ELECTRO–BIOREACTOR**  
2                   **TREATING MUNICIPAL WASTEWATER AT LOW**  
3                   **TEMPERATURE**

4  
5                   Abdelmajeed Adam & Maria Elektorowicz

6                   *Department of Building Civil & Environmental Engineering (BCEE), Concordia*  
7                   *University,*

8                   *1455 De Maisonneuve Blvd. West, Montréal, Québec, Canada, H3G 1M8*

9                   Corresponding Author Email: [Abdelmajeed.adam@mail.mcgill.ca](mailto:Abdelmajeed.adam@mail.mcgill.ca)

10  
11  
12  
13  
14                   **ABSTRACT**

15                   The anammox (anaerobic ammonium oxidation) process is a promising nitrogen removal  
16                   technique alternative to conventional nitrification–denitrification, which directly oxidizes  
17                   ammonium to diatomic nitrogen gas using nitrite as the electron acceptor without oxygen and  
18                   external carbon supplies, and hence achieving high energy-saving potential. Yet, the  
19                   implementation of anammox–related process is still limited to side-stream treatment of  
20                   municipal sewage mainly due to lower operating temperatures and nitrogen concentrations of  
21                   mainstream conditions. In this work, a novel lab-scale anammox electro–bioreactor was  
22                   constructed to examine whether the anammox biomass would preserve activity at low  
23                   temperature, in addition to investigate the potential application of mainstream anammox to treat  
24                   a synthetic domestic wastewater containing 34 mg/L ammonium. A synthetic solution, consisting  
25                   mainly of sodium nitrite and ammonium sulfate was used to feed the anammox reactor in the



ISTCONF

5<sup>th</sup> International Conference on  
Innovation in Science and Technology

Barcelona – Spain

7 - 9 December, 2018

26 ratio 1:1 at HRT of 1 day. After 4 months of stable operation, temperature was a stepwise  
27 decreased by 1°C each 4– 5 days, and afterwards heating device was disconnected maintaining  
28 sludge temperature at 14±2 °C. Results showed that the novel reactor achieved simultaneous  
29 removal of nitrate and ammonia by over 80% and 83%, respectively. The anammox electro–  
30 bioreactor successfully preserved adequate activity as a result of biomass adaptation to low  
31 temperature and substrate conditions. Furthermore, microbial community analysis by 16S rRNA  
32 analysis also proved the presence of the anammox bacteria at low temperature, while the  
33 abundance of anammox cells was severely affected by organic carbon inputs in the synthetic  
34 influent.

35

36

37 Keywords: anammox electro–assisted bioreactor; low temperature; low-strength ammonium;  
38 mainstream anammox process; sustainable technology

39

40