

Short Term Scientific Mission (STSM) 2014

Distinctive denitrifying capabilities leads to different N<sub>2</sub>O production in dPAO and dGAO cultures

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Objectives

- To explore the denitrification kinetics of two separated enriched cultures of Denitrifying Polyphosphate Accumulating Organisms (dPAOs) and Denitrifying Glycogen Accumulating Organisms (dGAOs).
- To explore if electron competition exists when using polyhydroxyalkanoates as the carbon source for the denitrification process
- To study the N<sub>2</sub>O accumulation potential under different electron acceptor combinations in dPAO and dGAO cultures.

Methodology

- Batch tests conducted (table 1) in a 330mL batch sealed reactor with different combination of electron acceptors (initial concentration of 20 mg N-NO<sub>x</sub>/L).
- Dissolved N<sub>2</sub>O monitored with an online N<sub>2</sub>O microsensor.

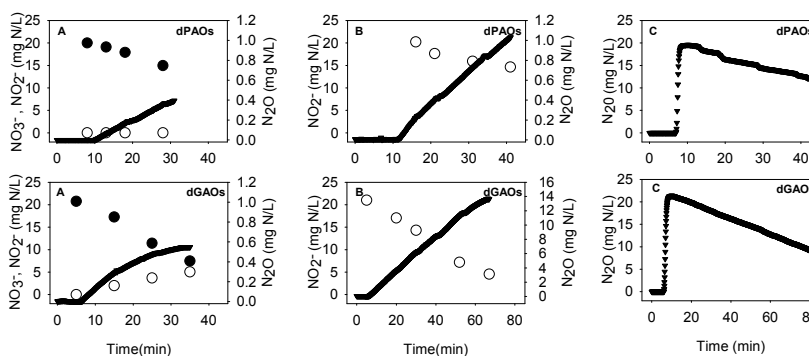
Results

Table 1. Denitrification kinetics obtained in all batch tests conducted using both cultures

Batch test type	NO <sub>3</sub> <sup>-</sup> (mg N/g VSS·min)	NO <sub>2</sub> <sup>-</sup> (mg N/g VSS·min)	N <sub>2</sub> O (mg N/g VSS·min)	NO <sub>3</sub> <sup>-</sup> (mg N/g VSS·min)	NO <sub>2</sub> <sup>-</sup> (mg N/g VSS·min)	N <sub>2</sub> O (mg N/g VSS·min)
	dPAOs			dGAOs		
A (NO <sub>3</sub> <sup>-</sup> )	0.244 ± 0.038	0.244 ± 0.038	0.175 ± 0.033	0.263 ± 0.006	0.224 ± 0.093	0.150 ± 0.013
B (NO <sub>2</sub> <sup>-</sup> )	-	0.354 ± 0.066	0.315 ± 0.077	-	0.166 ± 0.024	0.027 ± 0.012
C (N <sub>2</sub> O)	-	-	0.257 ± 0.077	-	-	0.118 ± 0.006
D (NO <sub>3</sub> <sup>-</sup> , N <sub>2</sub> O)	0.260 ± 0.012	0.260 ± 0.012	0.260 ± 0.012	0.227 ± 0.009	0.139 ± 0.001	0.127 ± 0.013
E (NO <sub>2</sub> <sup>-</sup> , N <sub>2</sub> O)	-	0.315 ± 0.049	0.315 ± 0.049	-	0.235 ± 0.021	0.113 ± 0.028
F (NO <sub>3</sub> <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> )	0.233 ± 0.041	0.371 ± 0.074	0.256 ± 0.061	0.214 ± 0.006	0.139 ± 0.016	0.076 ± 0.010
G(NO <sub>3</sub> <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , N <sub>2</sub> O)	0.301 ± 0.019	0.419 ± 0.002	0.439 ± 0.011	0.191 ± 0.015	0.120 ± 0.008	0.067 ± 0.018

Fig 1. Batch tests conducted with one electron acceptor added

- NO<sub>3</sub><sup>-</sup> (mg N/L)
- NO<sub>2</sub><sup>-</sup> (mg N/L)
- ▼ N<sub>2</sub>O (mg N/L)



Highlights

- dPAOs have a higher denitrifying capacity than dGAOs as their nitrogen oxides reduction rates are higher.
- No electron competition is detected when using PHA as the carbon source for denitrification in any of the cultures.
- dGAOs have a higher N<sub>2</sub>O accumulation potential than dPAOs under all the electron acceptor scenarios tested.

Earth System Science and Environmental Management (ESSEM)



Researcher



Anna Ribera-Guàrdia

ICRA (Institut Català de Recerca de l'Aigua), Girona, Spain

Host Institution

Department of Chemistry

Universidade Nova de Lisboa, Portugal

Responsible: Adrian Oehmen

Contact details

Chair of the Action

Prof. Juan M. Lema  
Professor of Chemical Engineering  
Univ. Santiago de Compostela, Spain  
Juan.Lema@usc.es

STSMs Manager

Prof. Peter Schröder  
Helmholtz Zentrum Muenchen, Germany  
peter.schroeder@helmholtz-muenchen.de

Website

www.water2020.eu



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