Supplementary Materials

The Influence of pH on Subsurface Denitrification Stimulated with Emulsified Vegetable Oil

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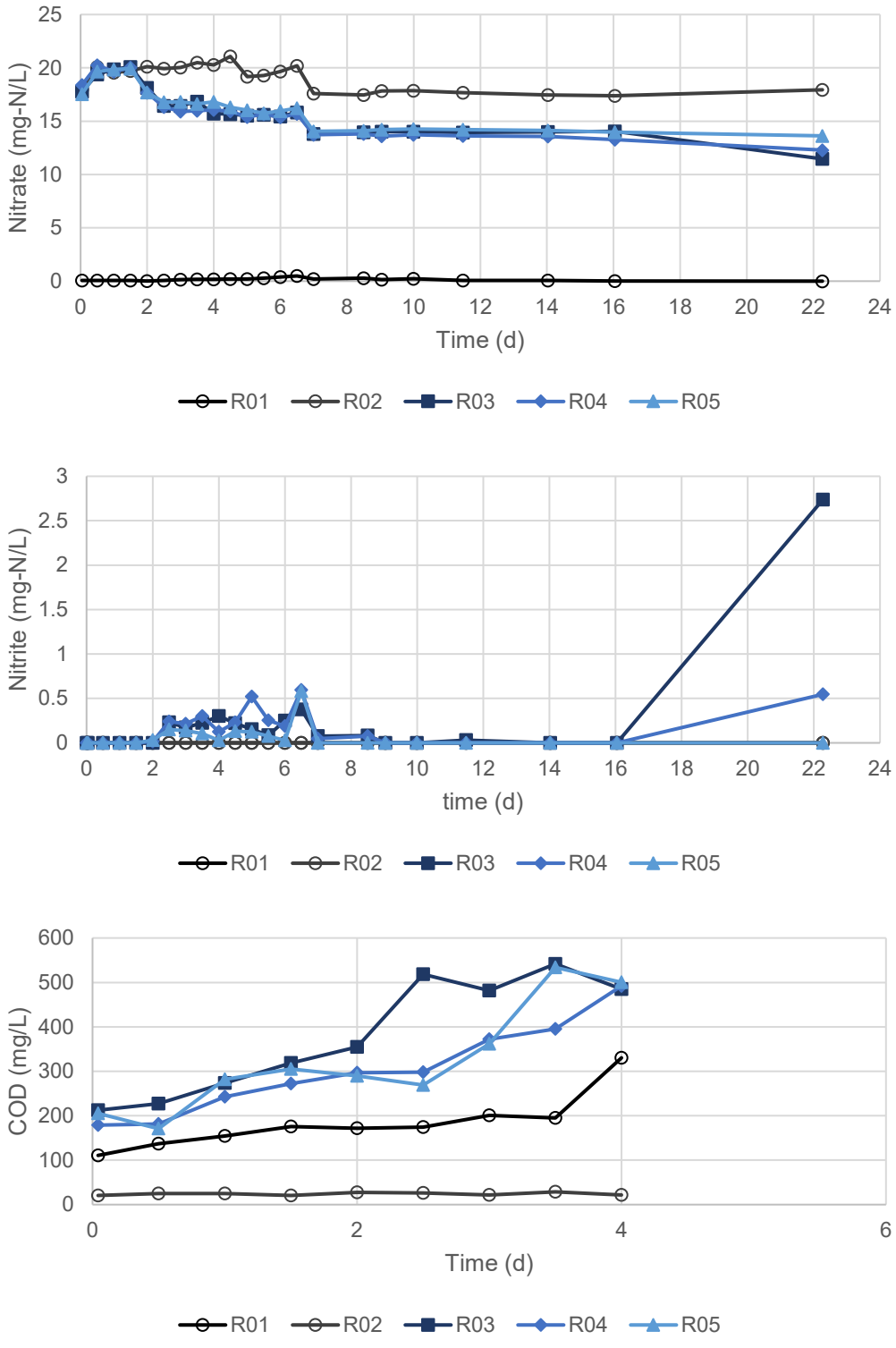

Figure S1. Experiment 1: (top) Nitrate; (middle) Nitrite; (bottom) COD. R01- control with no nitrate, R02- control with no EVO, R03, R04, R05- replicates of reactor with nitrate and EVO.

Table S1. Process rate equations used in the model.

#	Process	Process rate equation
1	Hydrolysis	$\hat{k}_H \frac{X_S/X_H}{K_X + X_S/X_H} X_H$
2	Aerobic Storage of S_S	$\hat{k}_{sto} \frac{S_O}{K_{H,O_2} + S_O} \frac{S_S}{K_{H,SS} + S_S} X_H$
3	Anoxic Storage of S_S NO_3–NO_2	$\hat{k}_{sto} \eta_{H,NO_3} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{S_S}{K_{H,SS} + S_S} \frac{S_{NO_3}}{K_{H,NO_3} + S_{NO_3}} X_H$
4	Anoxic Storage of S_S NO_2–N_2	$\hat{k}_{sto} \eta_{H,NO_2} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{S_S}{K_{H,SS} + S_S} \frac{S_{NO_2}}{K_{H,NO_2} + S_{NO_3}} X_H$
5	Aerobic Growth of X_H	$\mu_H \frac{S_O}{K_{H,O_2} + S_O} \frac{S_{NH}}{K_{H,NH_4} + S_{NH}} \frac{S_{ALK}}{K_{H,ALK} + S_{ALK}} \frac{X_{STO}/X_H}{K_{H,STO} + X_{STO}/X_H} X_H$
6	Anoxic Growth NO_3–NO_2	$\mu_H \eta_{H,NO_3} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{K_{H,NO_2,inh}}{K_{H,NO_2,inh} + S_{NO_2}} \frac{S_{NH}}{K_{H,N_4} + S_{NH}} \frac{S_{ALK}}{K_{H,ALK} + S_{ALK}} \frac{X_{STO}/X_H}{K_{H,STO} + X_{STO}/X_H} \frac{S_{NO_3}}{K_{H,NO_3} + S_{NO_3}} X_H$
7	Anoxic growth NO_2–N_2	$\mu_H \eta_{H,NO_2} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{K_{H,NO_2,inh}}{K_{H,NO_2,inh} + S_{NO_2}} \frac{S_{NH}}{K_{H,N_4} + S_{NH}} \frac{S_{ALK}}{K_{H,ALK} + S_{ALK}} \frac{X_{STO}/X_H}{K_{H,STO} + X_{STO}/X_H} \frac{S_{NO_2}}{K_{H,NO_2} + S_{NO_2}} X_H$
8	Aerobic Endogenous Resp. of X_H	$b_{H,O_2} \frac{S_O}{K_{H,O_2} + S_O} X_H$
9	Anoxic Endogenous Resp. NO_3–NO_2	$b_{H,O_2} \eta_{H,endNO_3} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{S_{NO_3}}{K_{H,NO_3} + S_{NO_3}} X_H$
10	Anoxic Endogenous Resp NO_2–N_2	$b_{H,O_2} \eta_{H,endNO_2} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{S_{NO_2}}{K_{H,NO_2} + S_{NO_2}} X_H$
11	Aerobic Resp. of X_{STO}	$b_{STO,O_2} \frac{S_O}{K_{H,O_2} + S_O} X_{STO}$
12	Anoxic Resp. of X_{STO} NO_3–NO_2	$b_{STO,O_2} \eta_{H,endNO_3} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{S_{NO_3}}{K_{H,NO_3} + S_{NO_3}} X_{STO}$
13	Anoxic Resp. of X_{STO} NO_2–N_2	$b_{STO,O_2} \eta_{H,endNO_2} \frac{K_{H,O_2 inh}}{K_{H,O_2 inh} + S_O} \frac{S_{NO_2}}{K_{H,NO_2} + S_{NO_2}} X_{STO}$

Table S2. Model stoichiometry [38].

#	Process	S_{NO_3}	S_{NO_2}	S_{N_2}	S_{NH}	X_S	S_S	S_0	S_{ALK}	X_H	X_{STO}	X_I
1	Hydrolysis	0	0	0	0	-1	$1-f_{SI}$	0	$\frac{i_{N,XS}-f_{SI}\cdot i_{N,SI}-(1-f_{SI})\cdot i_{N,SS}}{14}$	0	0	0
2	Aerobic Storage of S_S	0	0	0	$i_{N,SS}$	0	-1	$Y_{STO_{O2}}$-1	$\frac{i_{N,SS}}{14}$	0	$Y_{STO_{O2}}$	0
3	Anoxic Storage of S_S NO_3–NO_2	$-\frac{1-Y_{STO_{NO_3}}}{1.14}$	$\frac{1-Y_{STO_{NO_3}}}{1.14}$	0	$i_{N,SS}$	0	-1	0	$\frac{i_{N,SS}}{14}$	0	Y_{STONO_3}	0
4	Anoxic Storage of S_S NO_2–N_2	0	$-\frac{1-Y_{STO_{NO_2}}}{1.72}$	$\frac{1-Y_{STONO_2}}{1.72}$	$i_{N,SS}$	0	-1	0	$\frac{\left(i_{N,SS}\frac{-\left(Y_{STO_{NO_2}}-1\right)}{1.72}\right)}{14}$	0	Y_{STONO_2}	0
5	Aerobic Growth of X_H	0	0	0	$-i_{N,BM}$	0	0	$1-\frac{1}{Y_{HO2}}$	$-\frac{I_{N,BM}}{14}$	1	$-\frac{(1)}{Y_{HO2}}$	0
6	Anoxic Growth NO_3–NO_2	$-\frac{1-Y_{H_{NO_3}}}{1.14\cdot Y_{HNO_3}}$	$\frac{1-Y_{H_{NO_3}}}{1.14\cdot Y_{H\_NO_3}}$	0	$-i_{N,BM}$	0	0	0	$-\frac{I_{N,BM}}{14}$	1	$-\frac{(1)}{Y_{HNO_3}}$	0
7	Anoxic growth NO_2–N_2	0	$-\frac{1-Y_{H_{NO_2}}}{1.72\cdot Y_{HNO_2}}$	$\frac{1-Y_{HNO_2}}{1.72\cdot Y_{HNO_2}}$	$-i_{N,BM}$	0	0	0	$\frac{\left(\frac{Y_{H_{NO_2}}-1}{1.72\cdot Y_{H_{NO_2}}}+i_{N,BM}\right)}{14}$	1	$-\frac{1}{Y_{HNO_2}}$	0
8	Aerobic Endogenous Resp. of X_H	0	0	0	$-f_{XI}\cdot i_{N,XI}+i_{N,BM}$	0	0	$-(1-f_{XI})$	$\frac{-f_{XI}\cdot i_{N,XI}+i_{N_{BM}}}{14}$	-1	0	f_{XI}
9	Anoxic Endogenous Resp. NO_3–NO_2	$-\frac{1-f_{XI}}{1.14}$	$\frac{1-f_{XI}}{1.14}$	0	$-f_{XI}\cdot i_{N,XI}+i_{N,BM}$	0	0	0	$\frac{-f_{XI}\cdot i_{N,XI}+i_{N,BM}}{14}$	-1	0	f_{XI}
10	Anoxic Endogenous Resp NO_2–N_2	0	$-\frac{1-f_{XI}}{1.72}$	$\frac{1-f_{XI}}{1.72}$	$-f_{XI}\cdot i_{N,XI}+i_{N,BM}$	0	0	0	$\frac{i_{N,BM}-f_{XI}\cdot i_{N,XI}-\frac{f_{XI}-1}{1.72}}{14}$	-1	0	f_{XI}
11	Aerobic Resp. of X_{STO}	0	0	0	0	0	0	-1	0	0	-1	0
12	Anoxic Resp. of X_{STO} NO_3–NO_2	$-\frac{1}{1.14}$	$\frac{1}{1.14}$	0	0	0	0	0	0	0	-1	0

#	Process	S_{NO_3}	S_{NO_2}	S_{N_2}	S_{NH}	X_S	S_S	S_0	S_{ALK}	X_H	X_{STO}	X_I
13	Anoxic Resp. of X_{STO} NO_2–N_2	0	$-\frac{1}{1.72}$	$\frac{1}{1.72}$	0	0	0	0	$\frac{1}{24.08}$	0	-1	0