

## **WOODCHIP BIOREACTORS PROVIDE SUSTAINED DENITRIFICATION OF BRINE FROM GROUNDWATER DESALINATION PLANTS**

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Figure S1. Citrus woodchip bioreactors in the pilot plant at the Agri-food Experimental Station Tomás Ferro (ESEA) of the School of Agricultural Engineering, Technical University of Cartagena (ETSIA-UPCT) to denitrification experiment with brines.



Figure S2. Citrus woodchips placed in a bioreactor in the pilot plant at the Agri-food Experimental Station Tomás Ferro (ESEA) of the School of Agricultural Engineering, Technical University of Cartagena (ETSIA-UPCT) to denitrification experiment with brines.



Figure S3. Method of introducing the brine in the bioreactor in the pilot plant at the Agri-food Experimental Station Tomás Ferro (ESEA) of the School of Agricultural Engineering, Technical University of Cartagena (ETSIA-UPCT) to denitrification experiment with brines.

Table S1. Woodchips weight loss along the experiment. Values are average  $\pm$  standard error.

	Initial	Month 6	Month 12
Remaining mass (g)	1002 $\pm$ 1.45 a	687 $\pm$ 5.17 b	578 $\pm$ 3.30 c
Remaining mass (%)	100	68.6 $\pm$ 0.43	57.7 $\pm$ 0.41
Weight loss every 6 month (%)		31.4	10.9

Table S2. Nitrate Removal Efficiency (NRE), Nitrate Removal Rates (RNO<sub>3</sub>) and Temperature at 10 and 24 h of HRT, separated by cold seasons (fall and winter) and warm seasons (spring and summer) during the 121 weeks of the experiment. Values are the mean ± standard error (minimum – maximum).

	NRE		RNO <sub>3</sub>		Temperature	
	10 h	24 h	10 h	24 h	10 h	24 h
	P<0.001					
<b>Weeks 1-16</b>	61.9 ± 3.1	86.0 ± 1.9	16.8 ± 1.6	23.0 ± 1.1	14.7 ± 0.3	12.5 ± 0.3
<b>Fall 17 – Winter 18</b>	(30.0 - 97.5)	(53.9 - 98.3)	(6.1 - 36.8)	(11.7 - 37.4)	(10.3 - 19.4)	(8.9 - 16.8)
<b>Weeks 17 - 43</b>	86.8 ± 1.6	95.9 ± 0.1	19.9 ± 0.5	23.1 ± 0.3	22.1 ± 0.6	21.6 ± 0.5
<b>Spring 18 – Summer 18</b>	(77.3 - 95.8)	(94.7 - 99.3)	(16.8 - 22.2)	(19.5 - 27.0)	(12.8 - 28.5)	(10.9 - 26.0)
<b>Weeks 45 - 70</b>	46.3 ± 3.6	66.5 ± 1.9	9.9 ± 0.7	14.9 ± 0.5	17.3 ± 0.7	15.1 ± 0.4
<b>Fall 18 – Winter 19</b>	(25.2 - 90.0)	(35.6 - 95.9)	(5.6 - 17.8)	(7.7 - 21.6)	(11.6 - 26.7)	(10.8 - 25.3)
<b>Weeks 72 - 97</b>	55.3 ± 2.8	79.0 ± 2.0	13.2 ± 0.6	19.7 ± 0.6	22.8 ± 0.8	20.5 ± 0.5
<b>Spring 19 – Summer 19</b>	(27.8 - 73.9)	(42.7 - 97.0)	(6.1 - 17.0)	(9.7 - 35.1)	(15.0 - 27.2)	(12.1 - 26.5)
<b>Weeks 99 - 120</b>	26.3 ± 3.1	43.1 ± 3.7	6.1 ± 0.7	10.1 ± 0.9	17.2 ± 0.8	15.0 ± 0.7
<b>Fall 19 – Winter 20</b>	(8.0 - 55.5)	(21.0 - 83.8)	(1.8 - 12.5)	(4.7 - 19.1)	(11.1 - 25.1)	(9.9 - 22.7)

Table S3. Results of the non-parametric Friedman variance analysis and pairwise Friedman post-hoc Dunn tests, applied to seasonal NRE at 10 h and 24 h HRT.

Italics in bold indicate significant differences between NRE values for paired seasons.

<b>NRE at 10 h HRT</b>	Weeks 1-16 Fall 17 – Winter 18	Weeks 17 - 43 Spring 18 – Summer 18	Weeks 45 - 70 Fall 18 – Winter 19	Weeks 72 - 97 Spring 19 – Summer 19	Weeks 99 - 120 Fall 19 – Winter 20
Weeks 1-16 Fall 17 – Winter 18	-	N.S.	N.S.	N.S.	<b><i>≤0.010</i></b>
Weeks 17 - 43 Spring 18 – Summer 18		-	<b><i>≤0.003</i></b>	N.S.	<b><i>≤0.001</i></b>
Weeks 45 - 70 Fall 18 – Winter 19			-	N.S.	<b><i>≤0.045</i></b>
Weeks 72 - 97 Spring 19 – Summer 19				-	<b><i>≤0.017</i></b>
Weeks 99 - 120 Fall 19 – Winter 20					-
<b>NRE at 24 h HRT</b>	Weeks 1-16 Fall 17 – Winter 18	Weeks 17 - 43 Spring 18 – Summer 18	Weeks 45 - 70 Fall 18 – Winter 19	Weeks 72 - 97 Spring 19 – Summer 19	Weeks 99 - 120 Fall 19 – Winter 20
Weeks 1-16 Fall 17 – Winter 18	-	N.S.	N.S.	N.S.	N.S.
Weeks 17 - 43 Spring 18 – Summer 18		-	N.S.	N.S.	<b><i>≤0.003</i></b>
Weeks 45 - 70 Fall 18 – Winter 19			-	N.S.	N.S.
Weeks 72 - 97 Spring 19 – Summer 19				-	N.S.
Weeks 99 - 120 Fall 19 – Winter 20					-

Table S4. Pearson correlation coefficients for the pH, ORP, temperature, NRE and EC.

	pH	ORP	Temperature	DOC	NRE	EC
pH	1	0,284**	-0,203**	-0,308**	-0,463**	-0,147
ORP		1	-0,301**	-0,090	-0,642**	0,161
Temperature			1	-0,038	0,511**	-0,139
DOC				1	0,196*	-0,129
NRE					1	-0,068
EC						1

\*\* p≤0.001; \*≤0.005