Electronic Supplementary Information

Monitoring the treatment efficiency of a full scale ozonation on a sewage treatment plant with a mode-of-action based test battery†

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The Electronic Supplementary Information contains 12 Tables with all toxicity data for a 6 endpoints and the two sampling series in the two STPs.

Table ESI 1 Baseline-$TEQ_{bacteria}$ (mg/L) in the bioluminescence inhibition test with *Vibrio Fischeri*.

Sampling Date	Primary effluent [a]	Stdev.	Secondary effluent	Stdev.	Ozonation	Stdev.	Final effluent	Stdev.	Procedural blank
September 24-26, 2007	12.61	0.50	0.45	0.02	0.21	0.05	0.15	0.01	0.05
December 6-7, 2007	1.80	0.06	0.38	0.01	0.27	0.02	0.32	0.01	<LOD
January 8-10, 2008	9.13				2.62	0.13	2.90	0.00	0.02
February 7-8, 2008	3.62	0.51	0.47	0.03	0.22	0.02	0.22	0.01	0.05
February 12-13, 2008	22.12	2.66	0.82	0.02	0.41	0.01	0.22	0.02	0.03
May 19-21, 2008	2.31	1.27	0.27	0.11	0.06	0.02	0.06	0.02	0.003
May 21-24, 2008	3.19	1.91	0.32	0.15	0.07	0.03	0.04	0.02	<LOD
May 24-26, 2008	4.12	2.51	0.24	0.07	0.07	0.01	0.04	0.01	<LOD
June 18-19, 2008	3.46	0.51	0.11	0.01	0.03	0.01	0.02	0.01	0.05
August 26-28, 2008	5.21	0.07	0.12	0.02	0.05	0.00	0.03	0.00	0.02

[a] average of two to three independent replicates (starting from three water samples) and associated standard deviation (stdev.).

Table ESI 2 Diuron equivalent concentrations DEQ (µg/L) in the 2h photosynthesis inhibition test with *Pseudokirchneriella subcapitata* (combined algae test).

Sampling Date	Primary effluent [a]	Stdev.	Secondary effluent	Stdev.	Ozonation	Stdev.	Final effluent	Stdev.	Procedural blank
September 24-26, 2007	0.91	0.00	0.19	0.00	0.03	0.00	0.02	0.00	0.01
December 6-7, 2007	0.18	0.00	0.09	0.01	0.05	0.00	0.06	0.00	<LOD
January 8-10, 2008	0.10	0.01	0.09	0.00	0.03	0.00	0.03	0.00	<LOD
February 7-8, 2008	0.35	0.10	0.10	0.00	0.01	0.00	0.02	0.00	<LOD
February 12-13, 2008	0.76	0.31	0.09	0.01	0.02	0.00	0.02	0.00	<LOD
May 19-21, 2008	0.21	0.02	0.19	0.01	0.02	0.00	0.03	0.00	<LOD
May 21-24, 2008	0.16	0.01	0.13	0.00	0.02	0.00	0.02	0.00	<LOD
May 24-26, 2008	0.33	0.01	0.27	0.01	0.04	0.00	0.04	0.00	<LOD
June 18-19, 2008	0.18	0.02	0.09	0.00	<LOD	0.00	0.01	0.00	0.01
August 26-28, 2008	0.91	0.00	0.19	0.00	0.03	0.00	0.02	0.00	0.01

[a] average of two to three independent replicates (starting from three water samples) and associated standard deviation (stdev.).

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Table ESI 3 Baseline-TEQ_{algae} (mg/L) in the 24h growth inhibition test with *Pseudokirchneriella subcapitata* (combined algae test).

Sampling Date	Primary effluent [a]	Stdev.	Secondary effluent	Stdev.	Ozonation	Stdev.	Final effluent	Stdev.	Procedural blank
September 24-26, 2007	302.07	157.54	5.11	1.76	0.54	0.10	0.79	0.83	<LOD
December 6-7, 2007	10.45	4.34	3.09	0.19	1.78	0.85	3.48	0.60	<LOD
January 8-10, 2008	19.48	6.52	3.29	0.14	1.97	0.58	3.29	0.44	<LOD
February 7-8, 2008	144.28	0.00	9.40	0.00	2.27	0.00	1.59	0.00	<LOD
February 12-13, 2008	318.00	0.00	5.93	0.00	2.43	0.00	1.76	0.00	<LOD
May 19-21, 2008	10.40	1.30	2.36	0.23	0.14	0.14	0.11	0.20	<LOD
May 21-24, 2008	10.77	0.86	2.69	0.39	0.52	0.56	0.37	0.65	<LOD
May 24-26, 2008	55.12	2.76	5.76	0.54	0.20	0.35	0.07	0.12	<LOD
June 18-19, 2008	232.8	30.9	7.86	1.94	2.96	0.23	1.98	0.29	1.52
August 26-28, 2008	502.6	290.3	10.5	1.91	3.52	0.38	1.82	2.58	3.64

[a] average of two to three independent replicates (starting from three water samples) and associated standard deviation (stdev.).

Table ESI 4 Estradiol equivalent concentrations EEQ (ng/L) in the Yeast Estrogen Screen.

Sampling Date	Primary effluent [a]	Stdev.	Secondary effluent	Stdev.	Ozonation	Stdev.	Final effluent	Stdev.	Procedural blank
September 24-26, 2007	77	7.47	2.9	0.45	0.10	0.06	0.09	0.07	0.03
December 6-7, 2007	31	4.19	1.3	0.24	0.41	0.10	0.71	0.06	0.16
January 8-10, 2008	60	22.30	2.2	0.55	0.33	0.18	0.33	0.31	0.06
February 7-8, 2008	37	4.50	4.8	0.63	0.23	0.05	0.19	0.02	<LOD
February 12-13, 2008	39	10.37	5.9	0.35	0.09	0.01	0.06	0.01	<LOD
May 19-21, 2008	88	33.62	2.7	0.97	0.10	0.03	0.05	0.00	0.14
May 21-24, 2008	50	10.37	2.0	0.74	0.57	0.31	0.10	0.02	0.13
May 24-26, 2008	119	48.53	0.8	0.06	0.29	0.02	0.24	0.14	0.13
June 18-19, 2008	40	11.38	1.8	0.00	0.07	0.03	0.08	0.03	0.07
August 26-28, 2008	37	0.51	1.5	0.09	0.18	0.01	0.16	0.05	0.05

[a] average of two to three independent replicates (starting from three water samples) and associated standard deviation (stdev.).

Table ESI 5 PTEQ (μg/L) in the acetylcholinesterase inhibition test.

Sampling Date	Primary effluent [a]	Stdev.	Secondary effluent	Stdev.	Ozonation	Stdev.	Final effluent	Stdev.	Procedural blank
September 24-26, 2007	3.86	1.11	0.38	0.03	0.22	0.09	0.20	0.01	0.03
December 6-7, 2007	5.74	0.20	1.36	0.11	0.38	0.29	0.29	0.80	0.04
January 8-10, 2008	3.43	0.02	0.48	0.15	0.23	0.00	0.25	0.06	0.02
February 7-8, 2008	3.43	0.15	0.28	0.06	0.14	0.01	0.21	0.05	0.00
February 12-13, 2008	5.75	0.72	0.87	0.10	0.26	0.01	0.22	0.11	0.03
May 19-21, 2008	2.64	0.07	1.03	0.01	0.59	0.08	0.42	0.03	0.09
May 21-24, 2008	1.48	0.04	0.77	0.03	0.40	0.08	0.19	0.00	0.05
May 24-26, 2008	2.95	0.20	1.28	0.01	0.54	0.02	0.47	0.24	0.09
June 18-19, 2008	1.62	0.25	0.55	0.04	0.12	0.01	0.11	0.01	0.05
August 26-28, 2008	2.78	0.02	1.39	0.07	0.35	0.06	0.27	0.01	0.03

[a] average of two to three independent replicates (starting from three water samples) and associated standard deviation (stdev.).

Table ESI 6 LOECs and NOECs in units of REF in the umuC test for genotoxicity after metabolic activation.

Sampling Date	Primary effluent LOEC [a]	NOEC [b]	Secondary effluent LOEC	NOEC	Ozonation LOEC	NOEC	Final effluent NOEC	LOEC	Procedural blank NOEC
September 24-26, 2007	15	7	<15	nd	nd	>74	nd	>74	>148
December 6-7, 2007	59*	30	148	na*	na	> 148	148	37	>296
January 8-10, 2008	<15	na	< 37	na	148	74	148	74	>296
February 7-8, 2008	<15	nd	148	74*	148	74	na	>148	>296
February 12-13, 2008	<15	na	148	74*	148	37	148*	74	>296
May 19-21, 2008	59	29*	148	37*	nd	>148	nd	>148	>148
May 21-24, 2008	30	15*	<37	nd	nd	>148	nd	>148	>148
May 24-26, 2008	<15	nd	<37	nd	nd	>148	nd	>148	>148
June 18-19, 2008	<15	nd	<37	nd	nd	>148	nd	>148	>296
August 26-28, 2008	<15	nd	<37	nd	nd	>148	nd	>148	>296

[a] LOEC = lowest observed effect concentration, average of two to three independent replicates (starting from three water samples) . [b] NOEC = No observed effect concentration. * inconclusive data. Replicates disagree.

Table ESI 7 Baseline-TEQ (mg/L) in the bioluminescence inhibition test with *Vibrio Fischeri* for the samples of activated carbon treatment.

Sampling Date	Secondary effluent [a]	Stdev.	Final effluent	Stdev.	Procedural blank
week 1 without PAC	1.27	0.01	1.07	0.08	0.05
week 2 without PAC	0.96	0.03	0.80	0.02	0.05
week 3 with PAC	0.71	0.03	0.31	0.02	
week 4 with PAC	0.86	0.05	0.19	0.01	

[a] average of two independent replicates (starting from two water samples) and associated standard deviation (stdev.).

Table ESI 8 Diuron equivalent concentrations DEQ (µg/L) in the 2h photosynthesis inhibition test with *Pseudokirchneriella subcapitata* (combined algae test) for the samples of activated carbon treatment.

Sampling Date	Secondary effluent [a]	Stdev.	Final effluent	Stdev.	Procedural blank
week 1 without PAC	0.31	0.01	0.30	0.04	<LOD
week 2 without PAC	0.40	0.02	0.40	0.04	<LOD
week 3 with PAC	0.40	0.01	0.04	0.00	
week 4 with PAC	0.25	0.02	0.01	0.00	

[a] average of two independent replicates (starting from two water samples) and associated standard deviation (stdev.).

Table ESI 9 Baseline-TEQ (mg/L) in the 24h growth inhibition test with *Pseudokirchneriella subcapitata* (combined algae test) for the samples of activated carbon treatment.

Sampling Date	Secondary effluent [a]	Stdev.	Final effluent	Stdev.	Procedural blank
week 1 without PAC	10.31	2.31	11.08	4.94	1.66
week 2 without PAC	15.71	5.56	13.55	6.38	1.33
week 3 with PAC	7.95	0.44	1.66	2.07	
week 4 with PAC	9.09	0.25	1.51	0.01	

[a] average of two independent replicates (starting from two water samples) and associated standard deviation (stdev.).

Table ESI 10 Estradiol equivalent concentrations EEQ (ng/L) in the Yeast Estrogen Screen for the samples of activated carbon treatment.

Sampling Date	Secondary effluent [a]	Stdev.	Final effluent	Stdev.	Procedural blank
week 1 without PAC	1.02	0.71	0.05	0.02	4.92
week 2 without PAC	0.53	0.37	0.05	0.04	3.68
week 3 with PAC	0.38	0.29	0.01		1.63
week 4 with PAC	0.05	0.16	0.03		3.10

[a] average of two independent replicates (starting from two water samples) and associated standard deviation (stdev.).

Table ESI 11 PTEQ (µg/L) in the acetylcholinesterase inhibition test for the samples of activated carbon treatment.

Sampling Date	Secondary effluent [a]	Stdev.	Final effluent	Stdev.	Procedural blank
week 1 without PAC	0.86	0.03	0.76	0.09	0.05
week 2 without PAC	0.61	0.02	0.52	0.00	0.10
week 3 with PAC	0.59	0.03	0.16	0.03	
week 4 with PAC	0.52	0.01	0.11	0.06	

[a] average of two independent replicates (starting from two water samples) and associated standard deviation (stdev.).

Table ESI 12 LOECs and NOECs in units of REF in the umuC test for genotoxicity after metabolic activation for the samples of activated carbon treatment.

Sampling Date	Secondary effluent LOEC	NOEC	Final effluent LOEC	NOEC	Procedural blank NOEC
week 1 without PAC	<37	nd	<37	nd	>296
week 2 without PAC	<37	nd	<37	nd	>296
week 3 with PAC	<37	nd	148	37*	
week 4 with PAC	<37	nd	296	148*	

[a] average of two independent replicates (starting from two water samples) and associated standard deviation (stdev.).

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