Investigating synergies in sequential biofiltration-based hybrid systems for the enhanced removal of trace organic chemicals from wastewater treatment plant effluents

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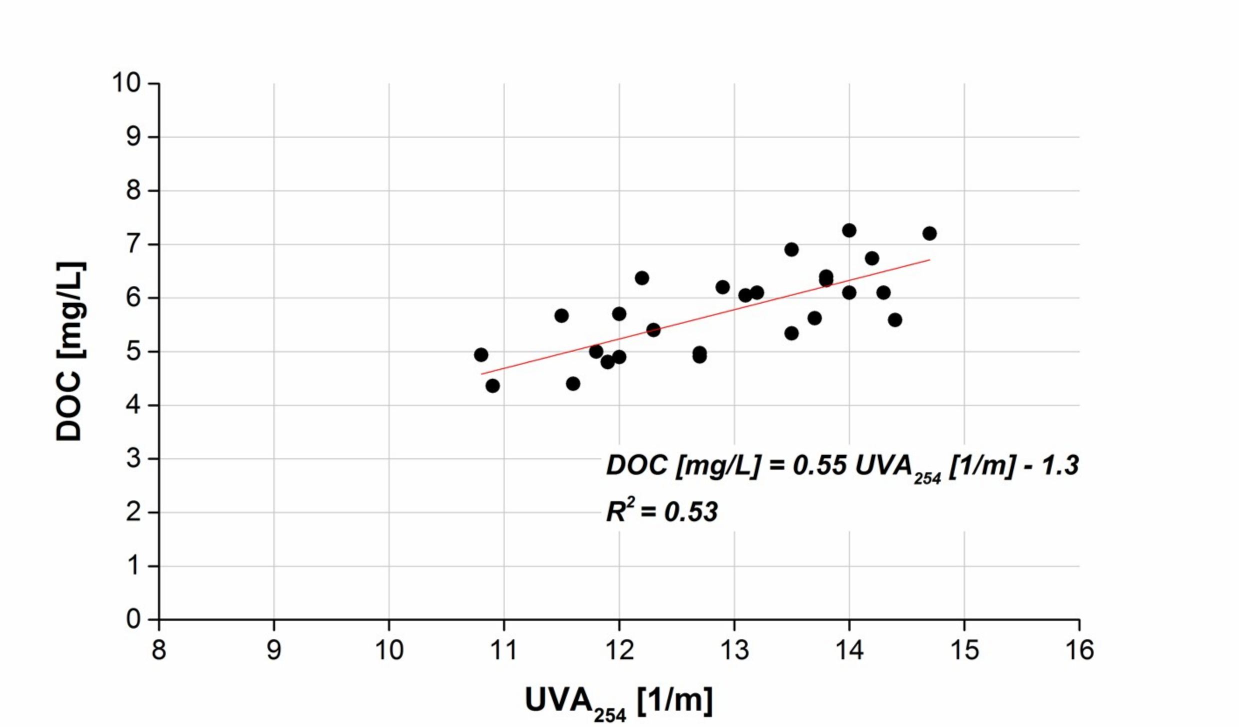

Figure 1: DOC/UVA$_{254}$ correlation for samples taken from column A effluent (n = 25). Correlation was used to estimate DOC values in column A effluent prior to pilot-scale ozonation.

Table SI-1: Limits of quantitation (LOQ), average concentrations with standard deviations in wastewater treatment plant effluent and number of detections above LOQ and 3.5 x LOQ during 10 sampling campaigns.

Compound	LOQ [ng/L]	c_0 [ng/L]	Std. dev. [ng/L]	Occurrence above LOQ	Occurrence above 3.5 x LOQ	k_{O3} [M^{-1} s^{-1}]	k_{OH} [M^{-1} s^{-1}]
4-Formylaminoantipyrine (4-FAA)	10	670	260	10	10	n/a	n/a
Atenolol	10	30	10	10	2	1.7×10^3 [a]	6.3×10^5 [c]
Antipyrine	10	30	10	10	2	6.2×10^5 [j]	8.9×10^9 [k]
Benzotriazole	50	5,880	1,190	10	10	2.4×10^2 [g]	7.6×10^9 [i]
Caffeine	50	170	90	4	2	2.5×10^4 [j]	6.4×10^9 [l]
Carbamazepine	5	410	40	10	10	3.0×10^5 [a]	8.8×10^9 [b]
Citalopram	5	160	60	10	10	n/a	n/a
Climbazole	5	90	20	10	10	n/a	n/a
Diclofenac	5	1,440	450	10	10	10^6 [a]	7.5×10^9 [b]
Gabapentin	2.5	1,530	420	10	10	2.2×10^2 [g]	9.1×10^9 [g]
Iopromide	50	90	40	4	1	<1 [b]	3.3×10^9 [b]
Metoprolol	2.5	280	60	10	10	2.0×10^3 [g]	7.3×10^9 [c]
Phenytoin	5	6	1	4	0	<10 [a]	6.3×10^9 [d]
Primidone	10	50	10	10	10	<10 [a]	6.7×10^9 [e]
Sotalol	5	60	20	10	10	1.9×10^4 [g]	10^{10} [g]
Sulfamethoxazole	5	180	70	10	10	5.7×10^5 [a]	5.5×10^9 [b]
tris(2-chloroethyl) phosphate (TCEP)	50	118	40	8	2	<1 [a]	5.6×10^8 [g]
Tramadol	5	210	70	10	10	4.0×10^3 [g]	6.3×10^9 [h]
Venlafaxine	2.5	370	60	10	10	8.5×10^3 [g]	10^{10} [g]
Trimethoprim	5	40	30	10	8	2.7×10^5	6.9×10^9 [f]
Valsartanic acid	5	3,440	1,330	10	10	n/a	7.9×10^9 [k]

[a] Lee et al. (2013); [b] Huber et al. (2003); [c] Benner et al. (2008); [d] Yuan et al. (2009); [e]Real et al. (2009); [f] Watts and Linden (2009); [g] Lee et al. (2014); [h] Zimmermann et al. (2012); [i] Naik and Moorthy (1995); [j] Javier Rivas et al. (2011); [k] Wols et al. (2014); [l] Wols and Hofman-Caris (2012)

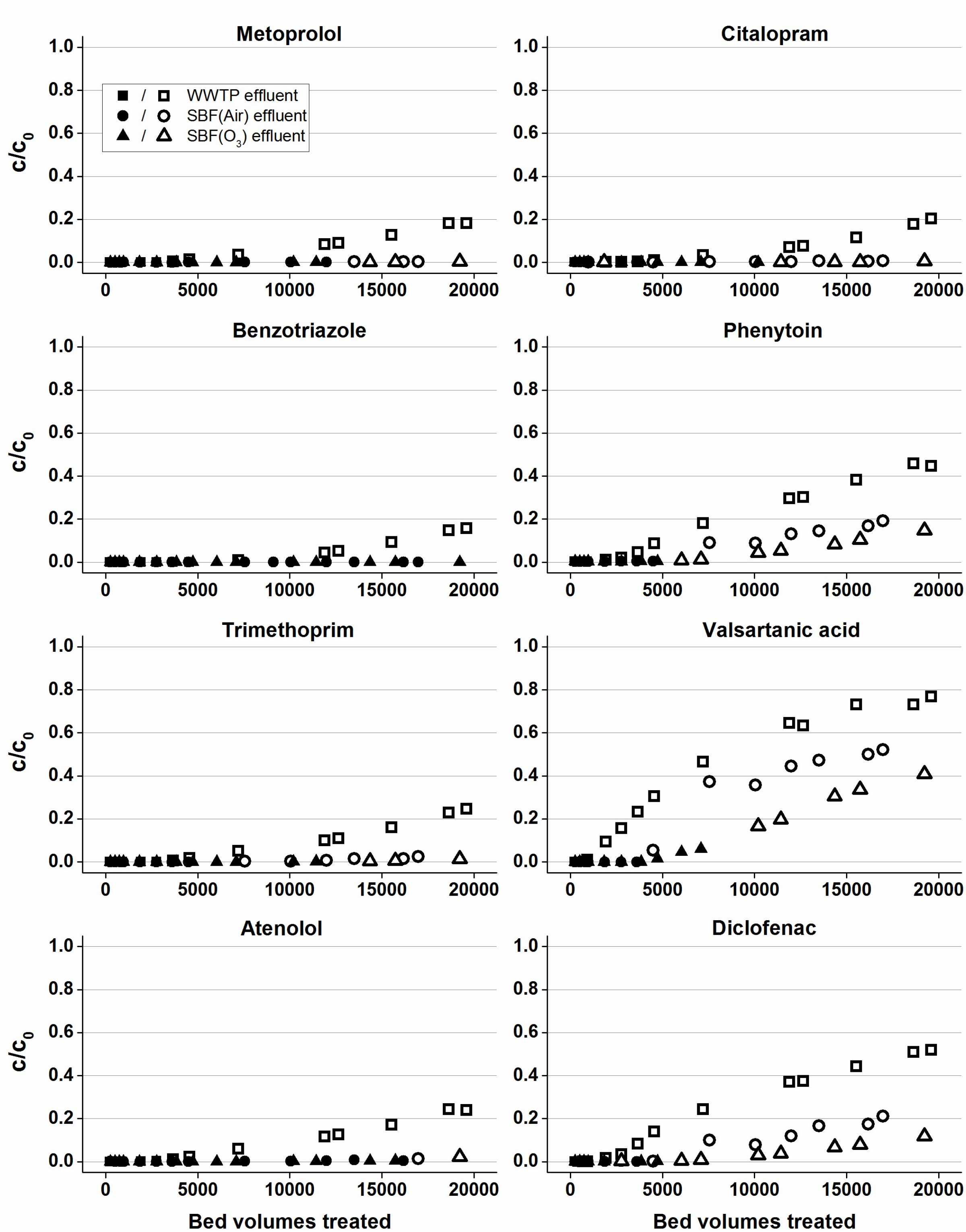

Figure SI-2: Breakthrough curves for indicator compounds from RSSCTs fed with WWTP effluent and effluent of systems SBF(Air) and SBF(O_3). Full symbols indicate values <LOQ, empty values indicate values >LOQ.

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