

The Efficacy of Chlorine Photolysis as an Advanced Oxidation Process for Drinking Water Treatment: Supplemental Information

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**Contents (9 pages):
Tables S1-S4**

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Tables S1-S4 summarize the experimental conditions for studies that quantified the formation of disinfection by-products (DBPs) by chlorine in the presence and absence of light. The type and fluence of the light source, the experimental duration (i.e., time between chlorine addition and DBP measurement), the free available chlorine (FAC) concentration, pH, and dissolved organic carbon (DOC) concentration are indicated for each data point. The difference between the concentration of DBP measured in the irradiated solutions and in dark control experiments is presented graphically in Figure 3 in the manuscript. Note that full-scale studies that pre-chlorinated water before any treatment are not included due to the elevated background DBP concentrations detected using that approach.

Table S1: Summary of experimental conditions for studies quantifying the formation of trihalomethanes (THMs) produced by chlorine in the presence and absence of light. The studies quantified either chloroform alone (denoted CHCl_3) or total trihalomethanes (denoted TTHM; the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane).

DBPs Quantified	Light Source	Fluence (mJ/cm ²)	Duration (min)	pH	[FAC] (mg/L as Cl ₂)	[DOC] (mg/L)	[DBP] in Irradiated Experiment (µg/L)	[DBP] in Dark Experiment (µg/L)	Reference
CHCl ₃	Hg	N/A	60	8.1	2	4	4.2	9.5	1
				6.5			2.9	3.1	
	LP UV	60	4,320	7	7	5	122	87	2
				7		5	78	55	
				6.8		1.8	35	24	
				7		5	80	47	
	MP UV			7		5	92	87	
				7		5	77	55	
				6.8		1.8	40	24	
				7		5	86	47	
TTHM	LP UV	3,900	120	7.5	10	2.6	14	13	3
	UV-A	7,000					24	13	
	MP UV	1,820	1	6.5	3.5	7	4	4	
						6	8		6
10						5	4		
7.5				2		8	7		
				6		8	10		
				10		6	8		

Table S1: Continued.

DBPs Quantified	Light Source	Fluence (mJ/cm ²)	Duration (min)	pH	[FAC] (mg/L as Cl ₂)	[DOC] (mg/L)	[DBP] in Irradiated Experiment (µg/L)	[DBP] in Dark Experiment (µg/L)	Reference
TTHM	MP UV	1,820	1	8.5	2	3.5	10	9	4
					6		10	11	
					10		7	9	
			1,440	6.5	6.5		100	50	
				7.5			100	65	
				8.5			120	85	
	LP UV	800	120	7.2	1.5	3.2	15	31	5
			1,440				17	40	
			4,320				19	50	

Table S2: Summary of experimental conditions for studies quantifying the formation of haloacetic acids (HAAs) produced by chlorine in the presence and absence of light. The studies quantified the sum of dichloroacetic acid (DCAA) and trichloroacetic acid (TCAA; denoted DCAA + TCAA), the five regulated HAAs (denoted HAA5; the sum of bromoacetic acid, dibromoacetic acid, dichloroacetic acid, monochloroacetic acid, and trichloroacetic acid), or nine HAAs (denoted HAA9; the sum of HAA5, bromochloroacetic acid, bromodichloroacetic acid, chlorodibromoacetic acid, and tribromoacetic acid).

DBPs Quantified	Light Source	Fluence (mJ/cm ²)	Duration (min)	pH	[FAC] (mg/L as Cl ₂)	[DOC] (mg/L)	[DBP] in Irradiated Experiment (µg/L)	[DBP] in Dark Experiment (µg/L)	Reference
DCAA + TCAA	LP UV	60	5	7	7	5	57	76	2
				7		5	118	108	
				7		5	80	68	
				6.8		1.8	48	37	
	MP UV			7		5	66	76	
				7		5	98	108	
				6.8		1.8	50	37	
				7		5	95	68	
HAA5	LP UV	3,900	120	7.5	10	2.6	37	17	3
	UV-A	7,000					31	17	
	LP UV	3,900					42	27	
	UV-A	7,000					47	27	
HAA9	MP UV	1,820	1	6.5	2	3.5	8	3	4
					6		7	3	
					10		4	2	
				7.5	2		13	3	
					6		9	3	
					10		5	3	

Table S2: Continued.

DBPs Quantified	Light Source	Fluence (mJ/cm ²)	Duration (min)	pH	[FAC] (mg/L as Cl ₂)	[DOC] (mg/L)	[DBP] in Irradiated Experiment (µg/L)	[DBP] in Dark Experiment (µg/L)	Reference
HAA9	MP UV	1,820	1	8.5	2		15	3	4
					6		8	3	
					10		5	2	
			1,440	6.5	6.5		140	70	
				7.5			100	75	
				8.5			70	60	
			HAA5	LP UV	800		30	7.2	
120	12	25							
1,440	18	34							
4,320	22	39							

Table S3: Summary of experimental conditions for studies quantifying the formation of haloacetonitriles (HANs) produced by chlorine in the presence and absence of light. Both studies quantified the sum of bromochloroacetonitrile, dibromoacetonitrile, dichloroacetonitrile, and trichloroacetonitrile.

DBPs Quantified	Light Source	Fluence (mJ/cm ²)	Duration (min)	pH	[FAC] (mg/L as Cl ₂)	[DOC] (mg/L)	[DBP] in Irradiated Experiment (µg/L)	[DBP] in Dark Experiment (µg/L)	Reference
HAN	MP UV	1,820	1	6.5	2	3.5	2.5	0	4
					6		2.5	0	
					10		1.5	0	
				7.5	2		4	0.5	
					6		3	0.5	
					10		1.5	0	
				8.5	2		5	0.5	
					6		3	0.5	
					10		1.5	0.5	
			1,440	6.5	6.5		30	9	
				7.5			16	8	
				8.5			4	3	
	LP UV	800	30	7.2	1.5	3.2	17	8	5
			120				22	11	
			1,440				26	14	
			4,320				40	20	

Table S4: Summary of experimental conditions for studies quantifying the formation of total organic halides (TOX) or adsorbable organic halides (AOX).

DBPs Quantified	Light Source	Fluence (mJ/cm ²)	Duration (min)	pH	[FAC] (mg/L as Cl ₂)	[DOC] (mg/L)	[DBP] in Irradiated Experiment (µg/L)	[DBP] in Dark Experiment (µg/L)	Reference
TOX	LP UV	60	10	6.5	0.28	5	479.25	443.75	6
				8.5			390.5	319.5	
	MP UV			6.5			461.5	443.75	
				8.5			284	319.5	
	MP UV	220	10	6.5	0.28	5	301.75	337.25	7
						461.5	443.75		
	LP UV	300	4,320	8.6	1.7	1	111	113	8
	MP UV				2.2		147	113	
	LP UV	3,900	120	7.5	10	2.6	65	97	3
UV-A	7,000	97					97		
AOX	MP UV	1,820	0.67	6.5	2	3.5	60	35	4
					6		40	40	
					10		25	35	
				7.5	2		70	35	
					6		50	35	
					10		30	35	
				8.5	2		90	42	
					6		70	35	
					10		40	35	
			1,440	6.5	6.5		300	200	
				7.5	6.5		225	200	
				8.5	6.5		210	200	

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