THM and HAA Formation: Chen–Westerhoff and Obolensky–Singer Models

Trihalomethane and haloacetic acid formation potentials from DOC, UV254 and bromide, SUVA, and THM4 under plant chlorination conditions.

Input parameters

Unit system: SI

Parameter	Value	Unit
Dissolved organic carbon	1.0000	mg/L
UV254 absorbance, 1/cm	0.020000	
Bromide	0.20000	mg/L
Water temperature, °C (Obolensky–Singer)	15.000	
Alkalinity, mg/L as $CaCO_3$	200.00	
Chlorine consumed (dose − residual), mg/L	1.0000	
Chlorine contact time	2.0000	h
pH	7.8000	
Chlorine residual in finished water, mg/L	0.80000	

Calculated results

Parameter	Value	Unit
Specific UV absorbance, L/(mg·m)	2.0000	
THM formation potential	46.859	µg/L
HAA formation potential	31.731	µg/L
THM4 under plant conditions, µmol/L	0.079136	
THM4 expressed as chloroform	9.4473	µg/L

Notes for this case

- Formation potentials (Chen and Westerhoff 2010) are upper limits under standard laboratory chlorination. The Obolensky–Singer (2008) regression from Information Collection Rule data uses DOC in place of TOC here and gives THM4 in µmol/L; the chloroform-equivalent mass is shown because the model's individual-species split is not included.

Formula and method

$$THMFP_4 = 1147\,(UV)^{0.83}(Br+1)^{0.27}, \quad HAAFP_9 = 1151\,(DOC)^{0.17}(UV)^{0.89}(Br+1)^{-0.60}$$

$$\log[THM_4] = -1.371 + 0.015T - 0.0005ALK + 0.188\log TOC + 0.326\log UV + 0.291\log Cl_2 + 0.119\log t + 0.087pH + 0.167\log Cl_{res}$$

Variables

DOC	Dissolved organic carbon	kg/m³
UV_{254}	UV254 absorbance, 1/cm	-
Br^-	Bromide	kg/m³
T	Water temperature, °C (Obolensky–Singer)	-
ALK	Alkalinity, mg/L as $CaCO_3$	-
Cl_2	Chlorine consumed (dose − residual), mg/L	-
t	Chlorine contact time	s
pH	pH	-
Cl_{res}	Chlorine residual in finished water, mg/L	-

$SUVA$	Specific UV absorbance, L/(mg·m)	-
$THMFP_4$	THM formation potential	kg/m³
$HAAFP_9$	HAA formation potential	kg/m³
$[THM_4]$	THM4 under plant conditions, µmol/L	-
$THM_4\,(as\ CHCl_3)$	THM4 expressed as chloroform	kg/m³

Method and standards

Empirical regressions for chlorination by-product formation.

Assumptions and limits

- Within the data ranges of the regressions; free chlorine only.

Report details

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