Chick–Watson Disinfection: Log Inactivation and Required CT

Log inactivation of a microorganism from disinfectant concentration and contact time by the Chick–Watson law, and the time and CT for a target log inactivation.

Input parameters

Unit system: SI

Parameter	Value	Unit
Coefficient of specific lethality, (L/mg)ⁿ per min	2.0000	
Coefficient of dilution (usually close to 1)	1.0000	
Disinfectant residual	1.0000	mg/L
Contact time (T10 for a real contactor)	6.0000	min
Target log inactivation	4.0000	

Calculated results

Parameter	Value	Unit
Natural log of survival	-12.000	
Log inactivation	5.2115	
Concentration times time	6.0000	
Time for the target log inactivation	4.6052	min
Ct for the target (n = 1 basis)	4.6052	

Notes for this case

• Ct in mg·min/L. Chick–Watson assumes first-order die-off at constant residual; many organisms show a lag (shoulder) or tailing, and regulatory CT tables already include safety factors.

Formula and method

$$\ln\frac{N}{N_0} = -\Lambda_{CW} C^n t$$

$$t_{req} = \frac{2.303\,\log_{target}}{\Lambda_{CW} C^n}$$

Variables

Λ_{CW}	Coefficient of specific lethality, (L/mg)ⁿ per min	-
n	Coefficient of dilution (usually close to 1)	-
C	Disinfectant residual	kg/m³
t	Contact time (T10 for a real contactor)	s
$\log_{target}$	Target log inactivation	-
$\ln(N/N_0)$	Natural log of survival	-
$\log_{10}(N_0/N)$	Log inactivation	-
Ct	Concentration times time	-
t_{req}	Time for the target log inactivation	s
$(Ct)_{req}$	Ct for the target (n = 1 basis)	-

Method and standards

Chick–Watson disinfection kinetics.

Assumptions and limits

- Constant residual; first-order die-off without lag or tailing.

Report details

Report reference	FCC-AHNB-TXV8 (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/drinking-water/chick-watson-disinfection

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.