Disinfection with a Lag (Rennecker–Mariñas): Log Inactivation and Ct

Log inactivation of oocysts or spores with a lag Ct before inactivation starts (Rennecker–Mariñas model), and the Ct needed for a target log removal.

Input parameters

Unit system: SI

Parameter	Value	Unit
Coefficient of specific lethality, L/(mg·min)	0.083000	
Lag coefficient, mg·min/L	34.900	
Disinfectant concentration	0.48000	mg/L
Contact time	61.600	min
Target log inactivation	1.0000	

Calculated results

Parameter	Value	Unit
Ct provided, mg·min/L	29.568	
Log inactivation achieved	0	
Ct needed for the target, mg·min/L	62.642	
Contact time needed at C	130.50	min

Notes for this case

• ln(N/N₀) = 0 for Ct < b and −Λ_CW(Ct − b) beyond it; b and Λ_CW come from fitting bench data (concentration in mg/L, time in min). Constant concentration is assumed; for decaying residuals integrate C over time.

Formula and method

$$\ln\frac{N}{N_0} = \begin{cases} 0 & Ct < b \\ -\Lambda_{CW}(Ct - b) & Ct \geq b \end{cases}$$

$$Ct_{req} = b + \frac{2.303\,\log_{10}(N_0/N)}{\Lambda_{CW}}$$

Variables

Λ_{CW}	Coefficient of specific lethality, L/(mg·min)	-
b	Lag coefficient, mg·min/L	-
C	Disinfectant concentration	kg/m³
t	Contact time	s
$\log_{10}(N_0/N)$	Target log inactivation	-
Ct	Ct provided, mg·min/L	-
Ct_{req}	Ct needed for the target, mg·min/L	-
t_{req}	Contact time needed at C	s

Method and standards

Chick–Watson inactivation delayed by a lag Ct.

Assumptions and limits

- Constant C and temperature; parameters from bench tests.

Report details

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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/disinfection-lag-rennecker-marinas

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.