SUPPLEMENTARY MATERIAL

PROOF OF THE CONVERSION FACTOR, 2.303

The inactivation rate constant (k) in first order kinetics is typically expressed as:

$$N_t = N_o exp(-kt) \tag{S.1}$$

Where:

$N_t =$ concentration at time, t

$N_o =$ initial concentration of microorganism

$k =$ inactivation rate constant (h^{-1})

$t =$ time in hours

The log reduction value (LRV) is:

$$LRV = log_{10}\left(\frac{N_o}{N_t}\right) \tag{S.2}$$

From Equation S1,

$$ln\left(\frac{N_o}{N_t}\right) = kt \tag{S.3}$$

Using the change of based formula to convert from natural log to base-10 log:

$$log_{10}\left(\frac{N_o}{N_t}\right) = \frac{ln\left(\frac{N_o}{N_t}\right)}{ln(10)} \tag{S.4}$$

Since $ln(10) \approx 2.303$,

$$LRV = \frac{kt}{2.303} \tag{S.5}$$

Rearranging to express LRV per hour (h):

$$LRV/h = \frac{k}{2.303} \tag{S.6}$$

Equation (S.6) shows that to convert inactivation rate constant k from per hour (h^{-1}) to LRV/h, divide by 2.303.

Table S1 – Dataset for analysis

Observation Number	Date (D-M-Y)	Response		Predictors		
		$k\ (h^{-1})$	$Y\ (LRV/h)$	$X\ (W/m^2)$	M (°C)	W **(NTU)**
1	20-4-2021	4.9	2.128 ± 0.057	57.3	48	12.7
2	23-4-2021	3.6	1.563 ± 0.018	54.8	49	22.5
3	25-4-2021	3.5	1.520 ± 0.086	55.9	49	1.2
4	26-4-2021	3.8	1.650 ± 0.073	53.6	51	30.8
5	2-5-021	3.8	1.650 ± 0.105	63.0	48	9.0
6	4-5-2021	4.8	2.084 ± 0.031	67.6	49	13.0
7	6-5-2021	3.6	1.563 ± 0.106	53.3	52	13.8
8	15-5-2021	4.6	1.997 ± 0.035	62.2	49	12.8
9	19-5-2021	4.1	1.780 ± 0.037	55.3	51	24.9
10	24-5-2021	3.9	1.693 ± 0.063	55.1	49	28.5
11	27-5-2021	2.5	1.086 ± 0.042	44.0	44	22.7
12	29-5-2021	3.0	1.303 ± 0.051	43.3	45	4.1
13	2-6-2021	6.2	2.692 ± 0.043	62.2	55	12.7
14	3-6-2021	3.4	1.476 ± 0.079	61.5	48	29.0
15	7-6-2021	3.4	1.476 ± 0.080	52.5	47	10.9
16	9-6-2021	4.1	1.780 ± 0.041	52.7	49	18.1
17	10-6-2021	3.3	1.433 ± 0.086	45.2	45	20.5
18	11-6-2021	3.4	1.476 ± 0.113	50.6	47	21.0
19	12-6-2021	3.3	1.433 ± 0.065	50.0	46	6.6
20	16-6-2021	3.2	1.390 ± 0.108	44.1	45	19.2
21	17-6-2021	3.0	1.303 ± 0.029	46.9	44	12.5
22	6-7-2021	3.3	1.433 ± 0.055	41.3	45	27.1
23	9-7-2021	2.2	0.955 ± 0.133	40.8	40	7.5
24	15-7-2021	2.4	1.042 ± 0.100	39.6	41	5.3
25	16-7-2021	2.3	0.999 ± 0.038	40.9	41	11.0
26	20-7-2021	2.2	0.955 ± 0.079	38.3	40	22.1
27	28-7-2021	2.5	1.086 ± 0.065	42.3	44	27.9
28	5-8-2021	2.4	1.042 ± 0.036	38.5	43	28.4
29	8-8-2021	0.7	0.304 ± 0.039	26.7	34	23.4
30	11-8-2021	0.6	0.261 ± 0.116	26.1	33	28.6
31	12-8-2021	1.5	0.651 ± 0.027	29.3	37	21.2
32	21-8-2021	1.3	0.565 ± 0.049	28.4	36	16.3
33	26-8-2021	1.4	0.608 ± 0.014	29.2	36	13.5

Y – die-off rate constant of E-coli; X – Maximum average 5-hour UV intensity; M - **Maximum** water temperature; W – water turbidity

Procedure for Non parametric implementation of Wu's (1986) bootstrapping scheme

1. Perform OLS on the original data and evaluate the residuals, $\hat{\varepsilon}_1, \hat{\varepsilon}_2 \ldots \hat{\varepsilon}_n$
2. Normalize the residuals, ε: $$a_i = \frac{\hat{\varepsilon}_i - \bar{\hat{\varepsilon}}}{\sqrt{n^{-1}\sum_1^n \left(\hat{\varepsilon}_i - \bar{\hat{\varepsilon}}\right)^2}}$$, where $\hat{\varepsilon} = n^{-1}\sum_1^n \hat{\varepsilon}_i$. Note that a_1, $a_2, \ldots a_n$ have zero mean and unit variance.
3. For each data point i, $i = 1, 2, \ldots, n$, draw a random value, t_i^* from $a_1, a_2, \ldots a_n$
4. Compute w_i, the ith diagonal elements of the "hat matrix" $X(X'X)^{-1}X'$
5. Form the bootstrap sample, (y^*, X), where $$y_i^* = X_i\hat{\beta} + \frac{t_i^* \hat{\varepsilon}_i}{\sqrt{1 - w_i}},$$
6. Compute the OLS estimate: $\hat{\beta}^* = (X'X)^{-1}X'y^*$

Compute $\hat{\beta}^*$ a large number of times, say 10,000