Electronic Supplementary Information

Evaluation of parameters governing dark and photorepair in UVC-irradiated *Escherichia coli*

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Table S1. *E. coli* decay rate constants of UVA-induced photoinactivation after an initial 3 h of photorepair contrasted with a case of UVA exposure with no prior UVC dosing. Error values represent standard error.

Repair condition	Decay rate constant (h^{-1})
UV_{254}	0.31 ± 0.06
UV_{254} + HA	0.40 ± 0.03
UV_{254} + CB	0.31 ± 0.08
UV_{278}	0.30 ± 0.05
UV_{278} + HA	0.29 ± 0.05
UV_{278} + CB	0.40 ± 0.08
All cases, post-photorepair	0.33 ± 0.06
No UVC exposure	0.17 ± 0.02

Supplementary Figures

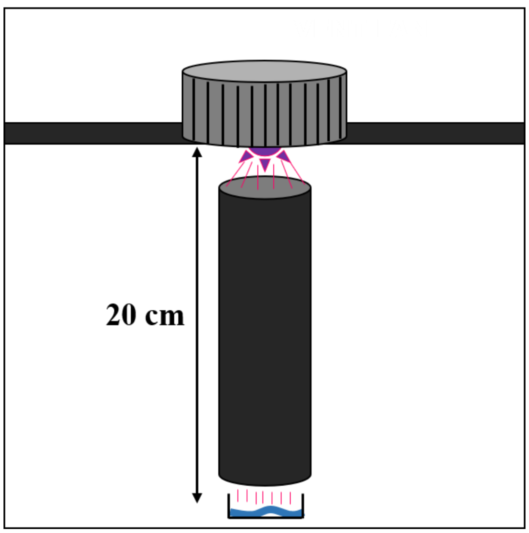

Figure S1: Schematic of LED photoreactor cabinet, lamp, and magnetically stirred reaction vessel.

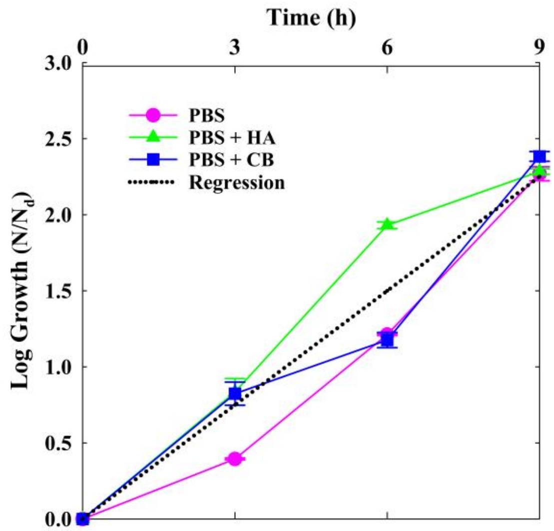

Figure S2. *E. coli* growth under dark conditions with humic acid, culture broth, or phosphate buffer solution alone. The black dotted line (••••) is the regression of all three plots together.

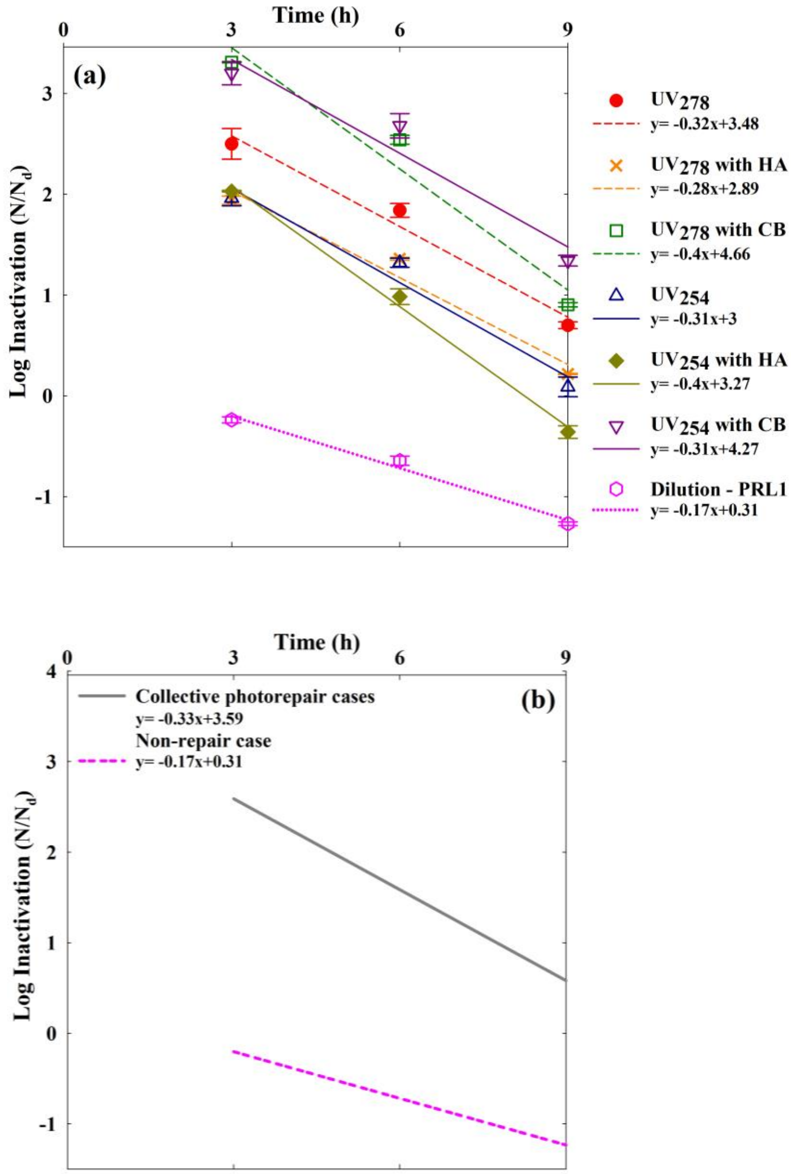

Figure S3. (a) Regressions of *E. coli* decay induced by PRL1 after UVC dosing and a 3h photorepair period. (b) Collective regression of all cases of decay vs non-repair case

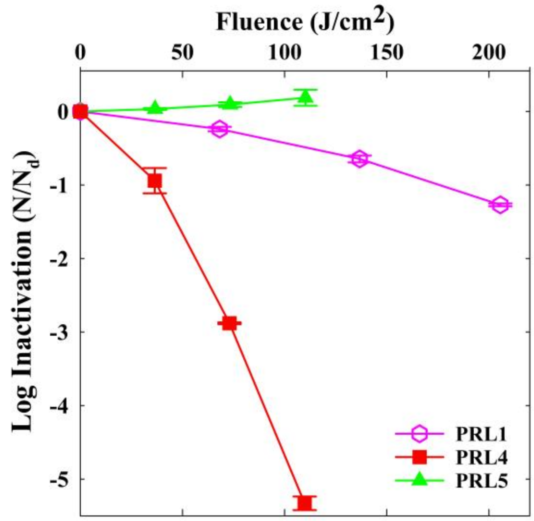

Figure S4. *E. coli* inactivation under PRL1 and PRL4 and growth under PRL5.

Supplementary Text

Text S1: Calculation of fluence in bench-scale UV experiments

Fluence calculations were performed according to (Bolton and Linden 2003), described here. An average irradiance value (E'_{avg}) was estimated by

$$E'_{avg} = E_0 \times \text{Petri Factor} \times \text{Reflection Factor} \times \text{Water Factor} \times \text{Divergence Factor}, \quad (1)$$

where E_0 is the irradiance measured via radiometer at the center of the reaction vessel. Each factor was calculated for the reactor or each sample, as needed. The Petri factor was found by measuring incident irradiance in multiple locations along two transects of the reactor vessel placement and determining an average value for the area; the factor was determined to be 0.996 for this reactor. The Reflection factor was taken to be 0.975, based on the refractive indices of water and air in the UV range (Meyer-Arendt 1984). The water factor accounts for light absorbed by the water and its constituents and was calculated as

$$Water\ Factor = \frac{1-10^{-a\ell}}{a\ell \ln(10)}, \quad (2)$$

where a is the decadic absorption coefficient of the solution measured by spectrophotometer at the irradiation wavelength and ℓ is the path length of the measurement cell. Unique water factor values were calculated for each experimental solution. The nature of an LED emission precludes true collimation of its beam, so the divergence of photons was accounted for using the Divergence factor as follows:

$$Divergence\ Factor = \frac{L}{(L+\ell)}, \quad (3)$$

where L is the distance between the lamp surface and the reaction solution. Finally, the fluence (or UV dose) values were calculated by multiplying irradiation time (s) by E'_{avg} (mW/cm^2), yielding a total absorbed UV energy value (mJ/cm^2).

References:

Bolton, J.R. and Linden, K.G. (2003) Standardization of Methods for Fluence (UV Dose) Determination in Bench-Scale UV Experiments. Journal of Environmental Engineering 129(3), 209-215.

Meyer-Arendt, J.R. (1984) Introduction to classical and modern optics, Prentice-Hall, Englewood Cliffs, NJ.