Supporting Information for

Comparison of *E. coli* inactivation by UV_{222}-ADPs and UV_{254}-ADPs in water

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Text S1. Chemicals and materials

H_2O_2 (30%, w/w), sodium percarbonate ($2Na_2CO_3 \cdot 3H_2O_2$, 99%), potassium persulfate ($K_2S_2O_8$, ≥ 99%), sodium thiosulfate ($Na_2S_2O_3$, ≥ 98%) and nitrobenzene (NB, 99%), were of analytical grade and purchased from Sinopharm Chemical Reagent Company Ltd. (Shanghai, China). All chemicals were used without purification.

Electron paramagnetic resonance (EPR, Bruker ESRA-300, Germany) analysis was conducted to detect the potential radicals produced during UV_{222} irradiation. 5,5-dimethyl-1-pyrroline N-oxide (DMPO, ≥ 97%, DOJINDO, Japan) was used as the spin trapping agent. The concentration of dissolved organic matter was measured by TOC-VCPH (Shimadzu, Japan). Inorganic anions were analyzed using ion chromatography (ICS-1100, Thermo Fisher Scientific, USA). The absorption spectra of three oxidants were detected using UV detector (Agilent, USA) (Fig. 1(b)), as well as the residual concentration of the treated oxidants.

Text S2. The calculation method for UV dose

The UV dose (Einstein/L) is calculated by the delivered radiation intensity (Einstein/(L·s)) to microbial cells multiplied by the exposure time (s). The UV radiation intensity was determined using H_2O_2 as an actinometer and radiometer. Based on the Beer-Lambert Law and the definition of quantum yield, the overall photodegradation rate of H_2O_2 could be described as follows (Beltran et al., 1995).

$$-\frac{dC}{dt} = \Phi_\lambda I_0 \quad , \qquad (S1)$$

$$-\frac{dC}{dt} = 2.303\Phi_\lambda I_0 \varepsilon_\lambda bC \quad , \qquad (S2)$$

Photodegradation of H_2O_2 at a high concentration of 50 mmol/L was conducted to determine the UV intensity of the photoreactor according to Eq. (S1). This equation indicates a zero-order kinetics for H_2O_2 photodegradation. Thus, a plot of C_f/C_i versus irradiation time should lead to a straight line with slope of $\Phi_\lambda I_0$ as shown in Figure S1. The UV intensity (I_0) was determined to be 1.89×10^{-5} Einstein/(L·s), 1.90×10^{-5} Einstein/(L·s) for UV_{222} and UV_{254}. And optical path length (b) was calculated to be 1.05 cm according to Eq. (S2).

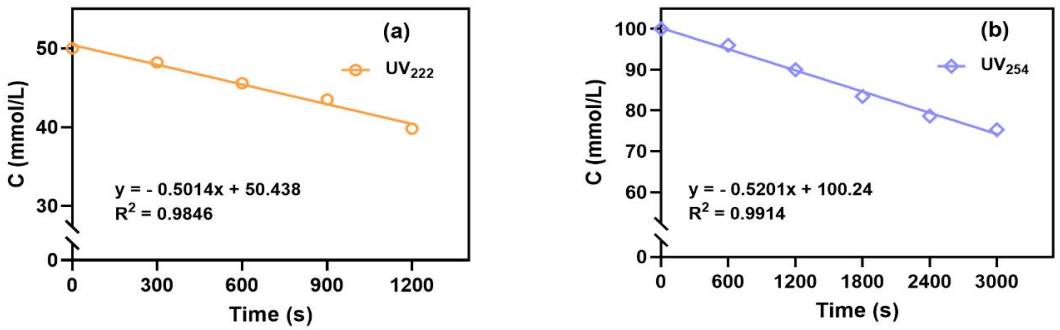

Fig. S1 Determination of the average photonic intensity per volume (I_0) of the photoreactor used in the present study. (a) UV_{222}; (b) UV_{254}.

Table S1 Physicochemical parameters of water samples.

Parameters	Values of the lake
pH	7.65
TOC (mg/L)	4.76
Cl^- (mmol/L)	0.11
SO_4^{2-} (mmol/L)	0.10
NO_3^- (mmol/L)	0.00

Text S3. Determination of reactive species

To determine the concentration of HO• produced during disinfection by UV alone and UV/H_2O_2 process, nitrobenzene (NB) was used as a probe compound (Wang et al., 2021), the specific calculation process is as follows (Eqs. (S3) and (S4)):

$$k_{obs,NB} = k_{UV,NB} + k_{HO\bullet,NB}[HO\bullet]_{ss} \quad , \quad (S3)$$

$$[HO\bullet]_{ss} = \frac{k_{obs,NB} - k_{UV,NB}}{k_{HO\bullet,NB}} \quad , \quad (S4)$$

where $k_{obs,NB}$ represent the pseudo-first order rate constants for the degradation of NB by UV/H_2O_2 process. $k_{UV,NB}$ represents the photolysis rate constants for the degradation of NB by UV/H_2O_2 process. $[HO\bullet]_{ss}$ represents the steady-state concentrations of HO•. $k_{HO\bullet,NB}$ represents the second-order rate constants for NB with HO•, which was reported to be 3.9×10^9 L/(mol·s) (Mahdi-Ahmed and Chiron, 2014).

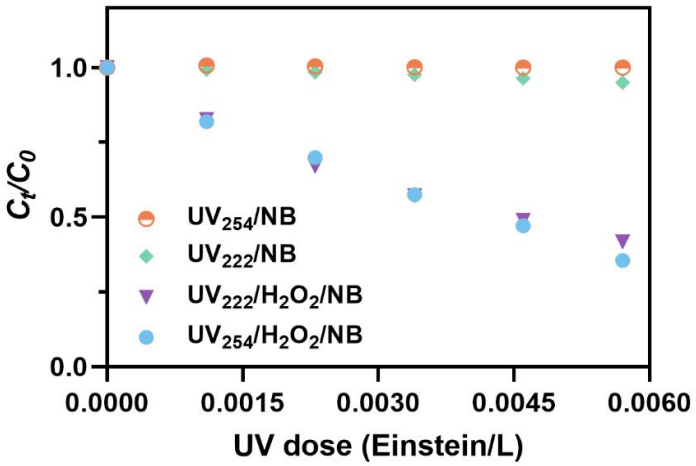

Fig. S2 The degradation of NB. Conditions: $[H_2O_2]_0$ = 0.5 mmol/L, $[NB]_0$ = 10 μmol/L, and $[E.\ coli]_0$ ≈6.5 $\log_{10}$ CFU/mL.

Text S4. Calculation of the fraction of light absorbed by each component in the UV based process

Based on Lambert Beer's Law, the fraction of light absorbed by each component in the UV based process was calculated using the following equations (Eqs. (S5) and (S6)) (Chuang et al., 2016; Zhao et al., 2021):

$$f_{solution} = 1 - 10^{-\sum \varepsilon_i C_i L} \quad , \qquad (S5)$$

$$f_x = \frac{\varepsilon_x C_x}{\sum \varepsilon_i C_i} \times f_{solution} \quad , \qquad (S6)$$

where $f_{solution}$ is the fraction of light absorbed by the reacting solution, ε is the molar absorption coefficient of a compound (e.g., H_2O_2, SPC, PDS and *E. coli*) in the solution at a certain wavelength, C is the initial molar concentration of a compound in the solution, L is the effective path length, f_x is the fraction of light absorbed by each component. The molar absorption of H_2O_2, SPC, PDS and *E. coli* at 222 nm are shown in Table S2.

Table S2 Absorbance of H_2O_2, SPC, PDS, FA and *E. coli* at 222 nm.

Substances	Absorbance
6.5 $\log_{10}$ *E. coli*	0.064 (mL/(CFU·cm))
H_2O_2	74 (L/(mol·cm))
SPC	180 (L/(mol·cm))
PDS	216 (L/(mol·cm))
FA	0.03 (L/(mg·cm))

Table S3 The fraction of 222 nm photons absorbed by the solution, 6.5 $\log_{10}$ CFU/mL *E. coli*, oxidants and FA during the co-exposure of UV and oxidants.

Groups	Solution	*E. coli*	H_2O_2	SPC	PDS	FA
UV_{222} + *E. coli*	13.7%	13.7%	-	-	-	-
UV_{222} + H_2O_2	99%	-	99%	-	-	-
UV_{222} + SPC	100%	-	-	100%	-	-
UV_{222} + PDS	100%	-	-	-	100%	-
UV_{222} + H_2O_2 + *E. coli*	21.3%	13.1%	8.2%	-	-	-
UV_{222} + SPC + *E. coli*	29.9%	12.4%	-	17.5%	-	-
UV_{222} + PDS + *E. coli*	32.7%	12.2%	-	-	20.5%	-
UV_{222} + FA + *E. coli*	29.7%	12.4%	-	-	-	17.3%
UV_{222} + H_2O_2 + FA + *E. coli*	35.8%	11.9%	7.4%	-	-	16.5%

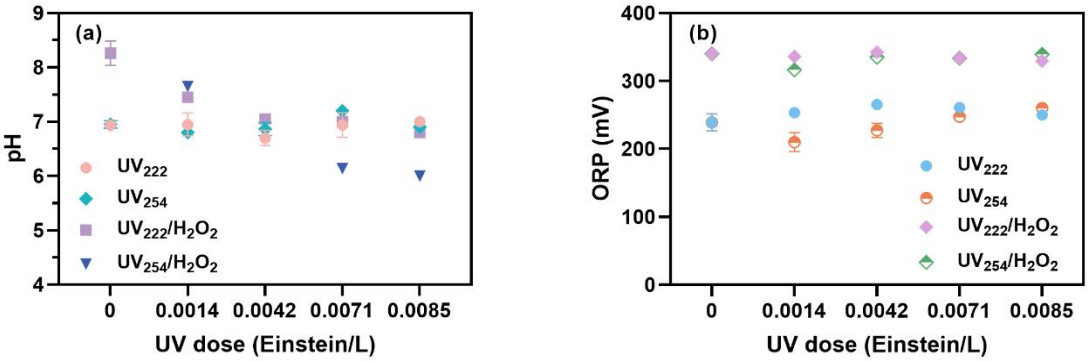

Fig. S3 Variations in pH (a) and redox potential (ORP) (b) during the inactivation of *E. coli* using UV and UV/H_2O_2 processes. Conditions: $[H_2O_2]_0$ = 0.5 mmol/L, and $[E.\ coli]_0 \approx 6.5$ $\log_{10}$ CFU/mL.

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