Electronic Supplementary Material (ESI) for Environmental Science: Processes & Impacts.

Supplementary data

Effect of fluence on the inactivation

A collimated beam apparatus (Calgon Carbon Corp., Pittsburgh, PA, USA. Model No. ps 1-1-120) equipped either a 1 KW MP lamp (Calgon Carbon Corp.) or a LP lamp (Model No. G12T6L, Atlantic Ultraviolet Corp., Haupauge, NY) were used in the laboratory. For the designed UV exposure time, water samples (25 mL) contained in Petri dishes (diameter: 60 mm) were put under the collimating tube and gently stirred. The inactivation fluences (UV doses) were applied by changing the exposure times, while the irradiance was fixed at 0.14 mW/cm^2 (corrected by the sensor factor) and 0.24 mW/cm^2 throughout the experiment for the MP and LP UV lamps, respectively. Exposure times for inactivation fluences between 5 to 35 mJ/cm^2 were adjusted between 30 to 230 s for both lamps. All experiments were carried out at room temperature (20 ± 1 ºC).

The inactivation curve of total coliforms by MP and LP UV lamps is shown in Figure S1. The average inactivation fluence reported by the target wastewater plant on three days was 24.2 mJ/cm^2 and they determined a log reduction of 3. However, based on laboratory experiments in this study and the ratio of influent to effluent counts, the log reduction for the wastewater treatment plant was 3.4 at which the inactivation fluence is 25.5 mJ/cm^2 according to Figure S1 for both the LP and MP UV systems. So, the indication of inactivation fluence at the target wastewater plant is reasonably accurate.

Method of calculating effective reactivation fluence (ERF)

Sample calculation: Based on Table 1, for outdoor experiment without any filter the integrated effective irradiance (IEI) is 5.2 (mW/cm^2), so the ERF after 4 hours would be as follows: $(5.2 \times 4 \times 3600)/1000 \approx 73.7$ (J/cm^2).

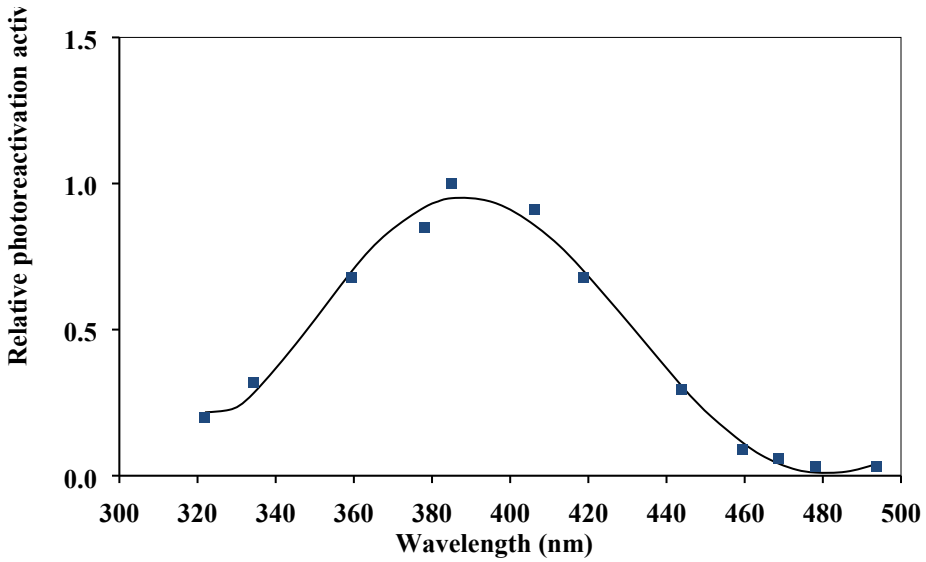

Figure S1. Action spectra for photoreactivation of *E. coli*; points (■) adapted from the data presented by Takao et al. (1989); the fitting line (see equation) is based on x = wavelength divided by 1000.

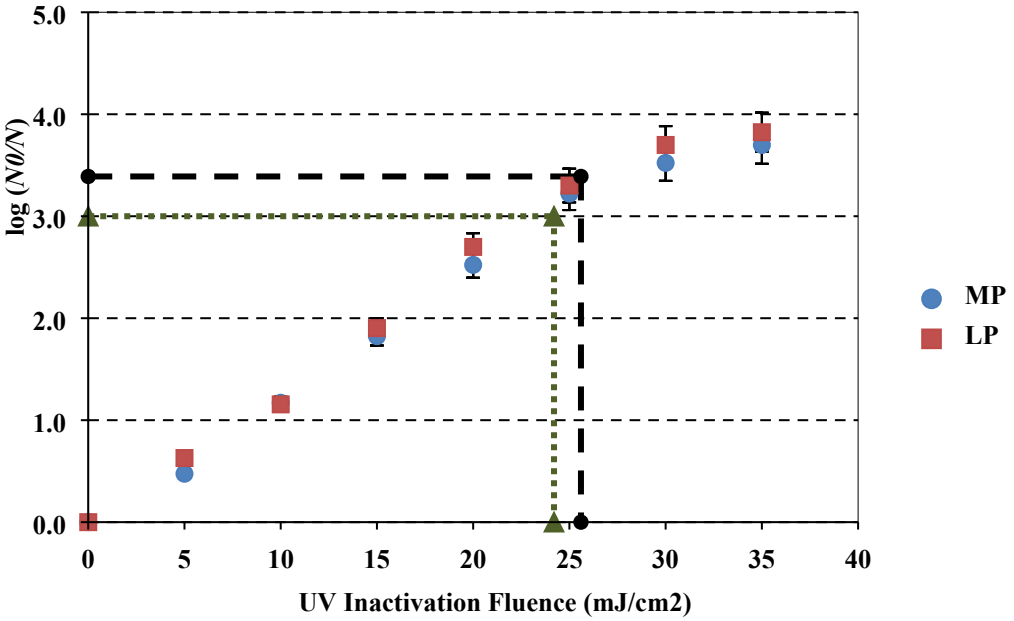

Figure S2. Log reduction of total coliforms in the wastewater after MP and LP UV exposure; • MP, ■ LP; inactivation fluence determined in the lab (dashed line); inactivation fluence reported by the target wastewater plant (dotted line); All results were evaluated statistically and the differences were not significant at $p > 0.05$ as determined by ANOVA.

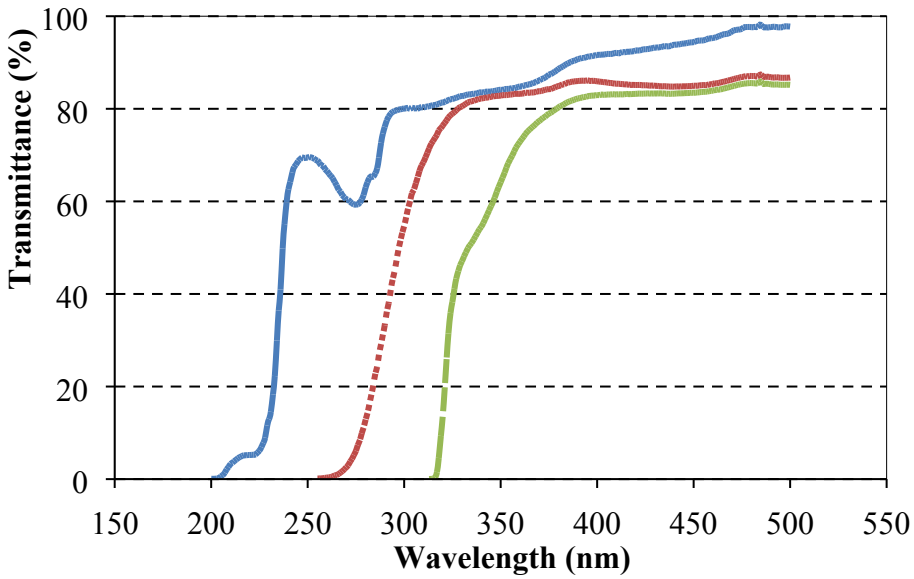

Figure S3. Transmittance spectra of a Pyrex® lid (dotted line), a PET bottle (dashed line) and Saran Wrap® (solid line).

Reference

Takao M, Oikawa A, Eker AP, Yasui A. Expression of an Anacystis nidulans photolyase gene in Escherichia coli; functional complementation and modified action spectrum of photoreactivation. Photochemistry and photobiology 1989; 50: 633-637.