Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supplementary Materials for

Locally Enhanced Electric Field Treatment (LEEFT) with Nanowire-Modified Electrodes for Water Disinfection in Pipes

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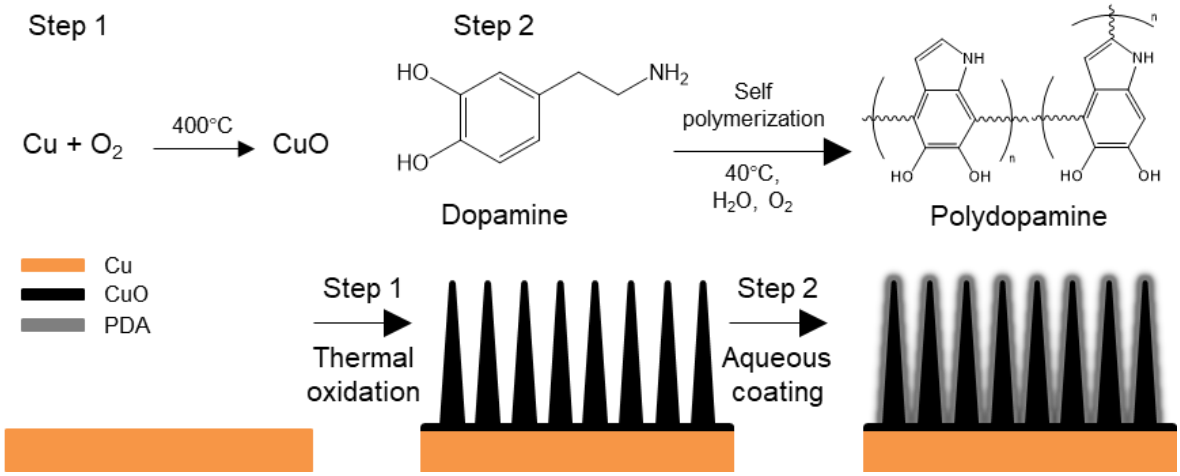

Fig. S1. Schematics showing the electrode fabrication processes.

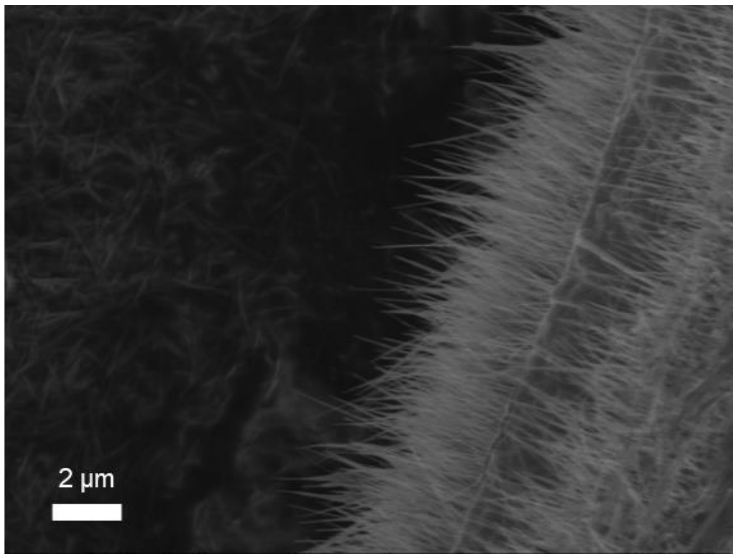

Fig. S2. Scanning electron microscopy image showing the bare CuONWs on the electrode surface.

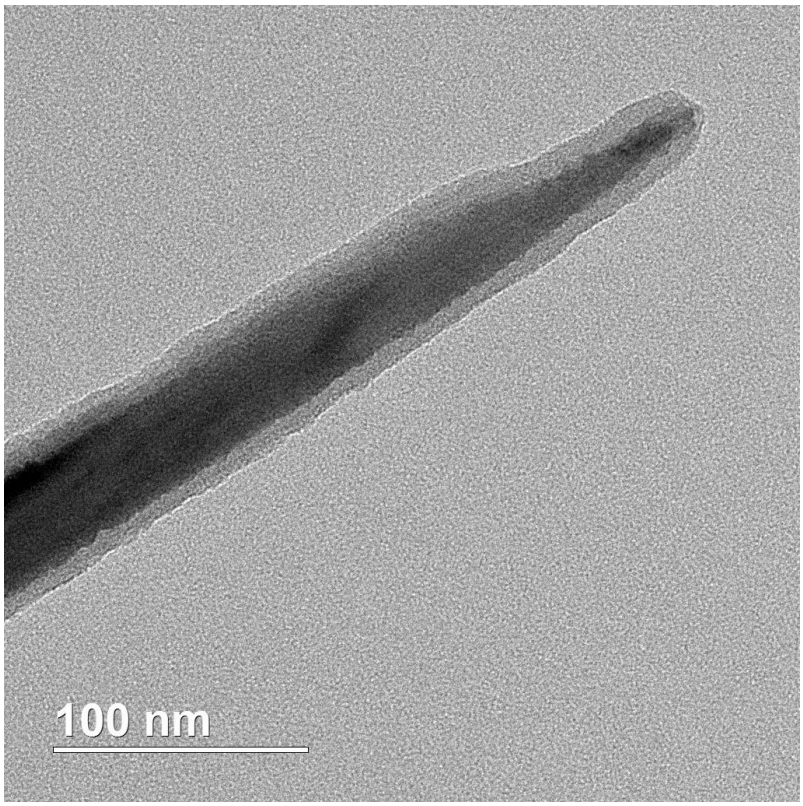

Fig. S3. Transmission electron microscopy image showing the single CuONW coated with polydopamine.

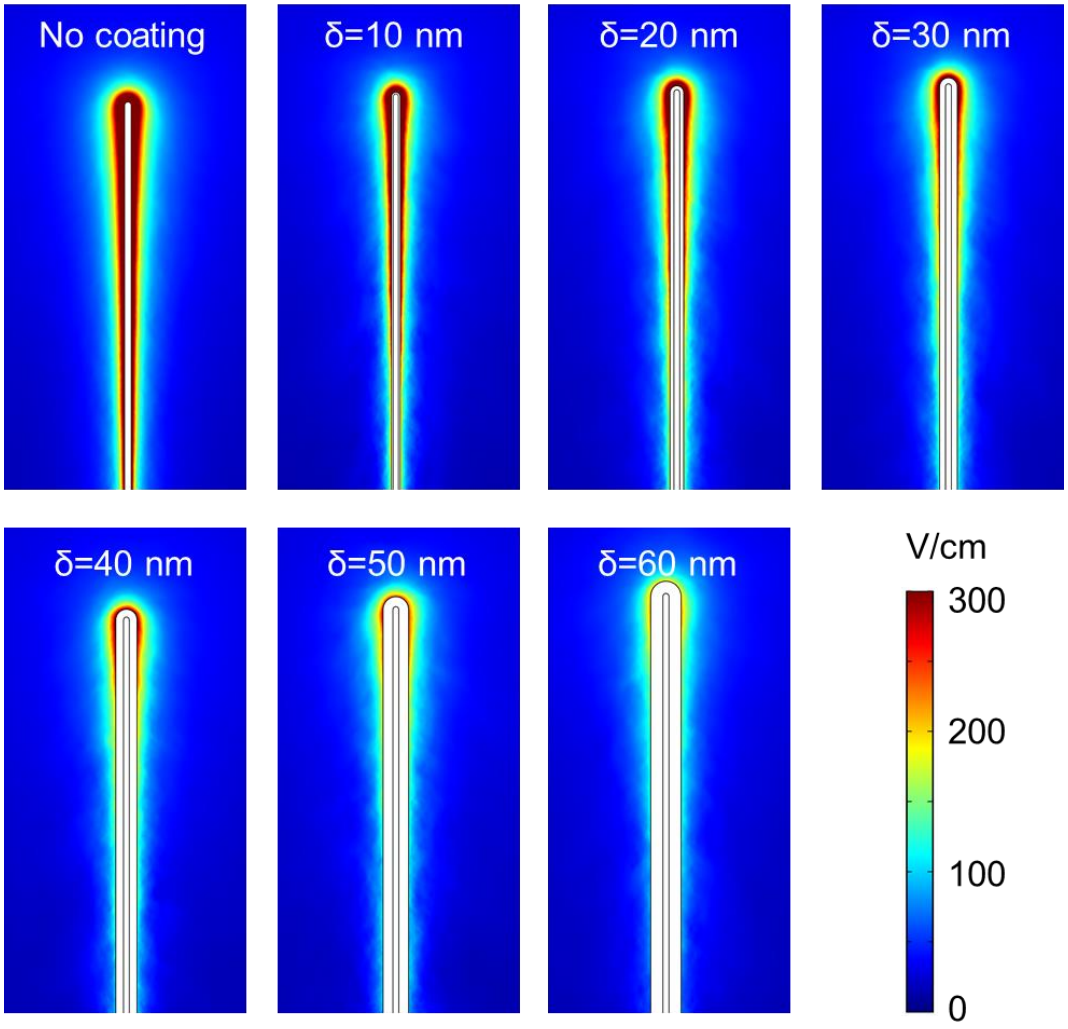

Fig. S4. Electric field simulation near the tip of the nanowire to study the influence of nanowire diameter. The bare nanowire has a diameter of 30 nm. The symbol δ indicates the thicknesses of different polydopamine coating layers.

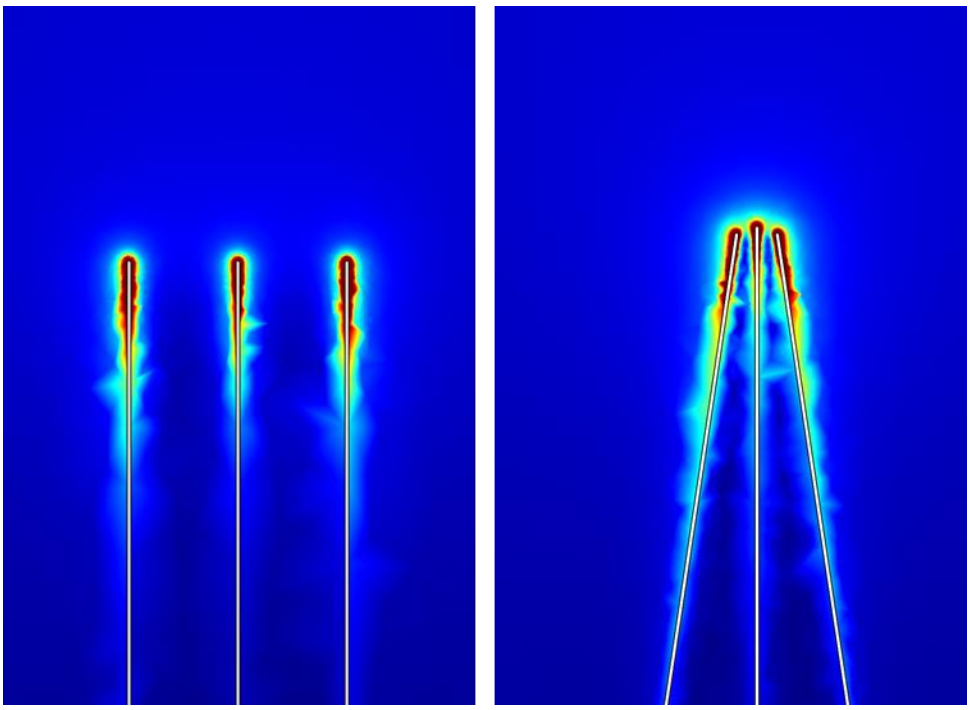

Fig. S5. Electric field simulation near the tip of the nanowire to study the influence of merging nanowires.

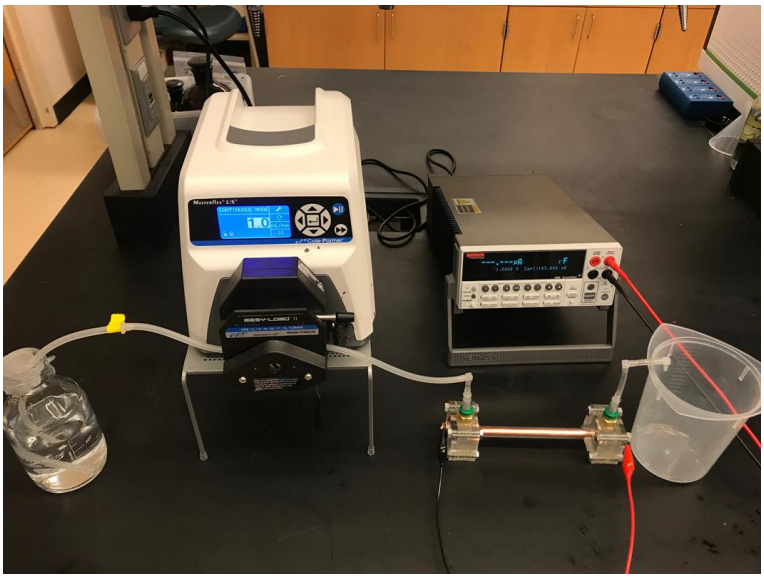

Fig. S6. Experimental setup of the LEEFT water disinfection.

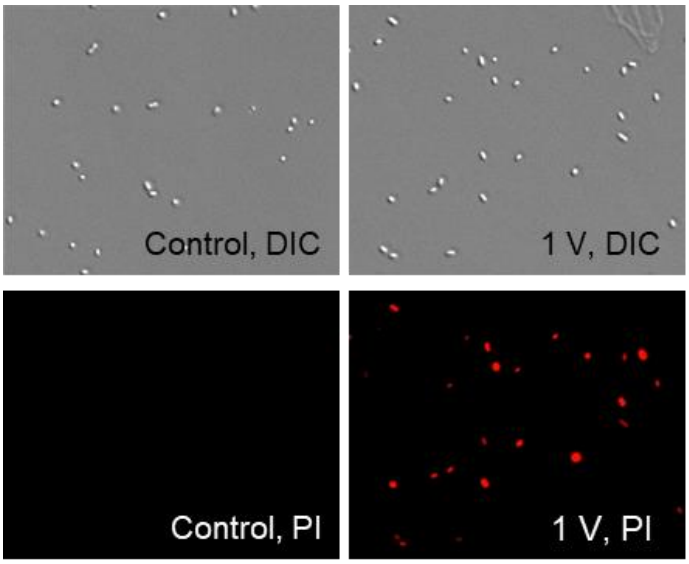

Fig. S7. Images of *E. coli* before (control) and after (1V) treatment using differential interference contrast (DIC) microscopy and fluorescence microscopy after PI staining.

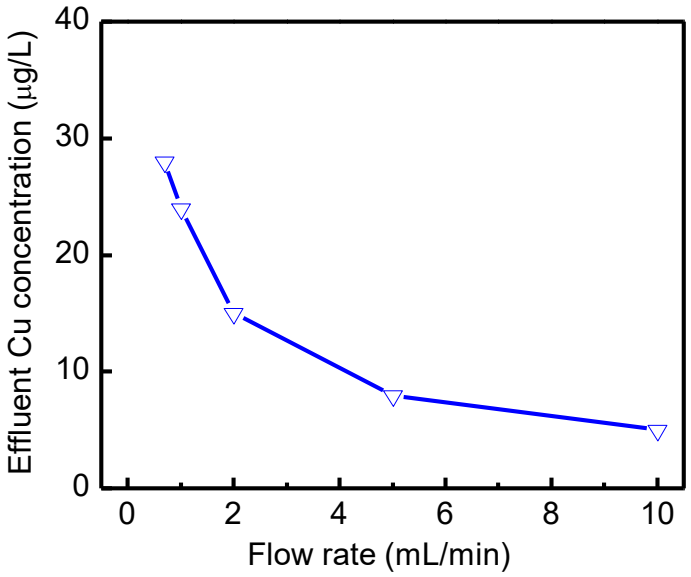

Fig. S8. Effluent Cu concertation of the LEEFT device operating at 1 V.

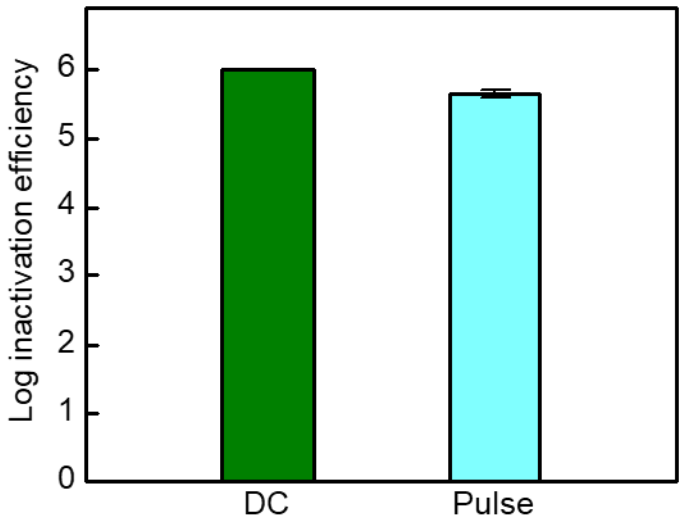

Fig. S9. Inactivation efficiencies of *E. coli* with direct current (DC) and pulse electric field. The peak voltage is 1V and the frequency is 10^5 Hz. The flow rate of the pulse treatment is 0.5 mL/min to remain the same treatment time (10 min).

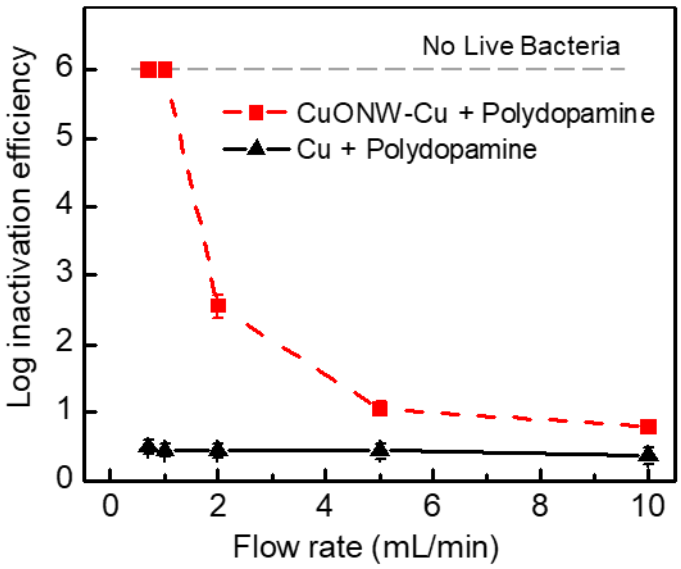

Fig. S10. Inactivation efficiency of *E. coli* using a polydopamine-coated copper wire as the center electrode under 1 V applied voltage.

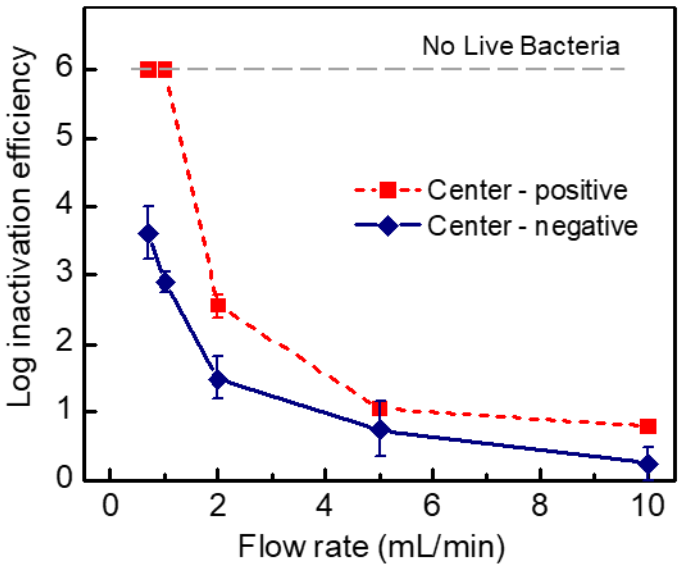

Fig. S11. Inactivation efficiencies of *E. coli* using an inversed electrode connection (center negative and outer positive electrodes). The applied voltage is 1 V.

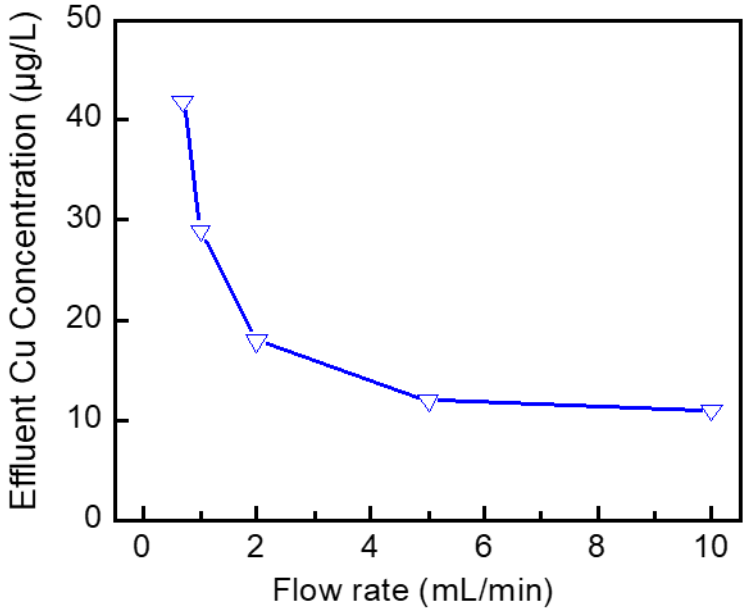

Fig. S12. Effluent Cu concertation of the LEEFT device with inversed current operation.

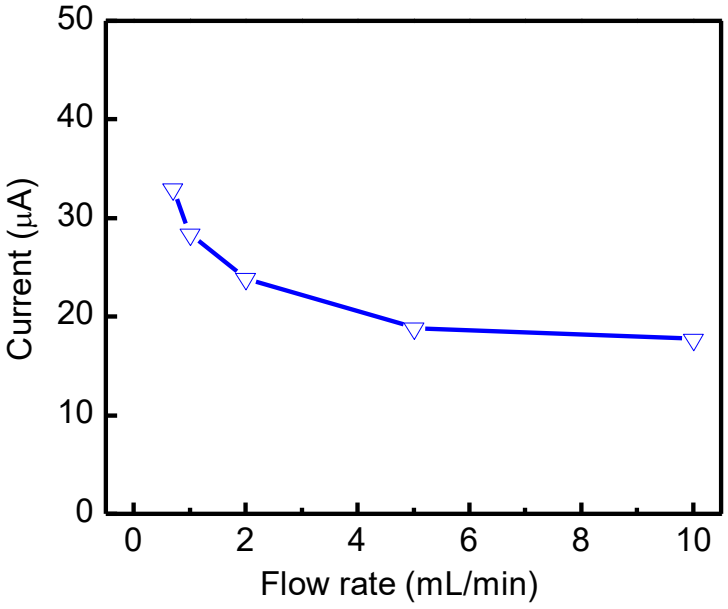

Fig. S13. Operating current of the LEEFT device at 1 V.

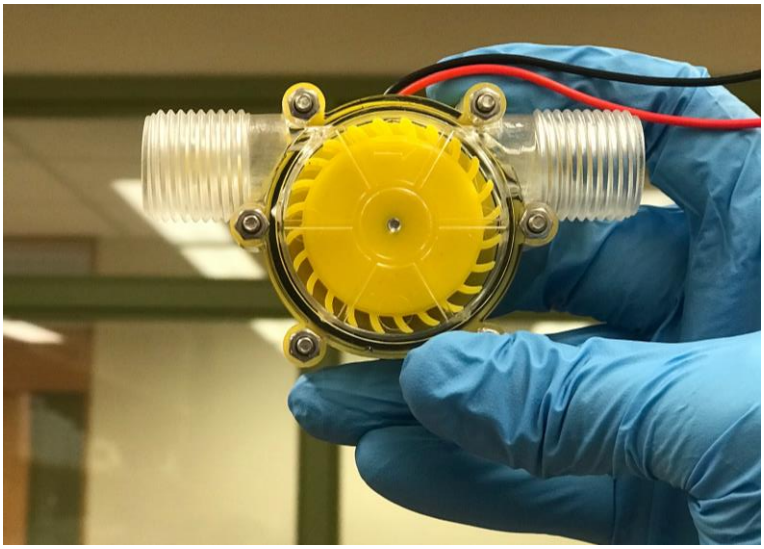

Fig. S14. A turbine electromagnetic generator that can be powered by flowing water.

Supplementary Tables

Table S1. Parameters that used for electric field simulation

Parameter	**Units**	**Value**
Radius of the tube	cm	0.475
Radius of copper wire	μm	38
Length of the nanowire	μm	5
Diameter of the nanowire	nm	30
Electrical conductivity of medium	S/m	5.5E-06
Electric potential	V	1
Vacuum permittivity	F/m	8.85E-12*
Relative Permittivity of medium	1	80*

* Reference: CRC handbook of chemistry and physics, 1988.

Table S2. Energy consumption of the coaxial-electrode LEEFT disinfection

Parameter	**Unit**	**Value**	**Notes**
Applied voltage (U)	V	1	
Average current (I)	μA	23.6	
Flow rate (Q)	mL/min	1	
Unit energy consumption (E)	J/L	1.42	$E = \frac{U \times I}{Q}$

Table S3. Water quality characteristics of the river water

Parameter	**Value**
Water source	Chattahoochee River, GA, USA
Location	33.902N, 84.444W
Sampling date	Dec./2/2018
pH	6.86
Conductivity	61.8 μs/cm