Supporting Information to

Size-controlled synthesis of Cu_2O nanoparticles: size effect on the antibacterial activity and application as photocatalyst for high efficient H_2O_2 evolution

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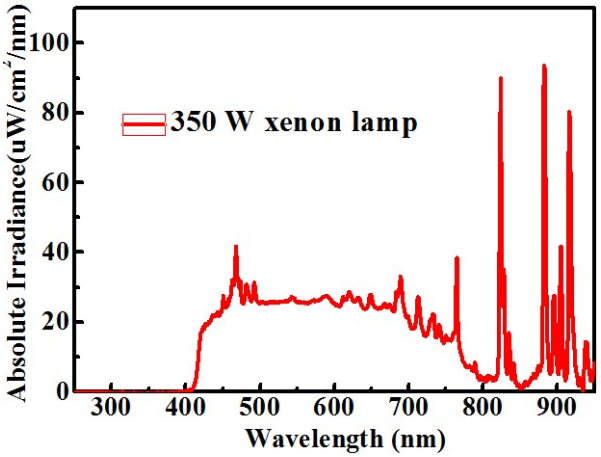

Figure S1. The light spectrum of the Xenon lamp used in irradiation experiments (intensity fixed at 100 mW/cm^2)

Figure S2 The photograph of membrane-separated (or partition) system. The left part is no-Cu_2O cell and the right counterpart is Cu_2O cell. A semipermeable membrane with a molecular weight cutoff of 12000 Da was placed between these two parts and used to separate bacterial cells and the Cu_2O NPs.

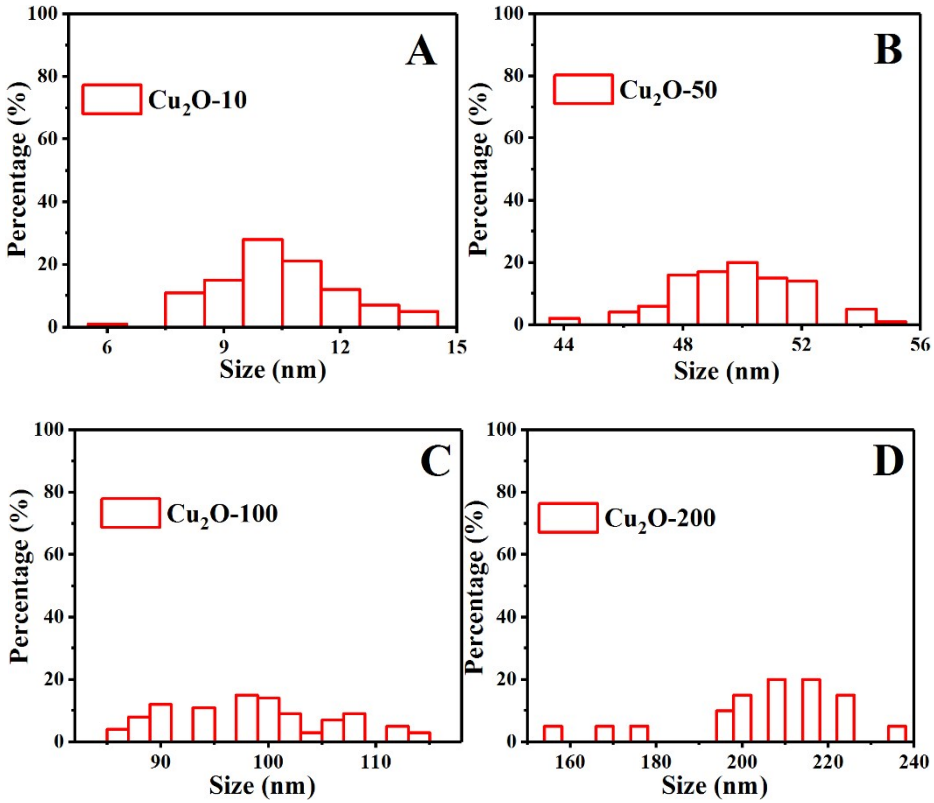

Figure S3 Histograms based on SEM images of Figures 1A-D for Cu_2O NPs prepared with the concentrations of 0.1 (A), 0.6 (B), 1 (C) and 1.2 (D) M, respectively. From Figures S3A-D, the mean sizes of the Cu_2O NPs can be determined as 9.5, 49.7, 95.3 and 200.7 nm, respectively. Thus, the corresponding Cu_2O NPs were named after Cu_2O-10, Cu_2O-50, Cu_2O-100 and Cu_2O-200, respectively.

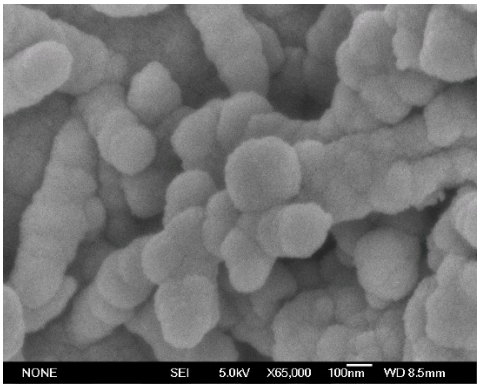

Figure S4 SEM images of Cu_2O NPs prepared with 2 M of Cu(II) ion solution. The concentration of NaOH solution was 5 M.

Table S1 Kinetic parameters δ and p for bacterial inactivation by (a) 20 μg/mL of Cu_2O NPs with different sizes and by (b) Cu_2O-10 with different concentration in dark. R^2, differences between the measured values and the mean of these measured values.

(a) Cu_2O NPs with different sizes

Cu_2O (size, nm)	δ (min)	p	R^2
10	20.7	1.85	1
50	84.9	1.86	0.994
100	106.3	1.89	0.999
200	164.5	2.46	0.998

(b) Cu_2O-10 with different content

Cu_2O (μg/mL)	δ (min)	p	R^2
5	26.65	1.81	0.996
10	22.86	1.81	0.996
20	22.68	1.87	0.992
50	20.31	2.90	0.997
200	5.41	3.22	1

Table S2 Kinetic parameters δ and p for bacterial inactivation by Cu_2O-10 with different content under VL. R^2, differences between the measured values and the mean of these measured values.

[Cu_2O] (μg/mL)	δ (min)	p	R^2
5	26.65	1.81	0.996
10	21.46	1.83	0.997
20	20.41	1.94	0.996
50	19.62	2.92	0.996
200	5.41	3.22	1

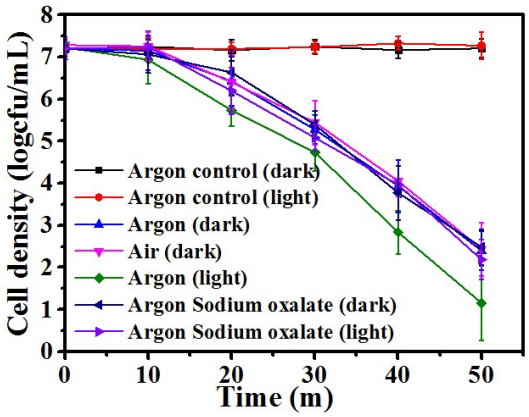

Figure S5 Inactivation efficiency of *E. coli* (2×10^7 cfu/mL, 50 mL) under different conditions as shown in following table.

Conditions	Light	Photocatalyst	Aerobic condition
Argon control (dark)	no	no	no
Argon control (light)	yes	no	no
Argon (dark)	no	yes	no
Air (dark)	no	yes	yes
Argon (light)	yes	yes	no
Argon Sodium oxalate (dark)	no	yes	no
Argon Sodium oxalate (light)	yes	yes	no

Scavenger condition (50 mmol/L sodium oxalate: h^+ scavenger) and aerobic (air aeration) and anaerobic (Ar aeration) conditions by 20 μg/mL of Cu_2O-10 in dark and under VL.

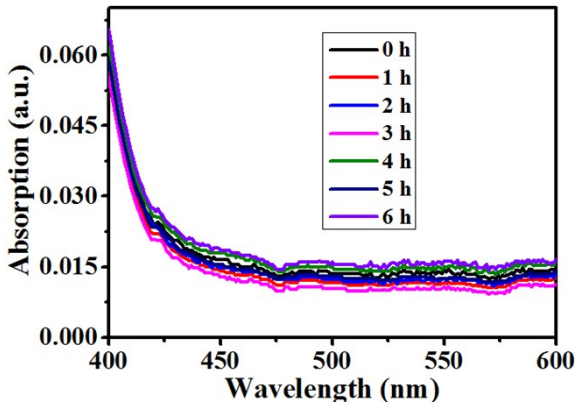

Figure S6 Absorption spectral changes for the filtrate from the suspension with Cu_2O-10 and 1×10^{-4} M XTT at different irradiation times. Superoxide radical ($\bullet O_2^-$) was measured by 2,3-bis(2-methoxy-4-nitro-5-sulfophehyl)-2H-tet-razolium-5-carboxanilide (XTT), which can be reduced by ($\bullet O_2^-$) to form XTT-formazan. The formazan has an absorption spectrum with a peak at 470 nm that can be used to quantify the relative amount of ($\bullet O_2^-$).

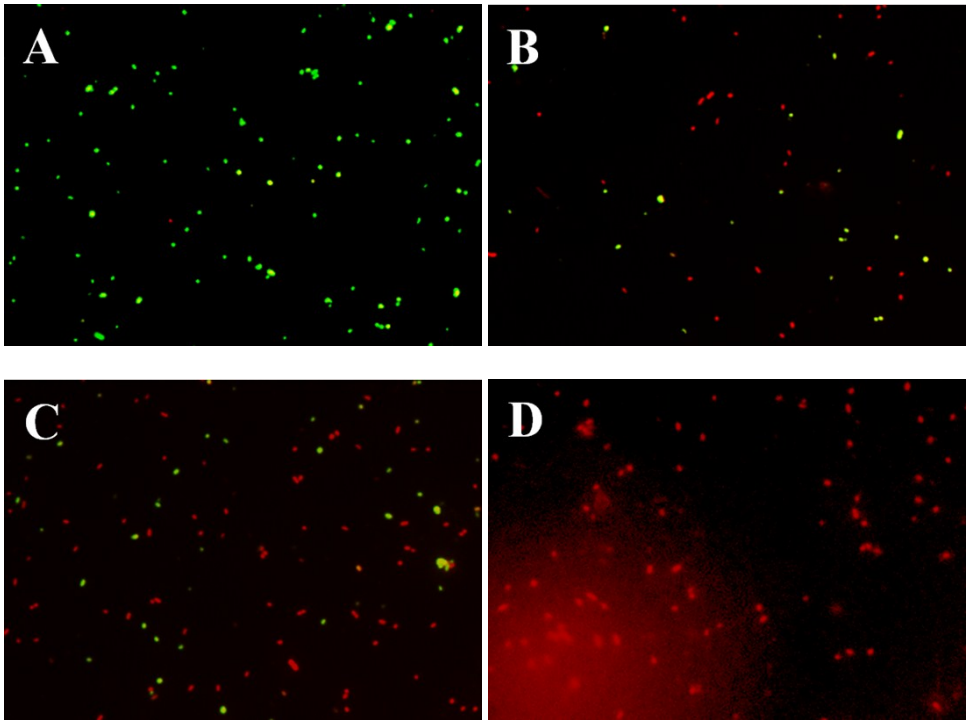

Figure S7 Fluorescence microscopic images of *E. coli* (about 2×10^5 cfu/mL, 50 mL) in no-Cu_2O cell of partition system with (A) 0 h, (B) 3 h, (C) 5 h, and (D) 7 h irradiation.

Figure S7 shows the viable cells with intense green fluorescence. After being treated for 2 h, some cells turned to red fluorescence, indicating some bacteria were cracked and intracellular component was released (Figure S7b). With prolonged irradiation time, fewer living bacterial cells were observed after 4 and 6 h (Figure S7c and d), more red stained intracellular DNA and protein came out, indicating that H_2O_2 in no-Cu_2O cell performed substantial inactivation effect.

Table S3 k, s and R^2 of bacterial inactivation by H_2O_2 in different conditions.

Concentration of H_2O_2 in different condition

H_2O_2	k (h^{-1})	s(h)	R^2
5	0.436	8.83	0.996
50	1.43	7.20	0.983
100	1.93	6.63	0.997
200	2.16	4.59	1
400	4.55	3.94	1
800	7.46	2.46	0.978
no-Cu_2O cell	7.49	2.45	0.986

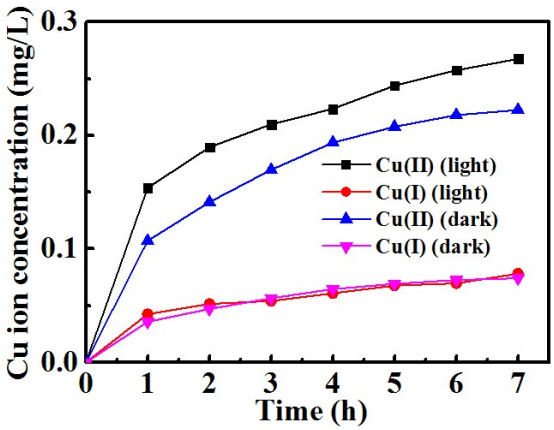

Figure S8 Concentrations of copper ion (leakage from Cu_2O-10, including Cu^{+} and Cu^{2+}) as a function of time when 20 μg/mL Cu_2O-10 under irradiation and dark.