

Supporting information for

Evaluation of Alkyl Chain Length and Photocatalytic Antibacterial Performance of Cation $g\text{-C}_3\text{N}_4$

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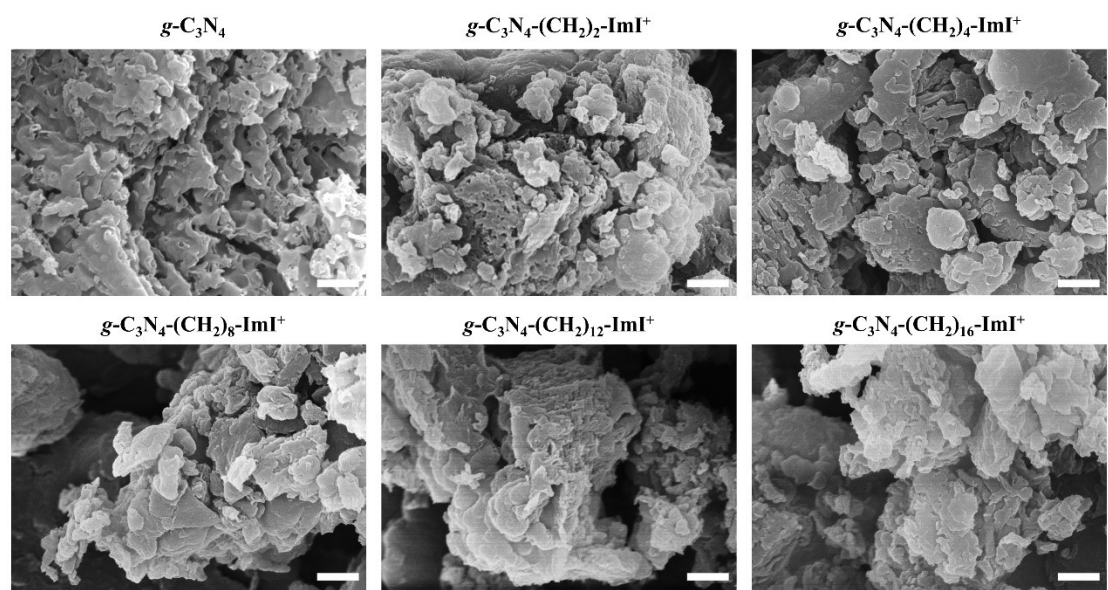


Fig. S1. SEM photos of synthesized carbon materials. Scale bar was 1 μm .

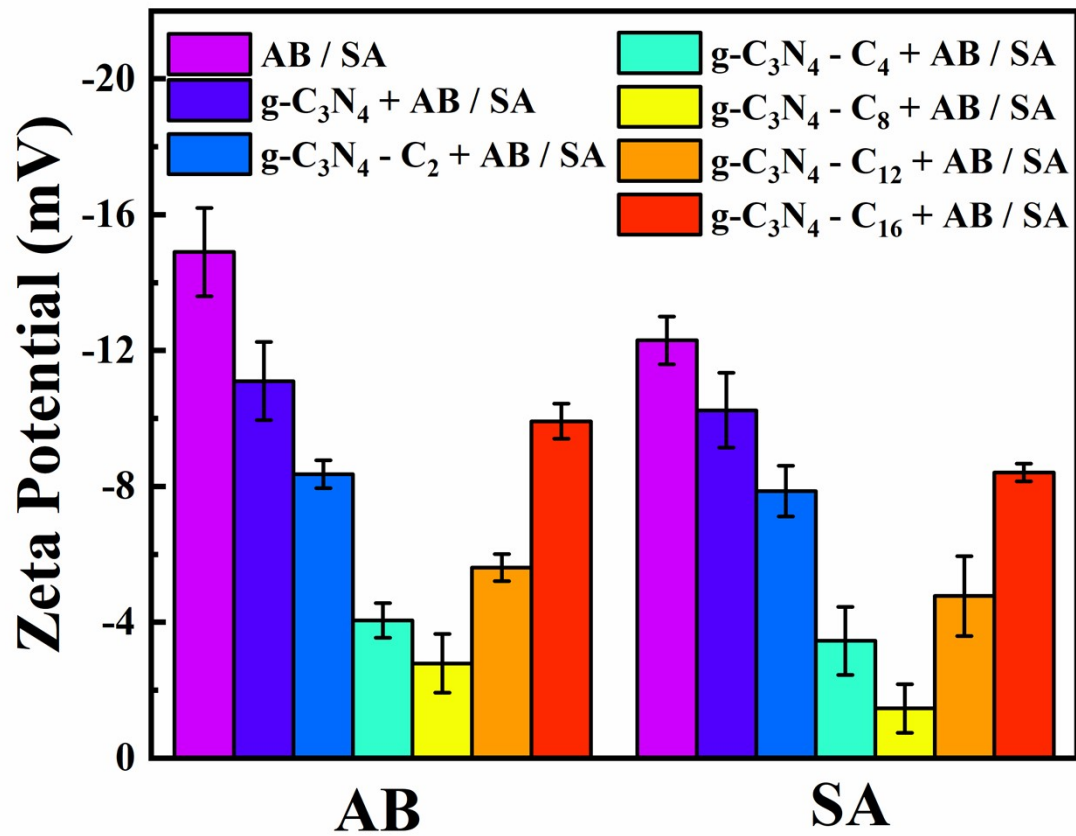


Fig. S2. ζ potential of *A. baumannii* and *S. aureus* incubated with $g-C_3N_4-(CH_2)_n-ImI^+$ ($n = 0, 2, 4, 8, 12$ and 16).

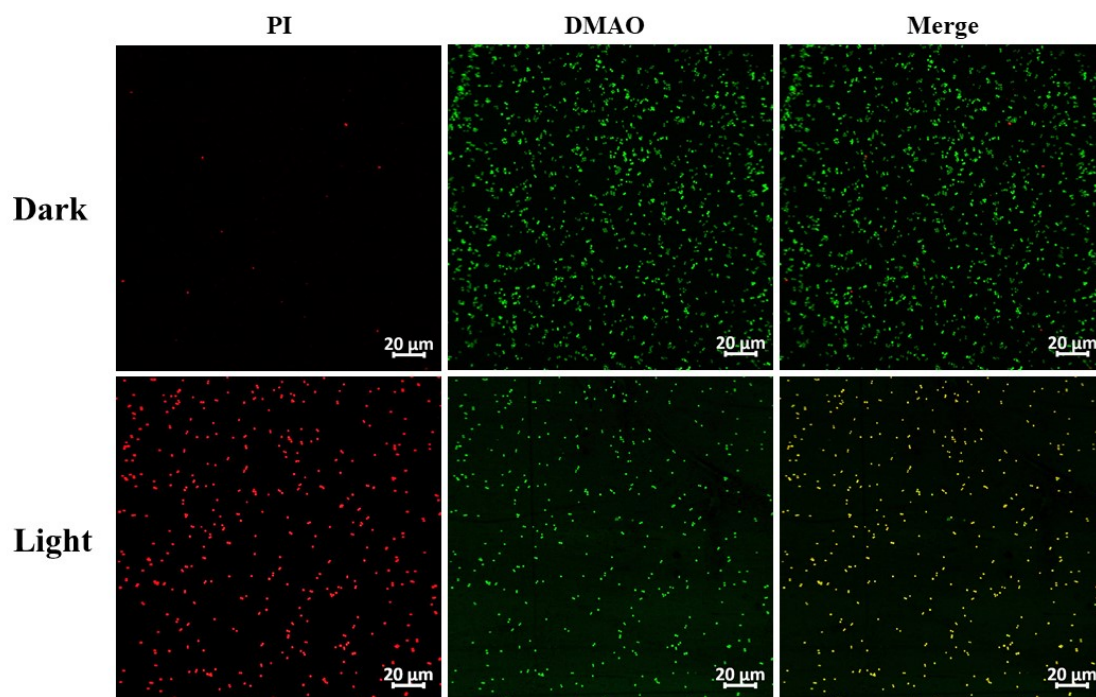


Fig. S3. Fluorescence images of live (DMAO), dead (PI) and merged *S. aureus* cells treated with $g\text{-C}_3\text{N}_4\text{-(CH}_2)_4\text{-ImI}^+$ in dark and under light irradiation. [$g\text{-C}_3\text{N}_4\text{-(CH}_2)_4\text{-ImI}^+$] = 1.0 mg/mL, light intensity was 100 mW/cm², irradiation time was 120 min.

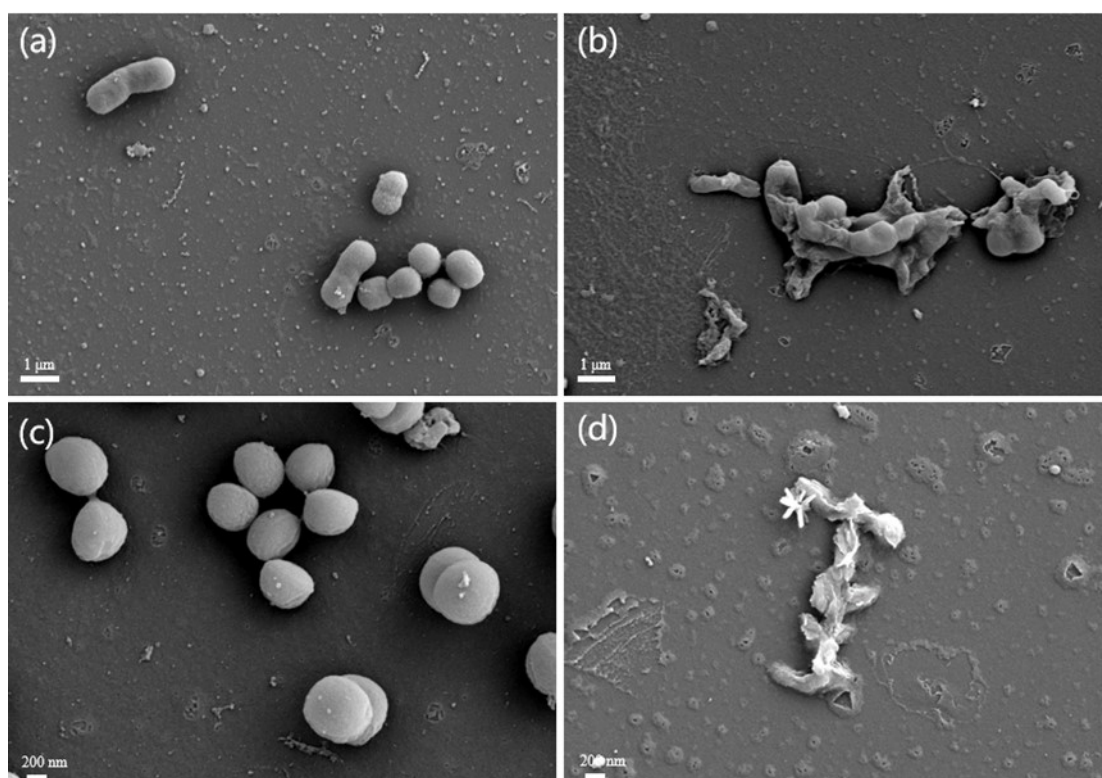


Fig. S4. Photos of MDR *A. baumannii* incubated with $g\text{-C}_3\text{N}_4\text{-(CH}_2)_4\text{-ImI}^+$ in dark (a) and after white light irradiation (b). Photos of *S. aureus* incubated with $g\text{-C}_3\text{N}_4\text{-(CH}_2)_4\text{-ImI}^+$ in dark (c) and after white light irradiation (d). White light intensity was 100 mW/cm^2 , irradiation time was 2 hours.

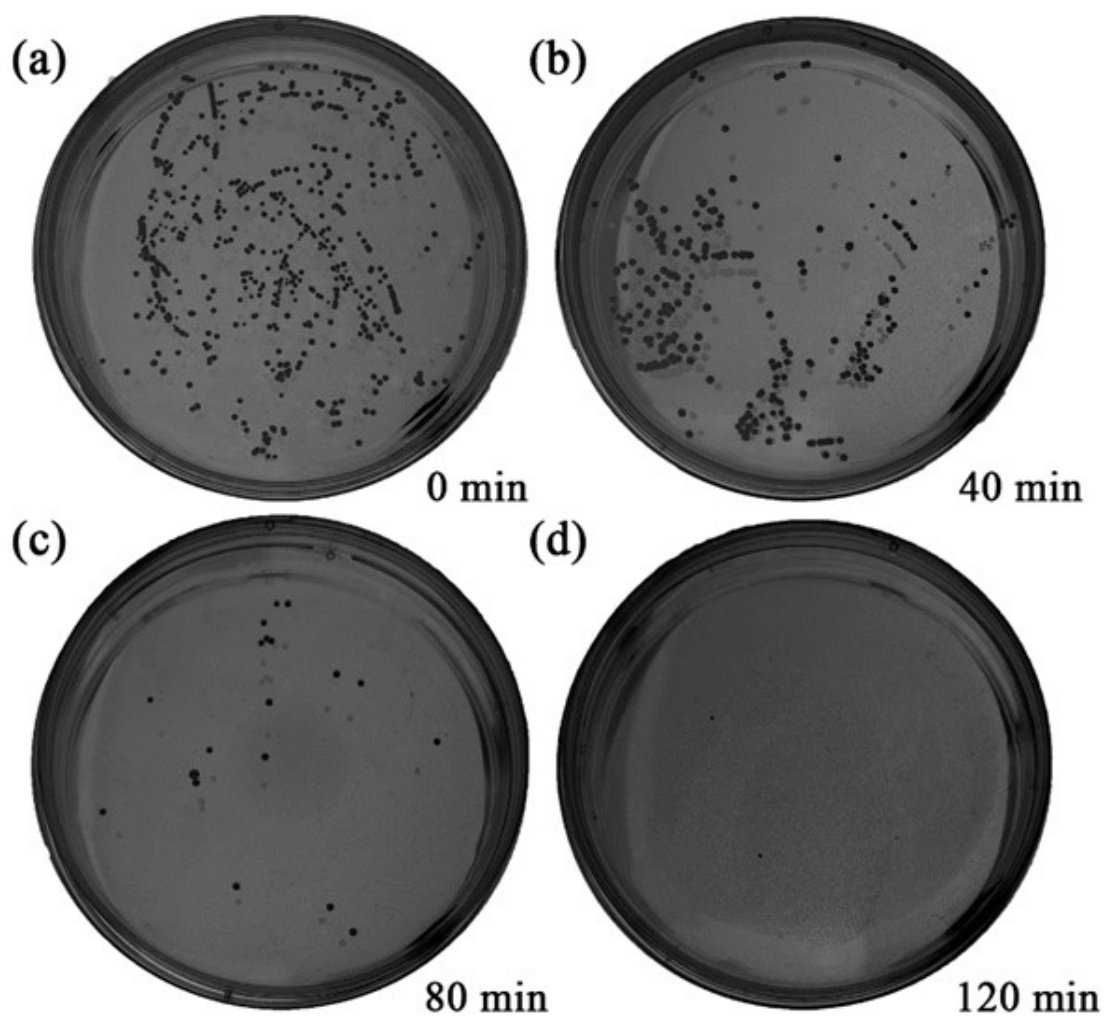


Fig. S5. Time dependent colony photos of *A. baumannii* incubated with $g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_4\text{-ImI}^+$ after light irradiation. [$g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_4\text{-ImI}^+$] = 1.0 mg/mL, white light intensity was 100 mW/cm².

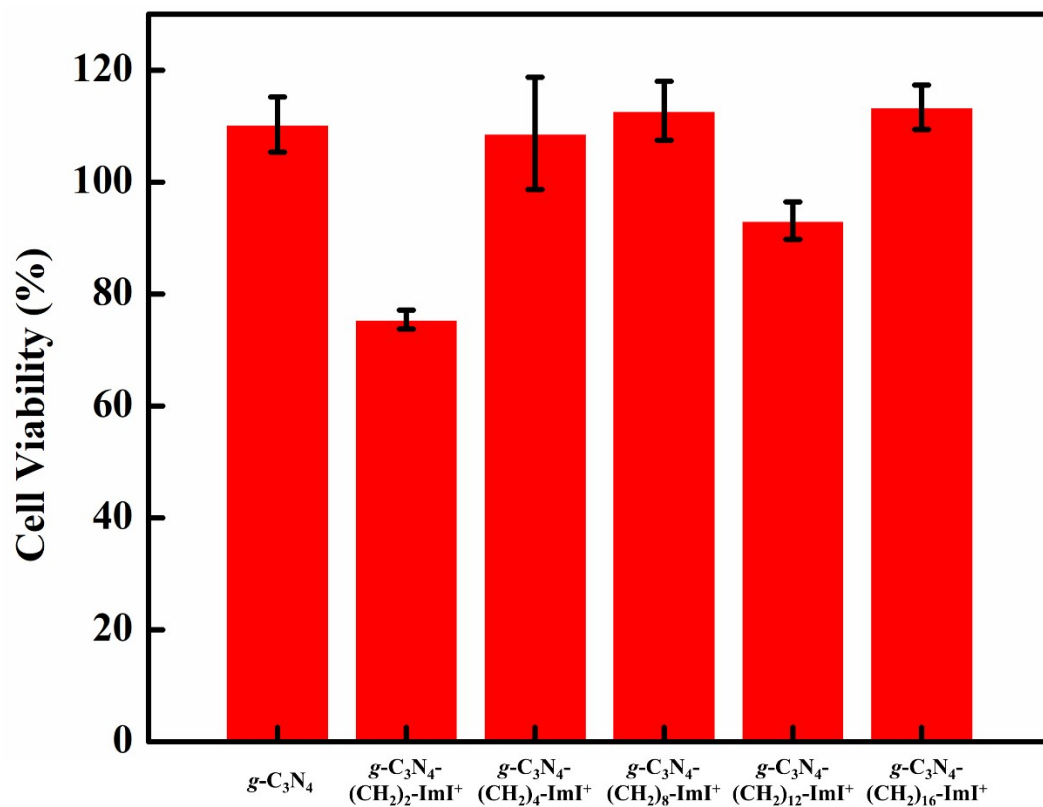


Fig. S6. 24 hours cellular viability of $g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_n\text{-ImI}^+$ in L929 cell line. Concentration of carbon materials was 1 mg/mL.

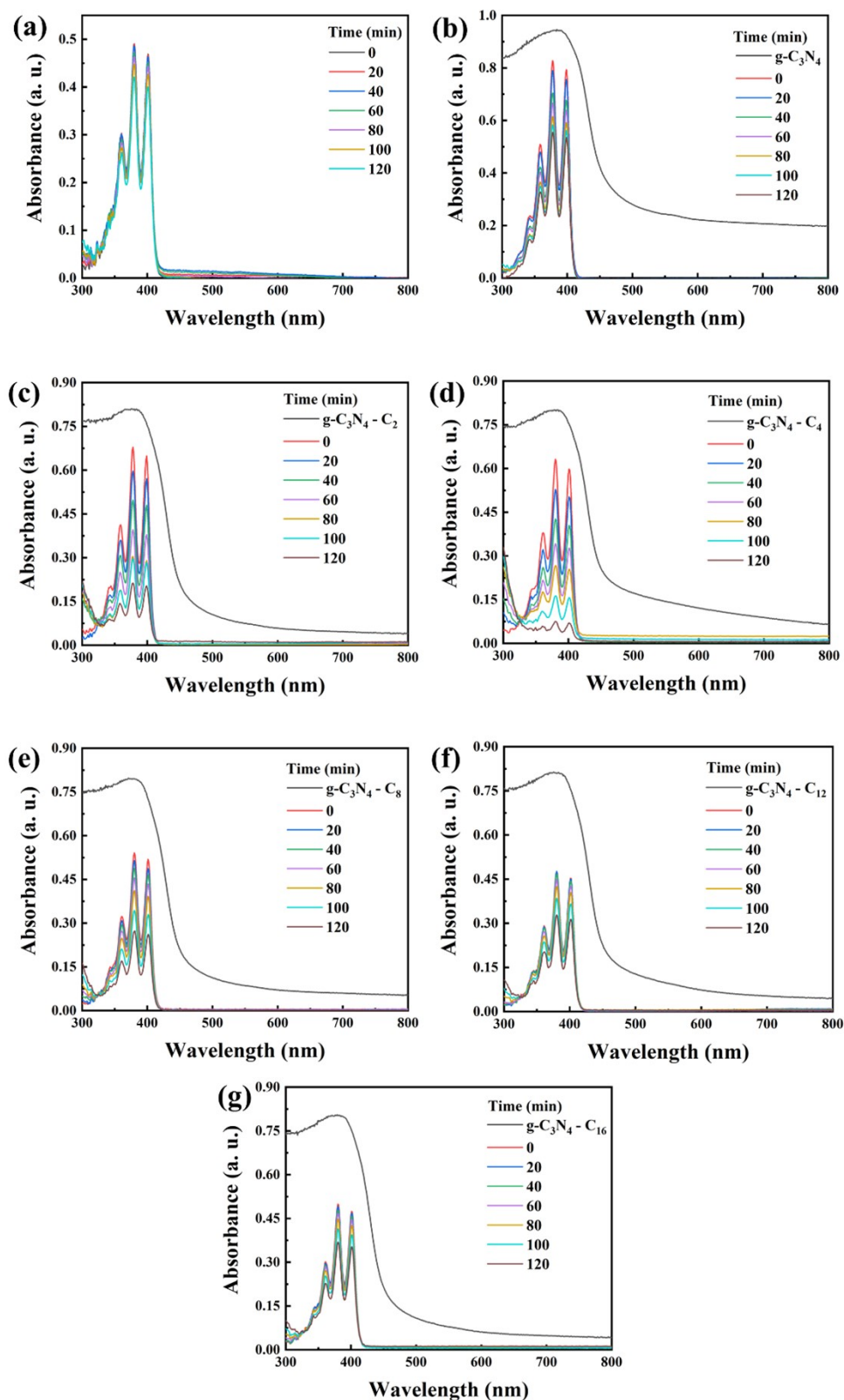


Fig. S7. Absorption spectra of ABDA with and without $g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_n\text{-ImI}^+$ ($n = 0, 2, 4, 8, 12$ and 16) after light irradiation for different time. $[g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_n\text{-ImI}^+] = 1.0$ mg/mL, $[\text{ABDA}] = 50$ μM , white light intensity was 100 mW/cm^2 .

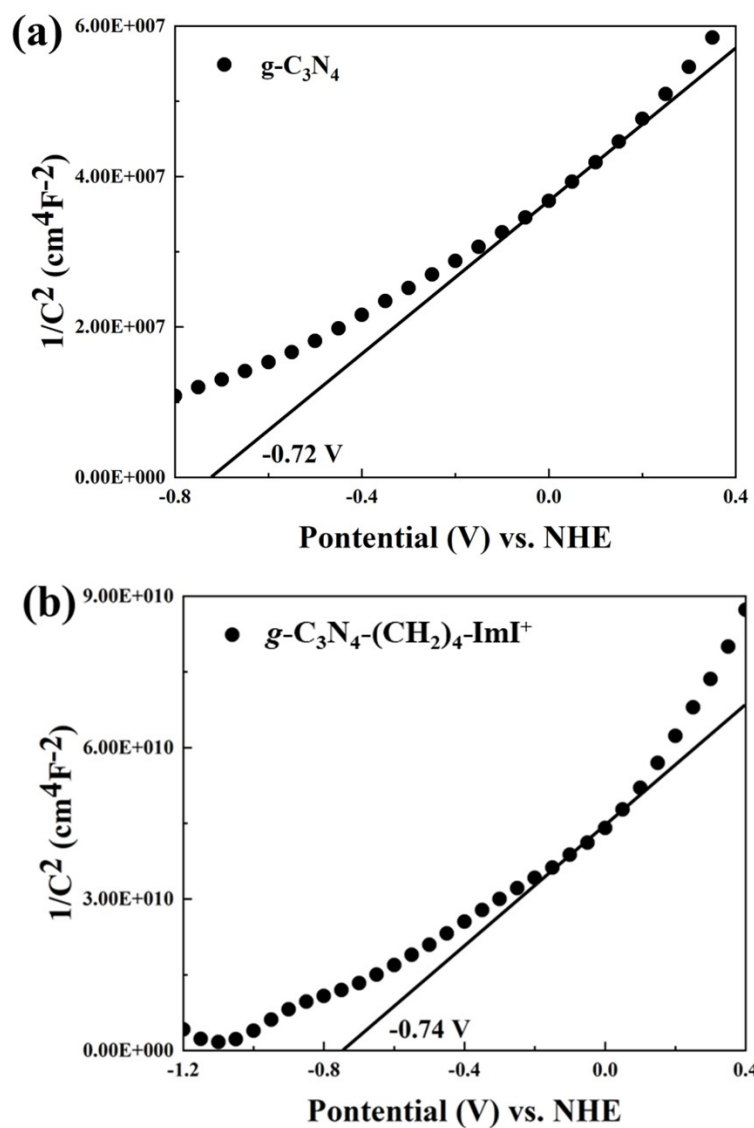


Fig. S8. Mott-Schottky plots of $g\text{-C}_3\text{N}_4$ (a) and $g\text{-C}_3\text{N}_4\text{-(CH}_2)_4\text{-ImI}^+$ (b).

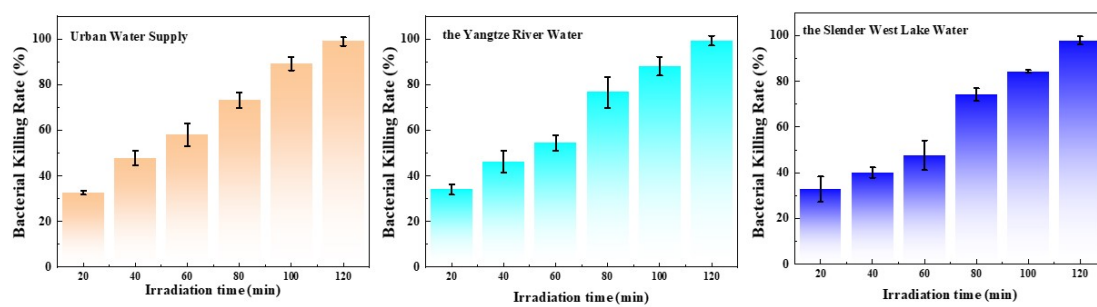


Fig. S8. Time dependent bacterial killing efficiencies of $g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_4\text{-ImI}^+$ towards water supplies after light irradiation. $[g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_4\text{-ImI}^+] = 1.0 \text{ mg/mL}$, white light intensity was 100 mW/cm^2 .

Table S1. Anti-MDR *A. baumannii* and *S. aureus* of ***g*-C₃N₄** and ***g*-C₃N₄-(CH₂)_n-ImI⁺** in dark (n = 2, 4, 8, 12 and 16). [Carbon materials] = 1.0 mg/mL, bacterial density was 1.0×10⁷ CFU/mL, incubation time was 2 hours.

Material	Antibacterial Efficiency in Dark (%)	
	<i>A. baumannii</i>	<i>S. aureus</i>
<i>g</i>-C₃N₄	7.15 ± 3.98	14.02 ± 3.50
<i>g</i>-C₃N₄-(CH₂)₂-ImI⁺	-22.47±3.81	-45.00 ± 7.79
<i>g</i>-C₃N₄-(CH₂)₄-ImI⁺	25.95 ± 1.43	-21.36 ± 4.41
<i>g</i>-C₃N₄-(CH₂)₈-ImI⁺	28.07 ± 3.24	-32.96 ± 3.32
<i>g</i>-C₃N₄-(CH₂)₁₂-ImI⁺	-35.28 ± 6.22	-23.12 ± 3.03
<i>g</i>-C₃N₄-(CH₂)₁₆-ImI⁺	16.38 ± 3.76	-58.05 ± 5.18

Table S2. Photocatalytic anti-MDR *A. baumannii* and *S. aureus* of ***g*-C₃N₄** and ***g*-C₃N₄-(CH₂)_n-ImI⁺** (n = 2, 4, 8, 12 and 16). [Carbon materials] = 1.0 mg/mL, bacterial density was 1.0×10⁷ CFU/mL, light intensity was 100 mW/cm², light irradiation time was 2 hours.

Conditions	Photo-assisted Antibacterial Efficiency (%)	
	<i>A. baumannii</i>	<i>S. aureus</i>
Light	59.32 ± 0.98	57.91 ± 5.16
<i>g</i>-C₃N₄	72.54 ± 3.49	75.92 ± 4.52
<i>g</i>-C₃N₄-(CH₂)₂-ImI⁺	94.59 ± 3.12	93.38 ± 1.61
<i>g</i>-C₃N₄-(CH₂)₄-ImI⁺	99.61 ± 0.12	99.06 ± 0.27
<i>g</i>-C₃N₄-(CH₂)₈-ImI⁺	95.14 ± 2.59	94.41 ± 3.80
<i>g</i>-C₃N₄-(CH₂)₁₂-ImI⁺	89.66 ± 3.15	89.72 ± 2.44
<i>g</i>-C₃N₄-(CH₂)₁₆-ImI⁺	86.52 ± 1.86	85.85 ± 1.28

Table S3 Cell viability of L929 cell line treated with carbon materials.

Carbon materials	Cell viability (%)
<i>g</i> -C ₃ N ₄	110.29 ± 4.93
<i>g</i> -C ₃ N ₄ -(CH ₂) ₂ -ImI ⁺	75.42 ± 1.71
<i>g</i> -C ₃ N ₄ -(CH ₂) ₄ -ImI ⁺	108.68 ± 10.05
<i>g</i> -C ₃ N ₄ -(CH ₂) ₈ -ImI ⁺	112.73 ± 5.27
<i>g</i> -C ₃ N ₄ -(CH ₂) ₁₂ -ImI ⁺	93.10 ± 3.31
<i>g</i> -C ₃ N ₄ -(CH ₂) ₁₆ -ImI ⁺	113.37 ± 3.95

Table S4. Summary of $\bullet\text{OH}$ and $\bullet\text{O}_2^-$ generated amount in the presence of $g\text{-C}_3\text{N}_4$ and $g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_n\text{-ImI}^+$ ($n = 2, 4, 8, 12$ and 16) after white light irradiation. [Carbon materials] = 1.0 mg/mL, light intensity was 100 mW/cm², light irradiation time was 2 hours.

Conditions	Photocatalytic generation of $\bullet\text{OH}$ and $\bullet\text{O}_2^-$ (mmol/L)	
	$\bullet\text{OH}$	$\bullet\text{O}_2^-$
$g\text{-C}_3\text{N}_4$	15.85 ± 2.26	38.00 ± 5.72
$g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_2\text{-ImI}^+$	46.84 ± 0.46	80.80 ± 1.04
$g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_4\text{-ImI}^+$	58.29 ± 2.69	124.80 ± 0.29
$g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_8\text{-ImI}^+$	57.58 ± 0.37	108.80 ± 0.66
$g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_{12}\text{-ImI}^+$	34.16 ± 1.22	61.20 ± 3.16
$g\text{-C}_3\text{N}_4\text{-(CH}_2\text{)}_{16}\text{-ImI}^+$	36.98 ± 2.14	51.60 ± 4.09

Table S5. Photo-assisted time dependent bacterial killing rate of **g-C₃N₄-(CH₂)₄-ImI⁺** towards different water supplies. [Carbon materials] = 1.0 mg/mL, light intensity was 100 mW/cm², light irradiation time was 2 hours.

Time (min)	Photo-assisted Antibacterial Efficiency (%)		
	<i>Urban Water</i>	<i>The Yangtze River</i>	<i>The Slender West Laker</i>
20	32.60 ± 0.94	34.03 ± 2.26%	32.80 ± 5.56
40	47.89 ± 3.17	46.31 ± 4.89	40.11 ± 2.28
60	58.18 ± 4.98	54.52 ± 3.37	47.64 ± 6.44
80	73.20 ± 3.29	76.67 ± 6.79	74.13 ± 2.81
100	89.17 ± 2.88	88.06 ± 4.14	84.27 ± 0.63
120	98.93 ± 1.87	99.26 ± 2.18	97.78 ± 1.77