Supporting Information

Combating Drug-Resistant Bacteria Infection by Biodegradation Nanoparticles Assembled by Comb-Like Polycarbonates Grafted with Amphiphilic Polyquaternium

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Preparation of cyclic carbonate monomer (MTC-Br)

(5-methyl-2-oxo-1,3-dioxane-5-y-l) methyl 2-bromo-2-methyl propanoate (MTC-Br) was synthesized according to our previous work. In brief, 1,1,1-Tris(hydroxymethyl)ethane (25 g) and toluenesulfonic acid monohydrate (500 mg) were dissolved in acetone (150 mL) under stirring 12 h. The solution was concentrated and purified by distillation at reduced pressure. Then the product solution was dissolved in 100 mL DCM and added triethylamine (19 g, 0.17 mol). And then α-bromoisobutyryl bromide (30 g, 0.13 mol) solution in DCM was added to the solution over 30 min. The mixed solution was stirred overnight. The triethylamine salt was filtered out, and the solvent was removed by rotary evaporation. Next add 2 mL concentrated HCl and mixture of MeOH and H_2O (2:1) to the product solution, stirring for 6 hours, and then purified by distillation at reduced pressure. Finally, 24 mL ethyl chloroformate was added to the obtained solution and dissolved in100 mL THF. 35 mL triethylamine was added dropwise to the mixture at 0 ℃ over 30 min. The reaction mixture was stirred for 2 h in ice-bath. The white precipitate was filtered out, and the filtrate was concentrated by rotary evaporation. The concentrated solution was recrystallized thrice from diethyl ether.

Synthesis of polycarbonate macro-initiator (PEG-PMTC-Br)

0.5 g PEG, 0.97 g 1,3-dioxane-2-one, and 0.22 g MTC-Br were added into a Schlenk tube with anhydrous circumstance, followed by dropped in 0.5 μL stannous octoate. The reactant was reacted at 130 ℃ for 12 h. The product was crystallized in ice-diethyl ether.

Table S1. MBC value of G-CgQAs

No.	Polymer	MBC (μg/mL)			
		E.coli	*E.coli*(resis.)	*S.aureus*	Mrsa
1	G-CgQA-1	1000	256	256	500
2	G-CgQA-2	64	64	256	256
3	G-CgQA-3	128	128	128	128

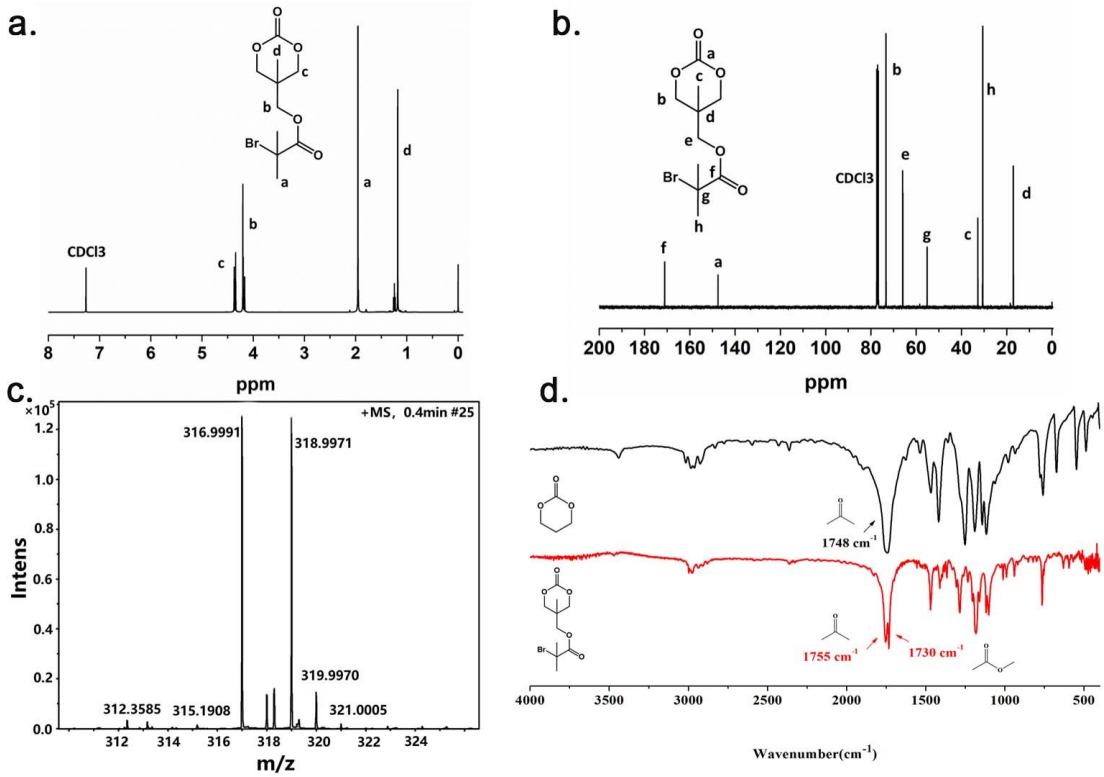

Fig. S1 Characterization of MTC-Br monomer. (a)1H NMR spectra of MTC-Br (b) 13C NMR spectra of MTC-Br (c) Mass spectra of MTC-Br (d) IR of MTC-Br

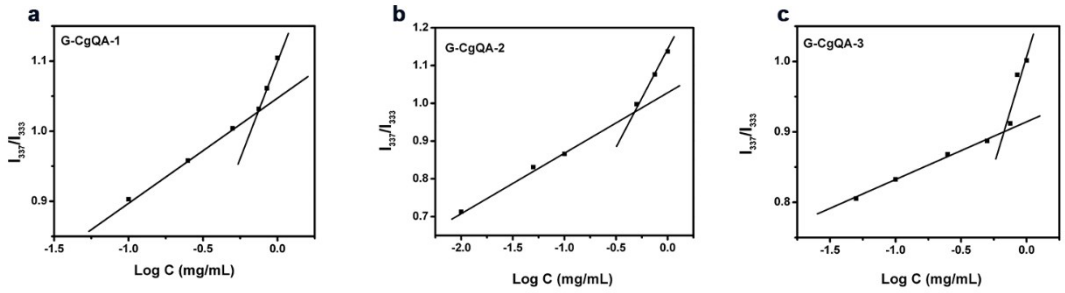

Fig. S2 CMC values of the three G-CgQA NPs. (a) G-CgQA-1 (b) G-CgQA-2 (c) G-CgQA-3.

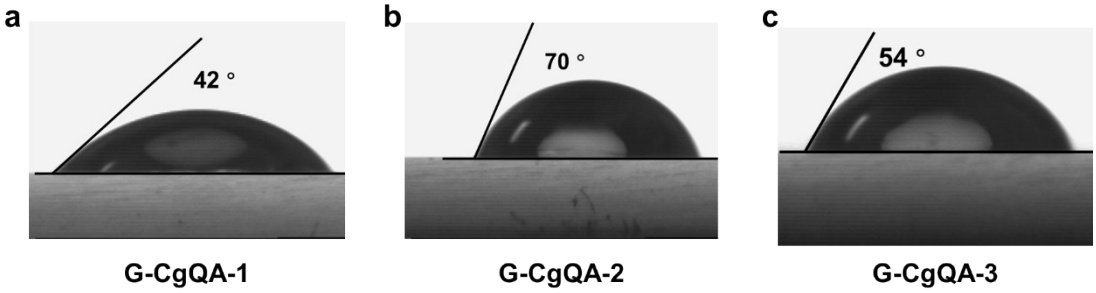

Fig. S3 Contact angle of different cationic polymers. (a) G-CgQA-1; (b) G-CgQA-2; (c) G-CgQA-3.

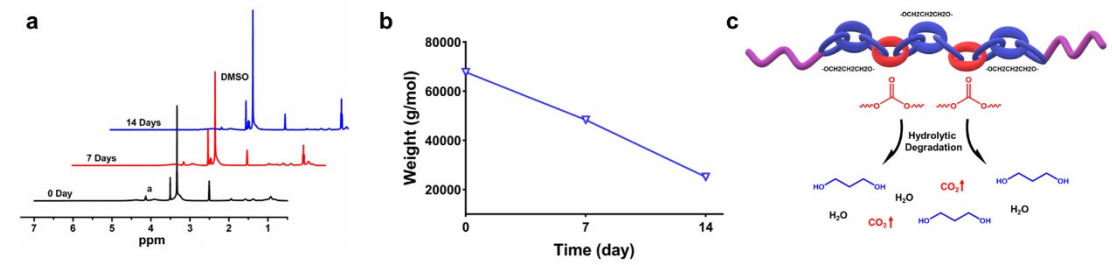

Fig. S4 Degradation of G-CgQA-3. (a) ^{1}H NMR of G-CgQA-3 and (b) Weight of G-CgQA-3 after cultivating in PBS (pH 7.4) 0, 7, and 14 days. (c) Schematic of polycarbonate degradation.

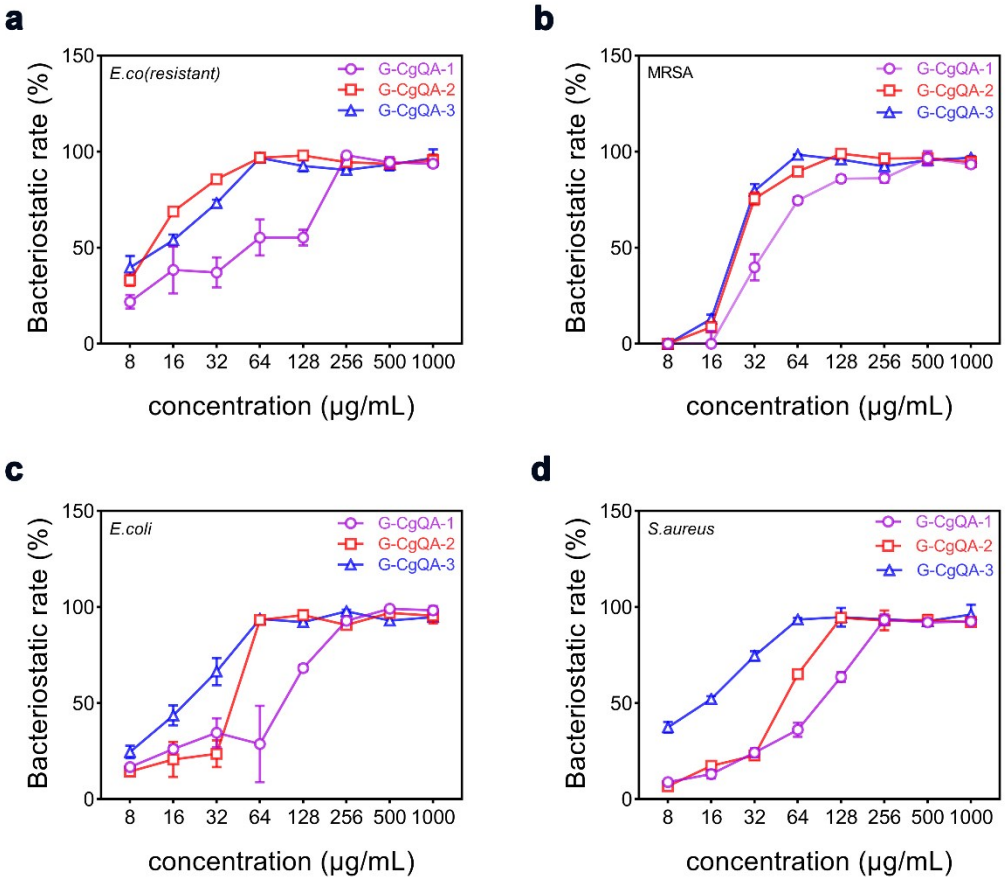

Fig. S5 Minimal inhibit concentration of three types cation polycarbonate. (a) Bacteriostatic rate against *E.coli* (resistant) at different concentration. (b) Bacteriostatic rate against MRSA at different concentration. (c) Bacteriostatic rate against *E.coli* at different concentration. (d) Bacteriostatic rate against *S.aureus* at different concentration.

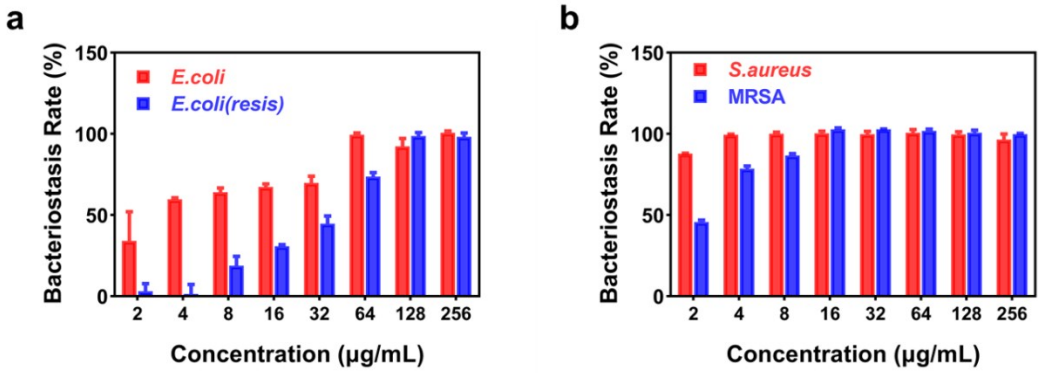

Fig. S6 Minimal inhibit concentration of Fusidic acid (a) *E.coli* and *E.coli* (resis) (b) *S.aureus* and MRSA.

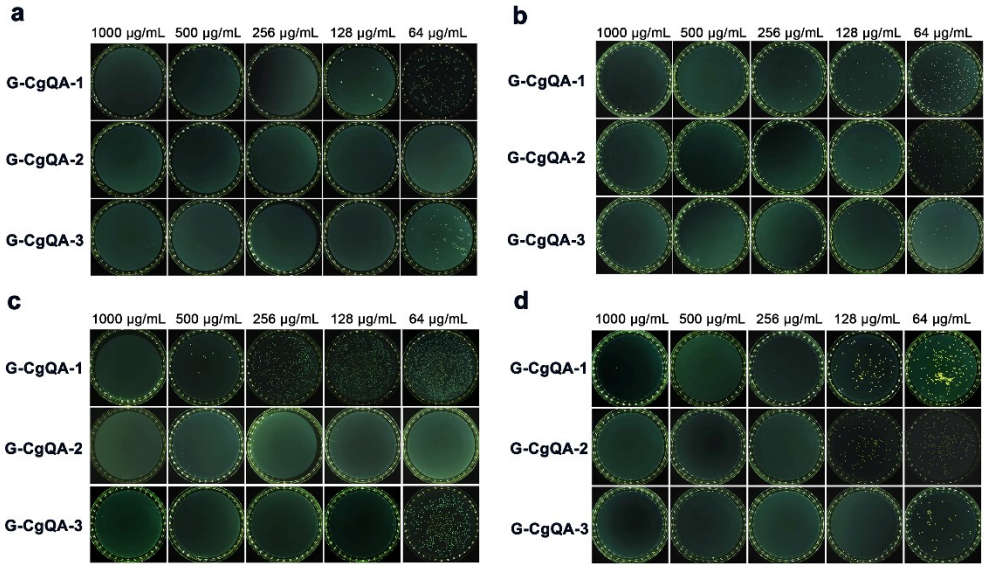

Fig. S7 Minimum bactericidal concentration (MBC) assay of three cation polycarbonate. Optical images of agar plates characteristic of (a) *E.coli*(resistant) (b) Mrsa (c) *E.coli* (d) *S.aureus*

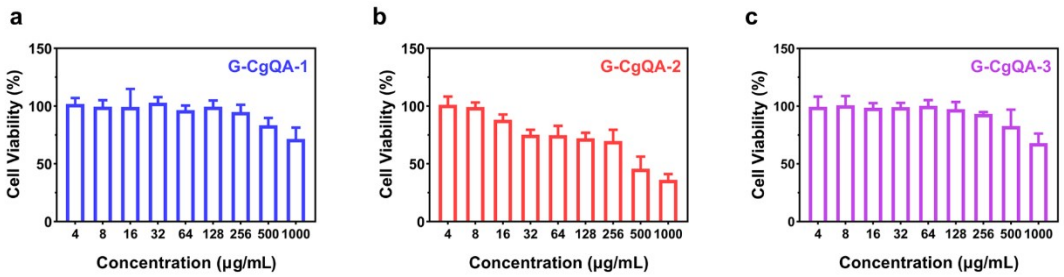

Fig. S8 Cell viabilities of three G-CgQA NPs. (a) G-CgQA-1 (b) G-CgQA-2 (c) G-CgQA-3 NPs.

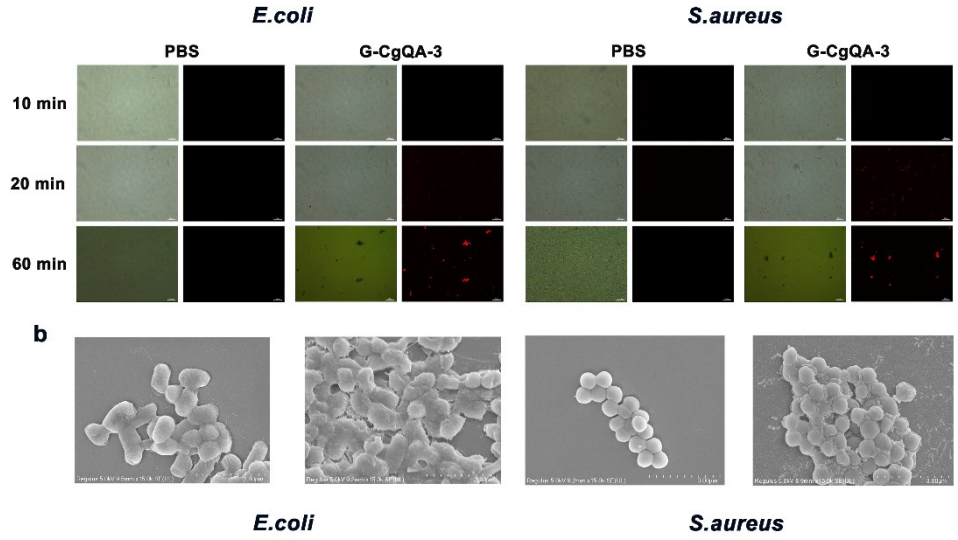

Fig. S9 (a) Invert fluorescence micrographs of *E.coli* and *S.aureus* (b) SEM images of *E.coli* and *S.aureus* before (left) and after (right) 2 h incubation with G-CgQA-3 NPs.

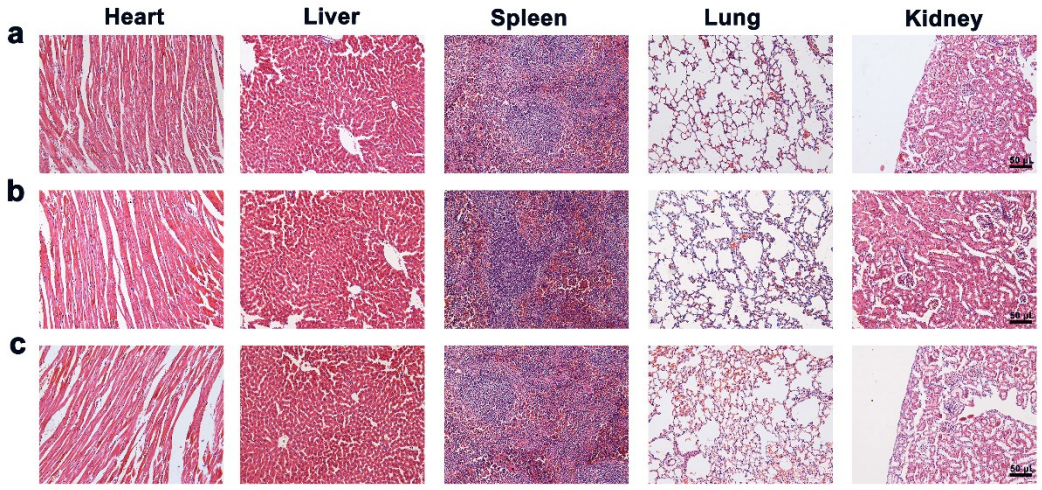

Fig. S10 Histological images of different organs (heart, liver, spleen, lung and kidney) of mice after 4 days treatment of (a) saline, (b) vancomycin (100 μL 120 mg/mL), (c) G-CgQA-3 (100 μL 500 μg/mL).