Supporting Information (SI)

A Novel Antibacterial Gold Nanoparticles Layer with Self-Cleaning Ability by the Production of Bubbles

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Cytotoxicity of p(METAI-co-BA) in solution

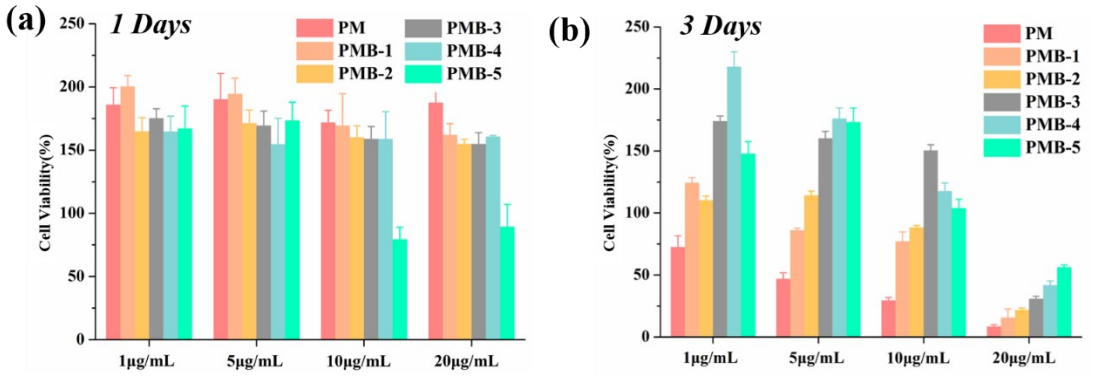

Fig. S1 (a) and (b) show the cell viability of L929 cells cultured with different concentration gradients for 1 d and 3d.

Characterization of GNPL with different topological structures

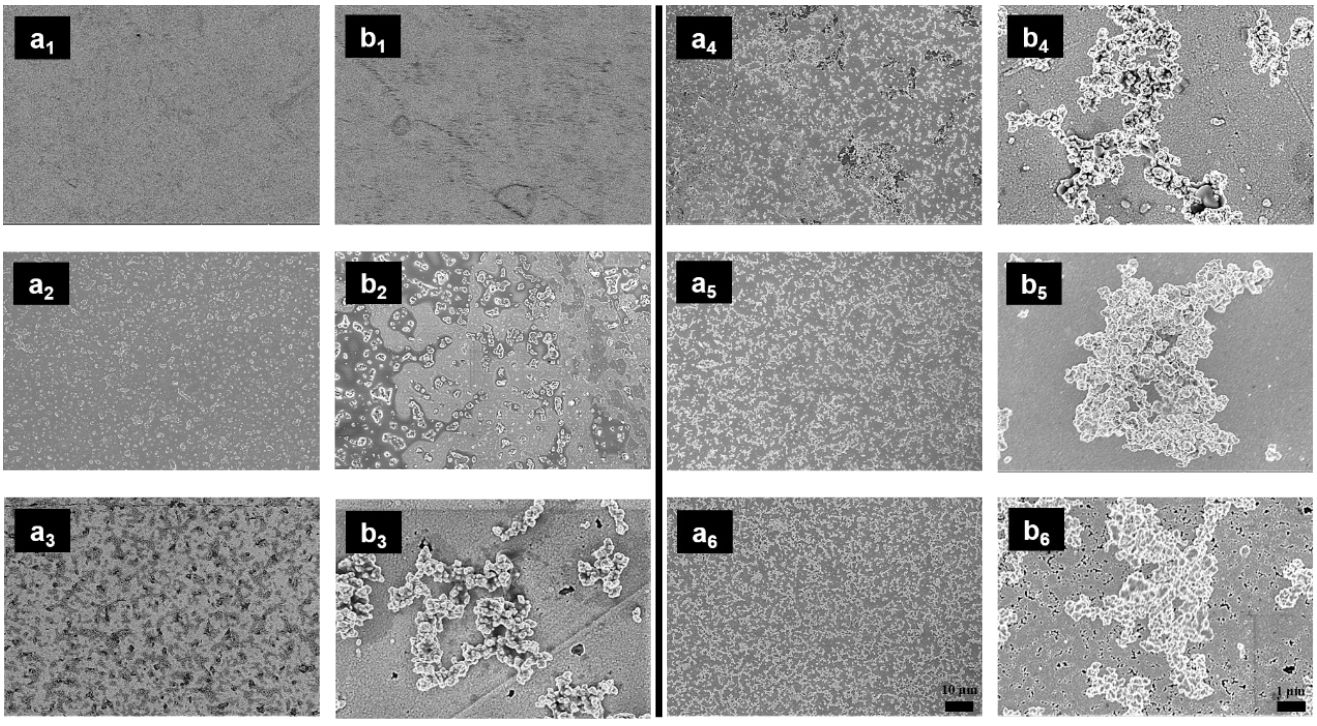

Fig. S2 The topological morphology of GNPL is characterized by SEM. a1-a6 is the change of topological morphology of GNPL surface from undeposited surface to deposited surface with a scale of 10 μm; b1-b6 are magnified observations of the local morphology of GNPL in a small field of view, and the substrate is a gold sheet with a scale of 1 μm.

Modification of p(METAI-co-BA)-SH and CAT on the surface of GNPL

Table S1. Changes of surface elements of GNPL samples with different topological structures in different modification stages.

Surface	Elemental composition (atom%)			
	C	N	O	S
GNPL	74.0	--	26.0	--
GNPL@CAT	62.3	16.6	21.1	--
GNPL1@PMB	73.3	0.9	25.5	0.3
GNPL5@PMB	74.4	3.7	18.0	3.9
GNPL1@PMB-CAT	73.9	1.1	24.6	0.4
GNPL5@PMB-CAT	69.4	7.6	20.4	2.6

Table S2. Density of polymer PMB-4 alone modified on GNPL surface with different topological structures, density of CAT alone modified and density of conjugated CAT after PMB-4 modified.

Sample	Density of PMB-4 (μg/cm^2)	CAT density (μg/cm^2)	Conjugated CAT density (μg/cm^2).
GNPL1	3.3±0.3	16.3±1.4	16.1±0.9
GNPL2	6.5±0.5	25.8±1.9	22.3±1.9
GNPL3	8.2±0.5	32.0±3.3	25.6±2.4
GNPL4	14.7±0.9	34.8±3.1	28.7±2.8
GNPL5	18.0±1.2	38.0±3.4	30.9±3.2

Characterization of the topological morphology of GNPL@PMB-CAT

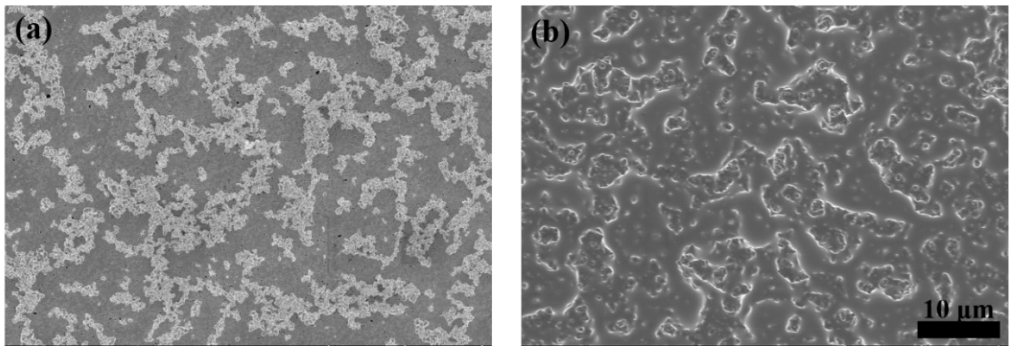

Fig. S3 The topological morphology of different samples was characterized by SEM, (a) GNPL; (b) GNPL@PMB-CAT, the substrate is gold sheet disc, and the scale is 10 μm.

Antibacterial activity results of GNPL@PMB-CAT surface

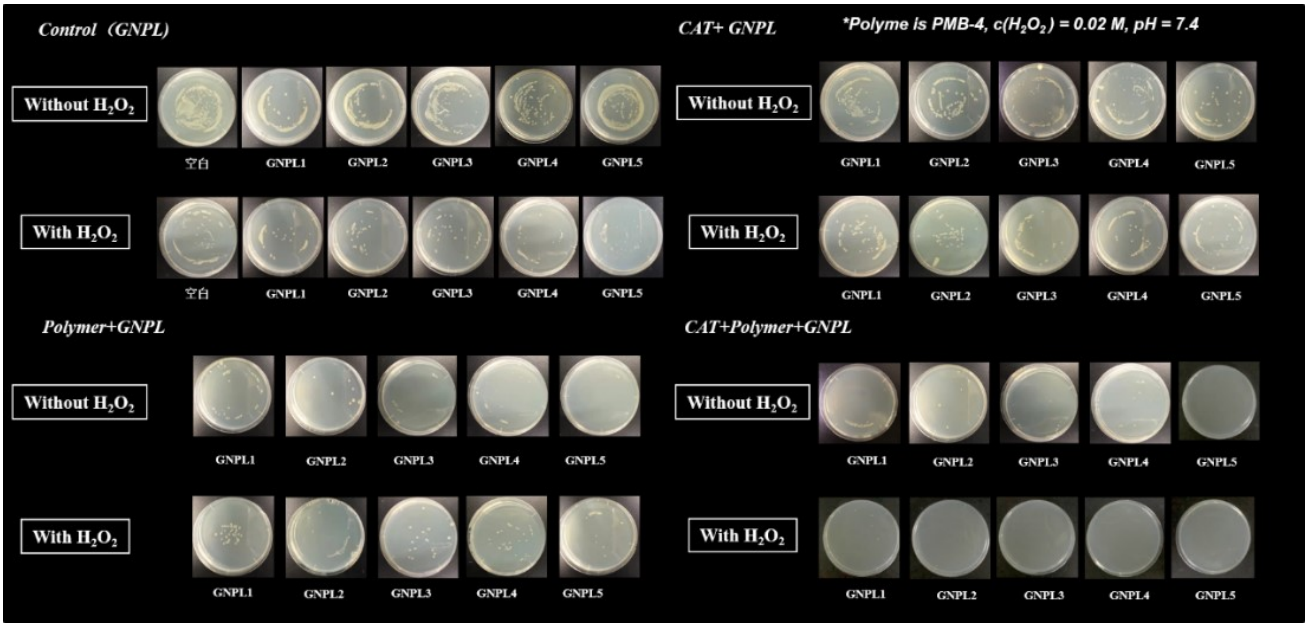

Fig. S4 The plate coating results of *E. coli* incubation on different sample surfaces under normal conditions of *E. coli* (i.e., without exogenous H_2O_2) and simulated exogenous H_2O_2 environment in vitro (i.e., H_2O_2 added).

Antibacterial activity results and bacterial adhesion density of GNPL@PMB-CAT surface

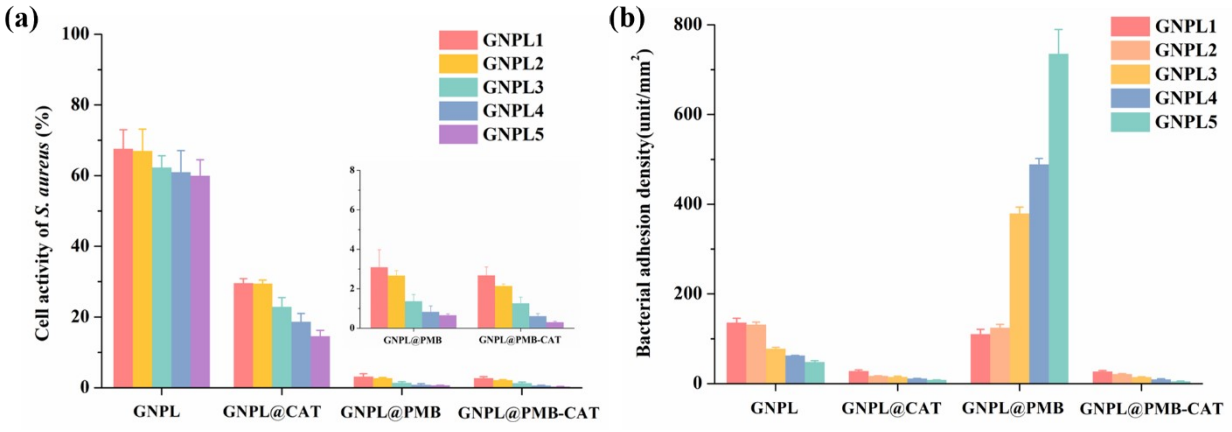

Fig. S5 (a) The activity of *S. aureus* on different sample surfaces under conventional conditions; (b) The adhesion density of *S. aureus* on different sample surfaces under conventional conditions, mean ± SD (n = 3).

Bacterial adhesion on the surface of materials

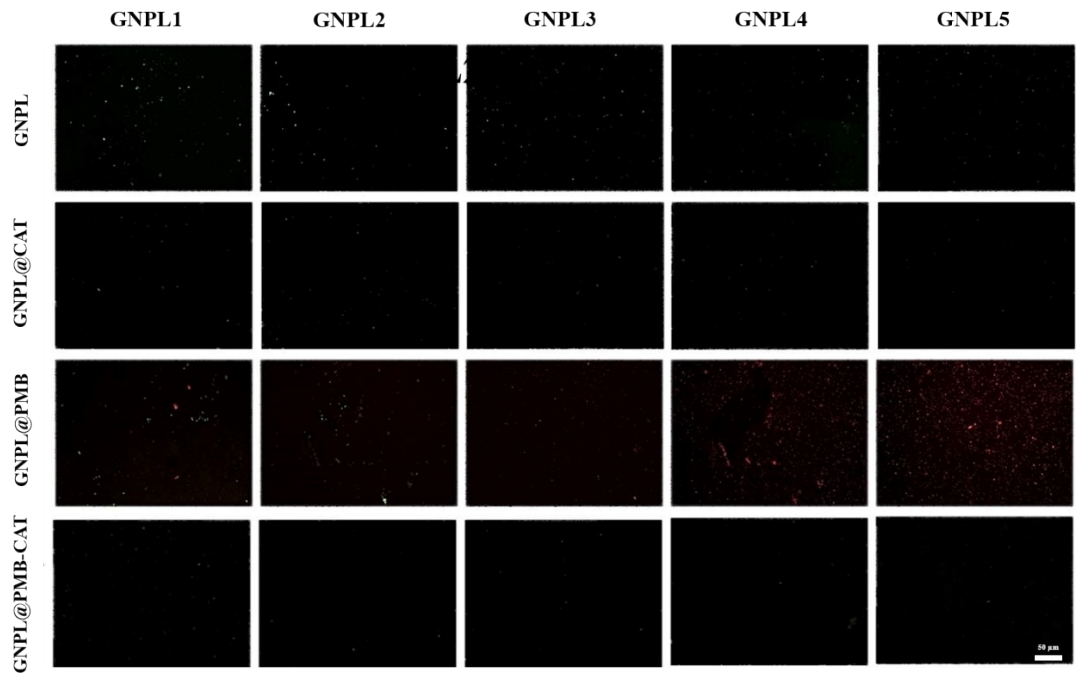

Fig. S6. *E. coli* adhesion on the surface of samples with different topological shapes.

Decomposition of endogenous H_2O_2 in bacteria on the surface of GNPL@PMB-CAT

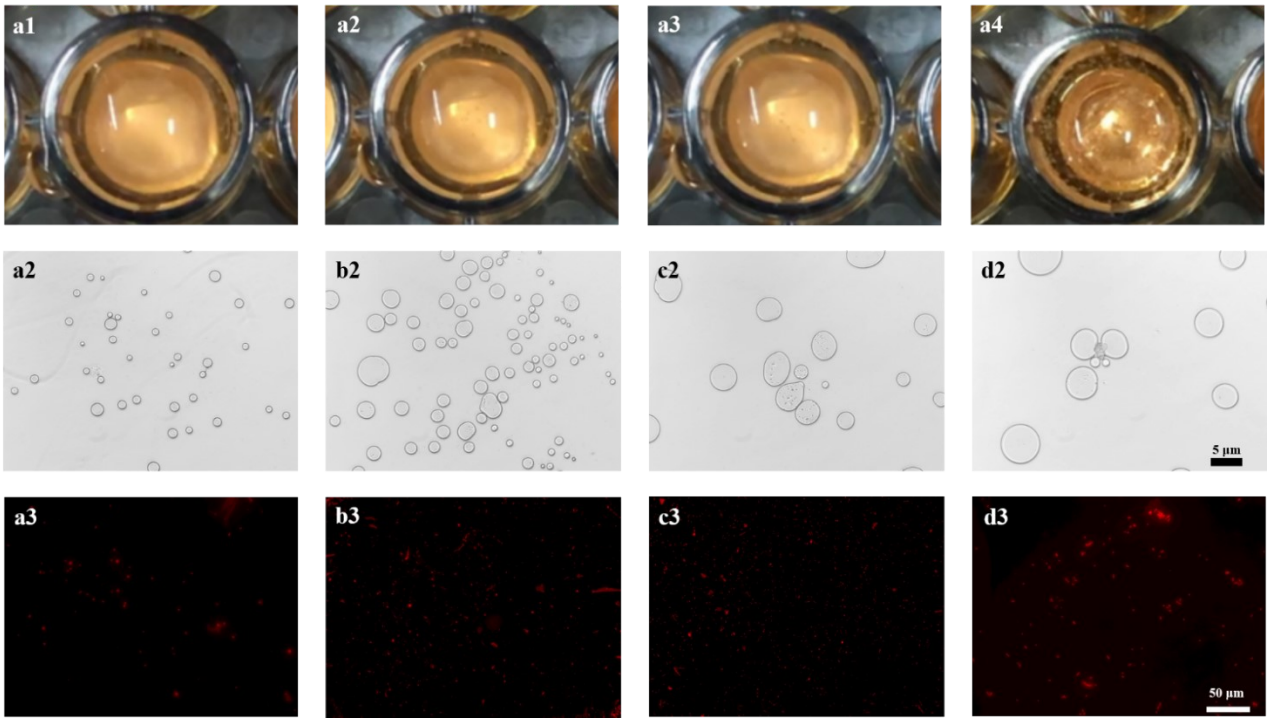

Fig. S7 After incubating the surfaces of different samples with bacteria for a period of time, (1) the suspension on GNPL@PMB-CAT began to produce bubbles' (2) Bubbles and bacteria were observed under bright-field microscope; (3) Dead bacteria were observed in the corresponding bacterial suspension. (a-30 min; b-1 h; c-2 h; d-3 h)

Dissolved oxygen test

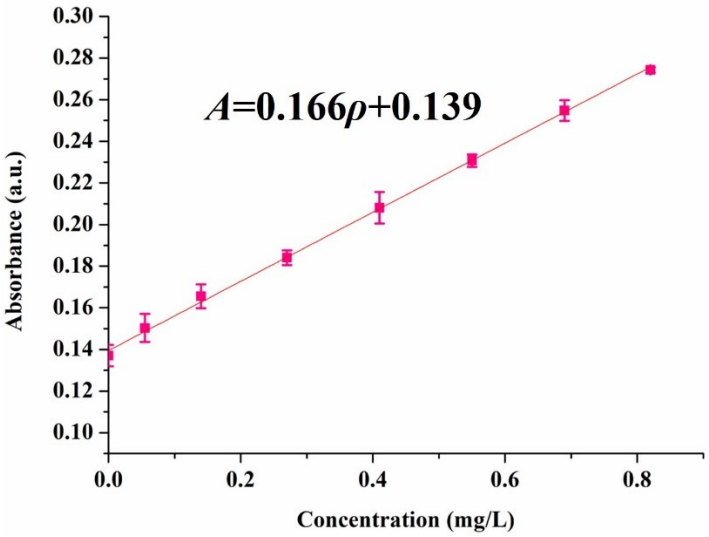

Fig. S8 The standard curve for the dissolved oxygen.

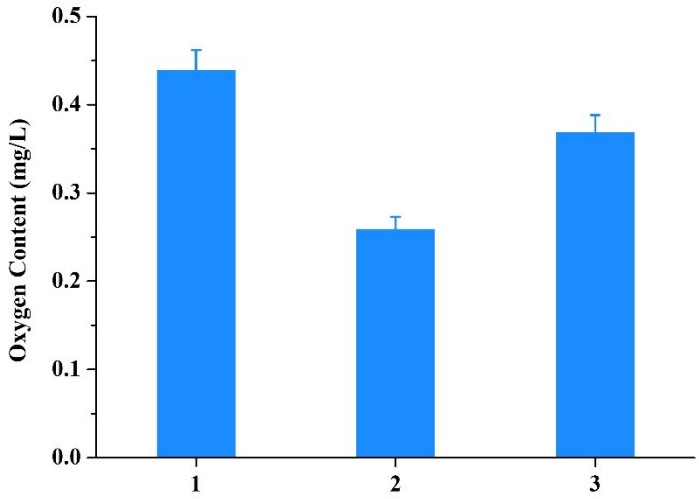

Fig. S9 Oxygen content released from the sample and dissolved in the solution.

Antibacterial mechanism of GNPL@PMB-CAT surface

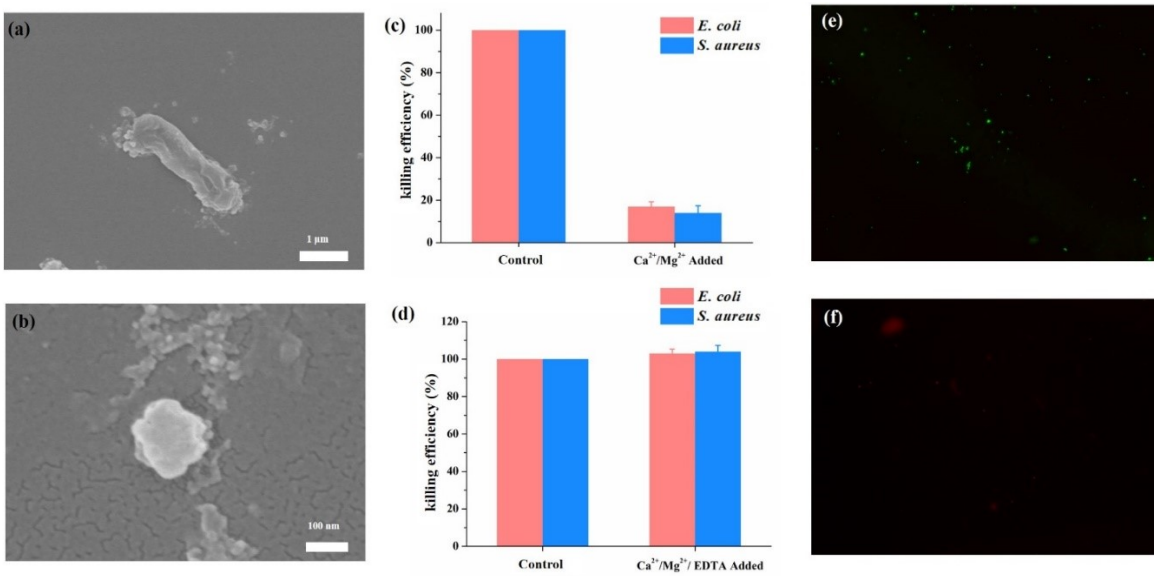

Fig. S10 (a), (b) show the death state of the bacteria characterized by SEM. (c) shows the bacterial killing efficiency when adding Ca^{2+} ions (20 mM) and Mg^{2+} (35 mM) ions to inhibit PMB. (d) shows the bacterial killing efficiency when adding EDTA (20 mM) to chelate the Ca^{2+} and Mg^{2+} ions.

(e) and (f) show the typical adhesion state of *E. coli* on the surface of GNPL5@PMB-CAT.

Self-cleaning of GNPL@PMB-CAT surface assisted by exogenous reactive oxygen species

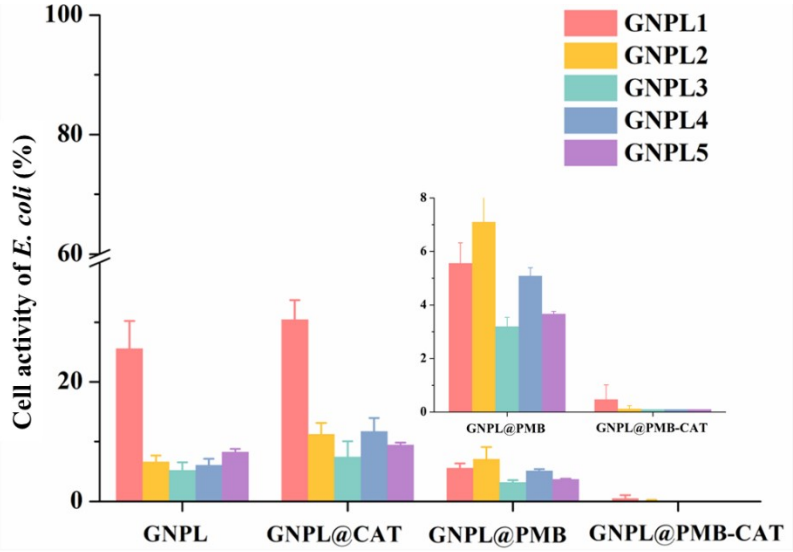

Fig. S11 Simulating the activity of *E. coli* on the surface of different samples in vitro in the presence of exogenous H_2O_2 (i.e. adding H_2O_2).