

Supplementary Information

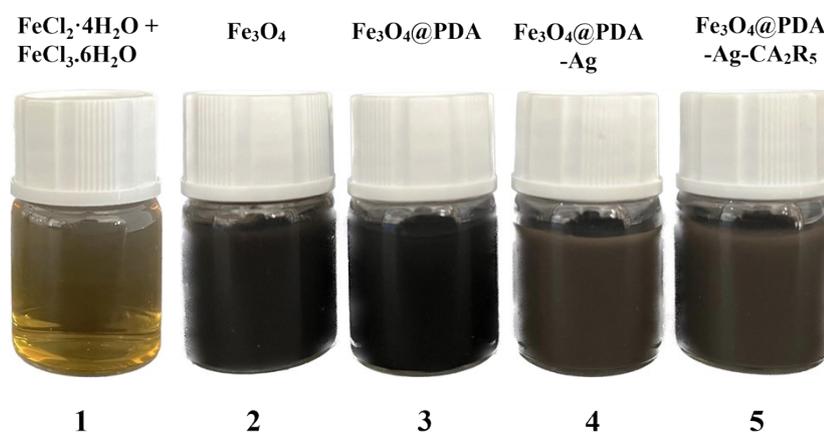


Fig. S1. The images of Fe_3O_4 , $\text{Fe}_3\text{O}_4@\text{PDA}$, $\text{Fe}_3\text{O}_4@\text{PDA}-\text{Ag}$, and $\text{Fe}_3\text{O}_4@\text{PDA}-\text{Ag}-\text{CA}_2\text{R}_5$ nanocomposites.

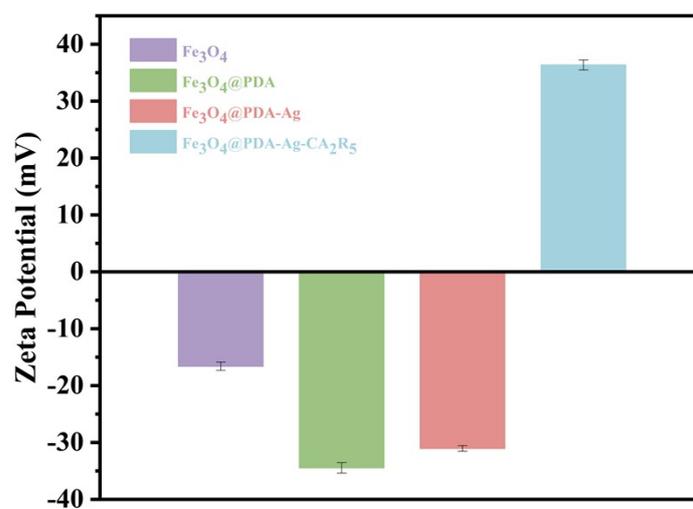


Fig. S2. Zeta potential of Fe_3O_4 , $\text{Fe}_3\text{O}_4@\text{PDA}$, $\text{Fe}_3\text{O}_4@\text{PDA}-\text{Ag}$, and $\text{Fe}_3\text{O}_4@\text{PDA}-\text{Ag}-\text{CA}_2\text{R}_5$ nanocomposites.

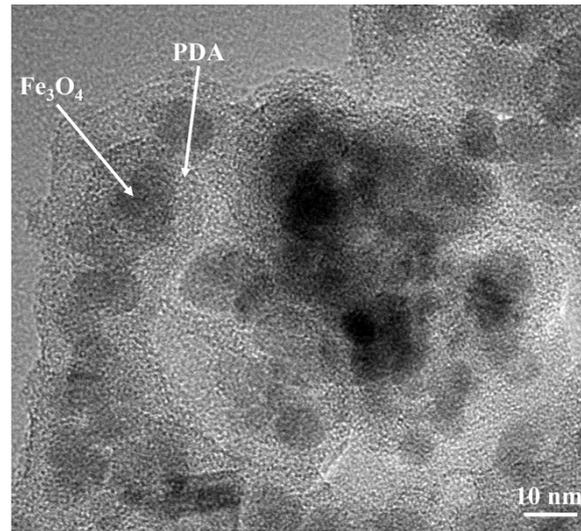


Fig. S3. TEM images of $\text{Fe}_3\text{O}_4@$ PDA nanocomposites.

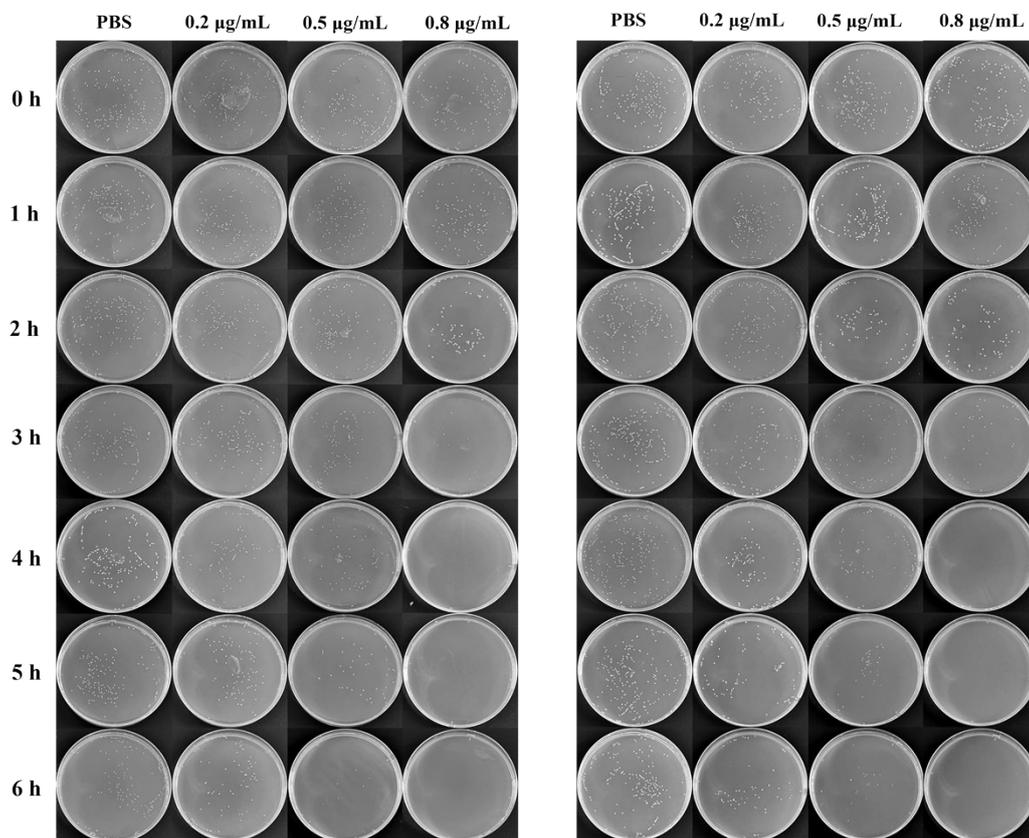


Fig. S4. The colonies on *S. aureus* (A) and *E. coli* (B) treated with $\text{Fe}_3\text{O}_4@$ PDA-Ag- CA_2R_5 nanocomposites with 0.2, 0.5, 0.8 $\mu\text{g/mL}$ Ag with the increased time. The bacteria were incubated for 0, 1, 2, 3, 4, 5, and 6 h with $\text{Fe}_3\text{O}_4@$ PDA-Ag- CA_2R_5 nanocomposites, respectively.

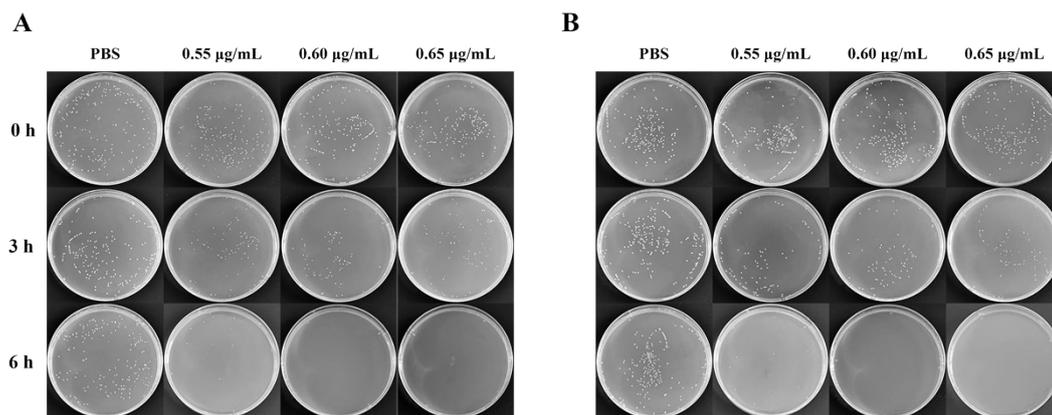


Fig. S5. The colonies on *S. aureus* (A) and *E. coli* (B) treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites with 0.55, 0.60, 0.65 µg/mL Ag with the increased time. The bacteria were incubated for 0, 3, and 6 h with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites, respectively.

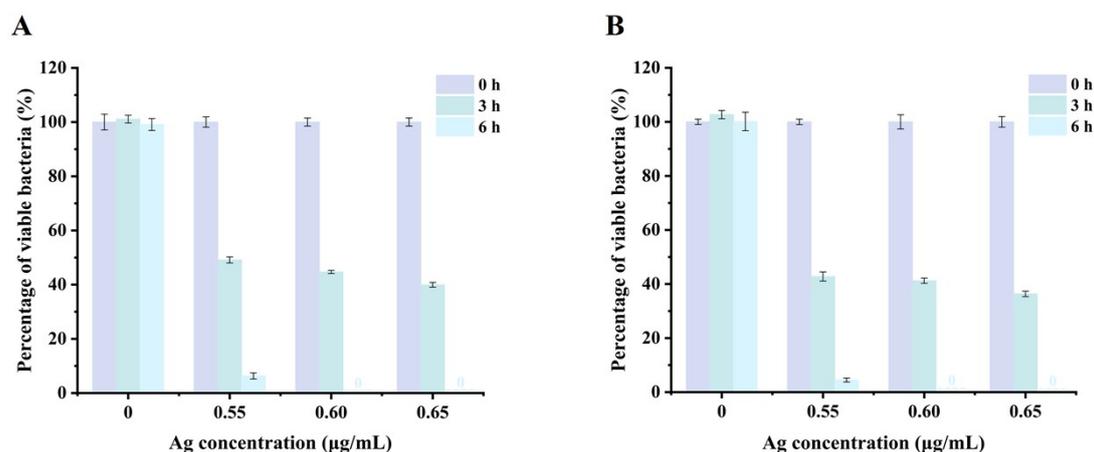


Fig. S6. The time-dependent effect of $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites with different concentrations (0.55, 0.60, and 0.65 µg/mL Ag) to the growth of *S. aureus* (A) and *E. coli* (B). The bacteria were incubated for 0, 3, and 6 h with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites, respectively. The survival of the bacteria was determined by calculating the number of the bacterial colony.

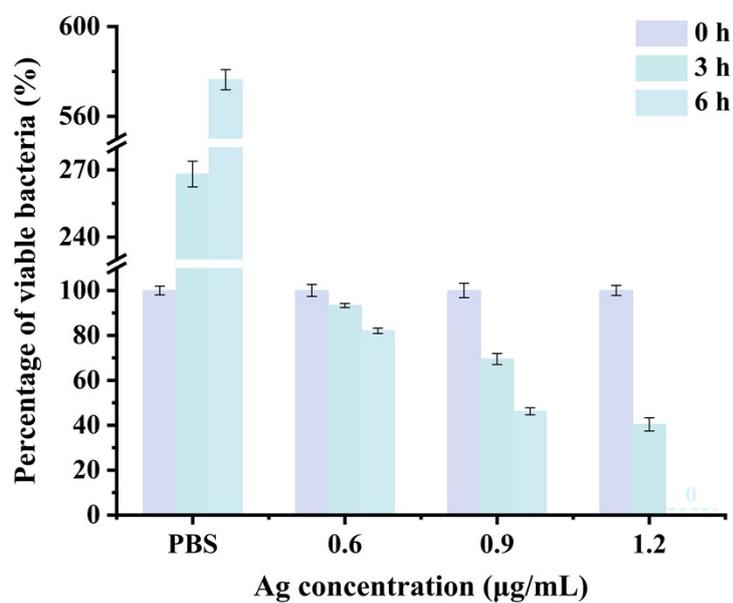


Fig. S7. The time-dependent survival rate of *S. aureus* in the milk system after treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites containing 0.6, 0.9, and 1.2 $\mu\text{g/mL}$ Ag. Bacteria were incubated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites for 0, 3, and 6 h, respectively.

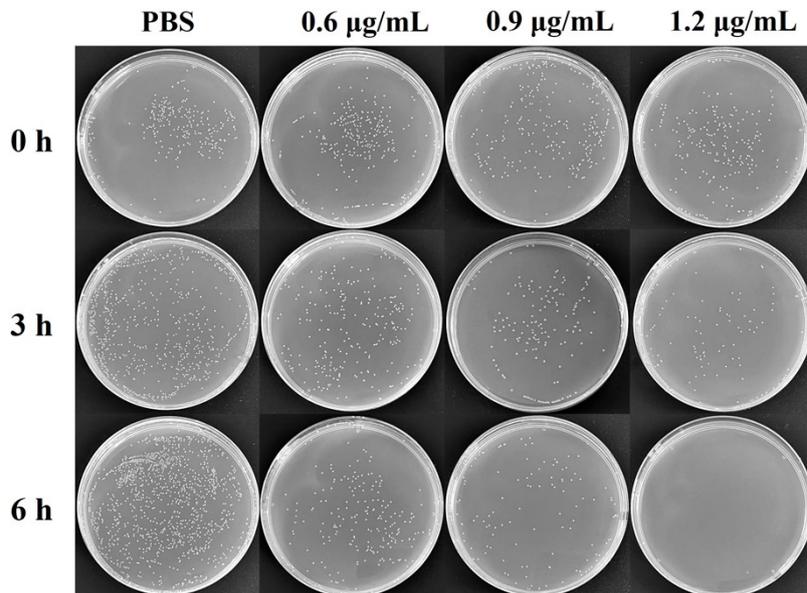


Fig. S8. The images of the colonies of *S. aureus* in the milk system after treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites containing 0.6, 0.9, and 1.2 $\mu\text{g/mL}$ Ag. Bacteria were incubated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites for 0, 3, and 6 h, respectively.

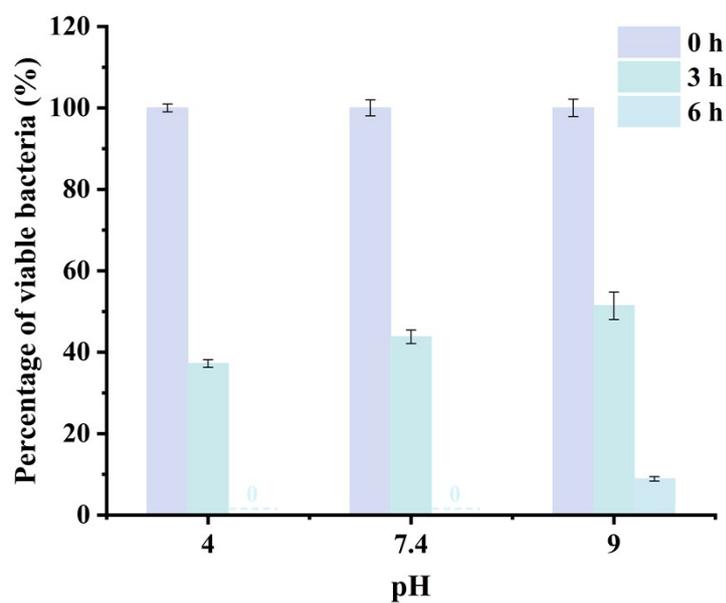


Fig. S9. The survival rate of *S. aureus* treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites containing $0.6 \mu\text{g/mL}$ Ag in the different environment (pH 4, 7.4, and 9). Bacteria were incubated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites for 0, 3, and 6 h, respectively.

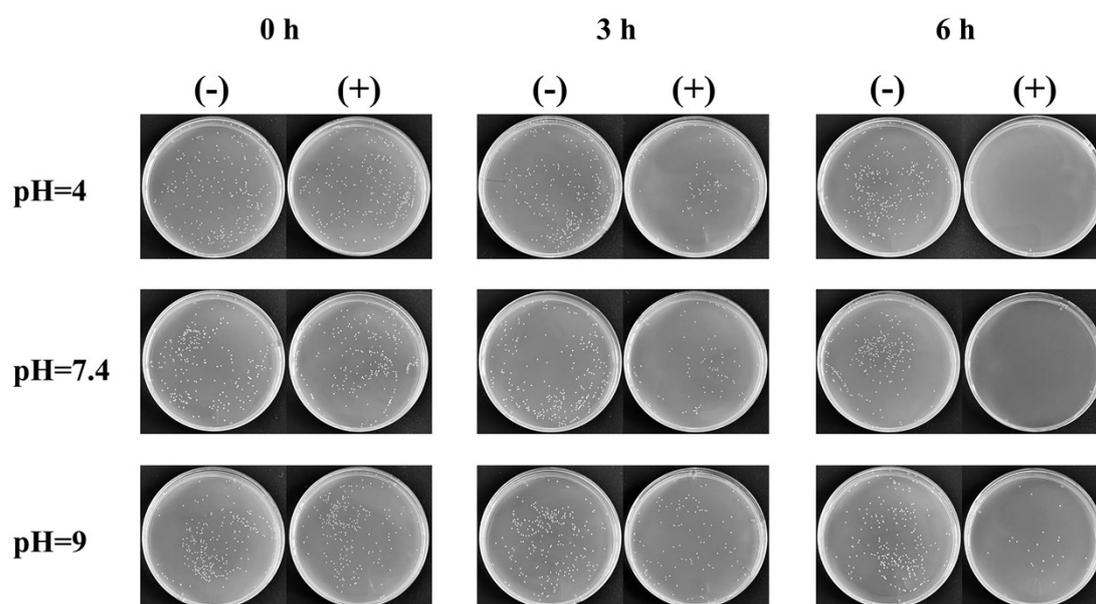


Fig. S10. The images of the colonies of *S. aureus* treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites containing $0.6 \mu\text{g/mL}$ Ag in the different environment (pH 4, 7.4, and 9). Bacteria were incubated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites for 0, 3, and 6 h, respectively.

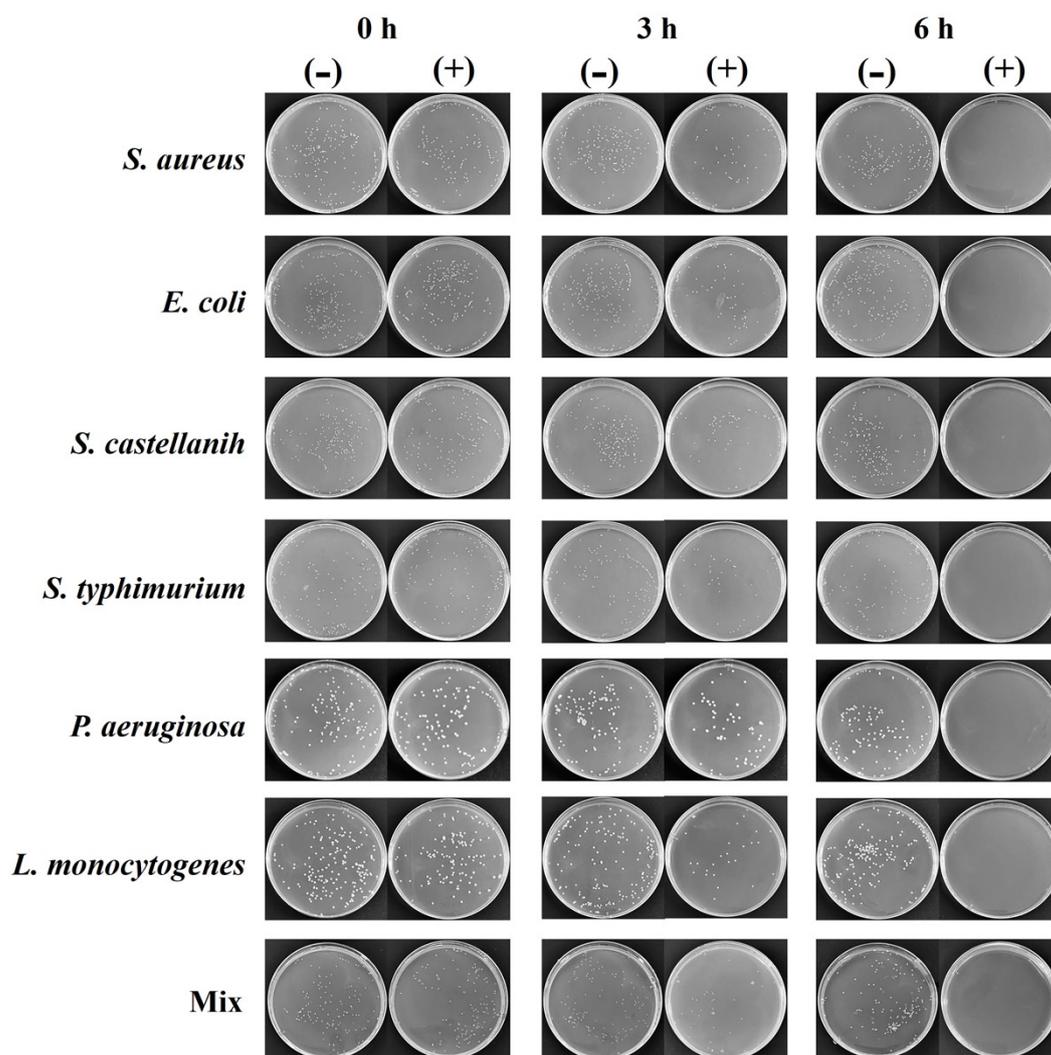


Fig. S11. The time-dependent colonies of different bacteria treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites with $0.6 \mu\text{g/mL}$ Ag, including *S. aureus*, *E. coli*, *S. castellanii*, *S. typhimurium*, *P. aeruginosa*, *L. monocytogenes* and their mixed bacterial solution. The bacteria were incubated for 0, 3, and 6 h with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites, respectively.

Table S1 Comparative antibacterial activity of other magnetic materials

| Nanomaterials | Antibacterial efficiency | Species | Reference |
|--|--------------------------|-------------------------|-----------|
| Fe ₃ O ₄ @SiO ₂ /β-lactams | 25 µg/mL MIC | <i>S. aureus</i> | 1 |
| | 50 µg/mL MIC | <i>E. coli</i> | |
| | 50 µg/mL MIC | <i>S. aureus</i> | |
| β-tricalcium phosphate doped with Ni | 50 µg/mL MIC | <i>E. faecalis</i> | 2 |
| | > 800 µg/mL MIC | <i>E. coli</i> | |
| | > 800 µg/mL MIC | <i>P. aeruginosa</i> | |
| Gentamicin sulfate grafted magnetic GO nanohybrids | 1.5 mg/mL MBC | <i>E. coli</i> | 3 |
| | 1.25 mg/mL MBC | <i>S. aureus</i> | |
| | 0.05 mg/mL MBC | <i>L. monocytogenes</i> | |
| | 5 µg/mL MIC | <i>E. coli</i> | |
| Ni _{0.5} Zn _{0.5} Fe ₂ O ₄ @Ag | 5 µg/mL MBC | <i>S. aureus</i> | 4 |
| | 5 µg/mL MIC | | |
| | 10 µg/mL MBC | | |

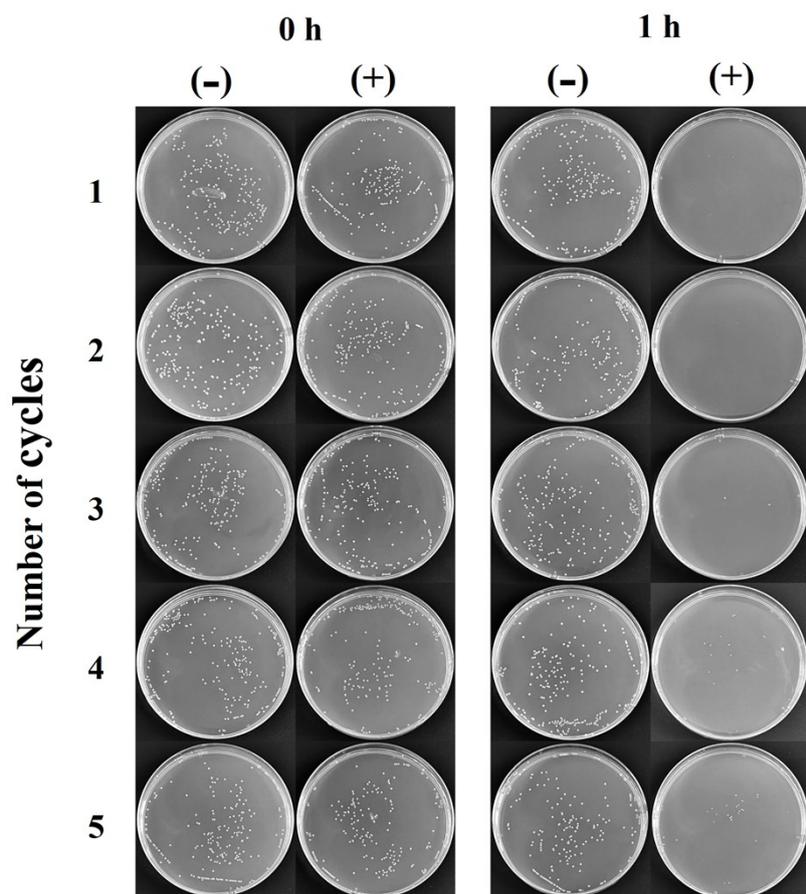


Fig. S12. The colonies of *S. aureus* treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites with 20 $\mu\text{g}/\text{mL}$ after different recycle (1, 2, 3, 4 and 5 times) of antibacterial action and magnetic separation. The bacteria were incubated for 0 and 1 h with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites, respectively.

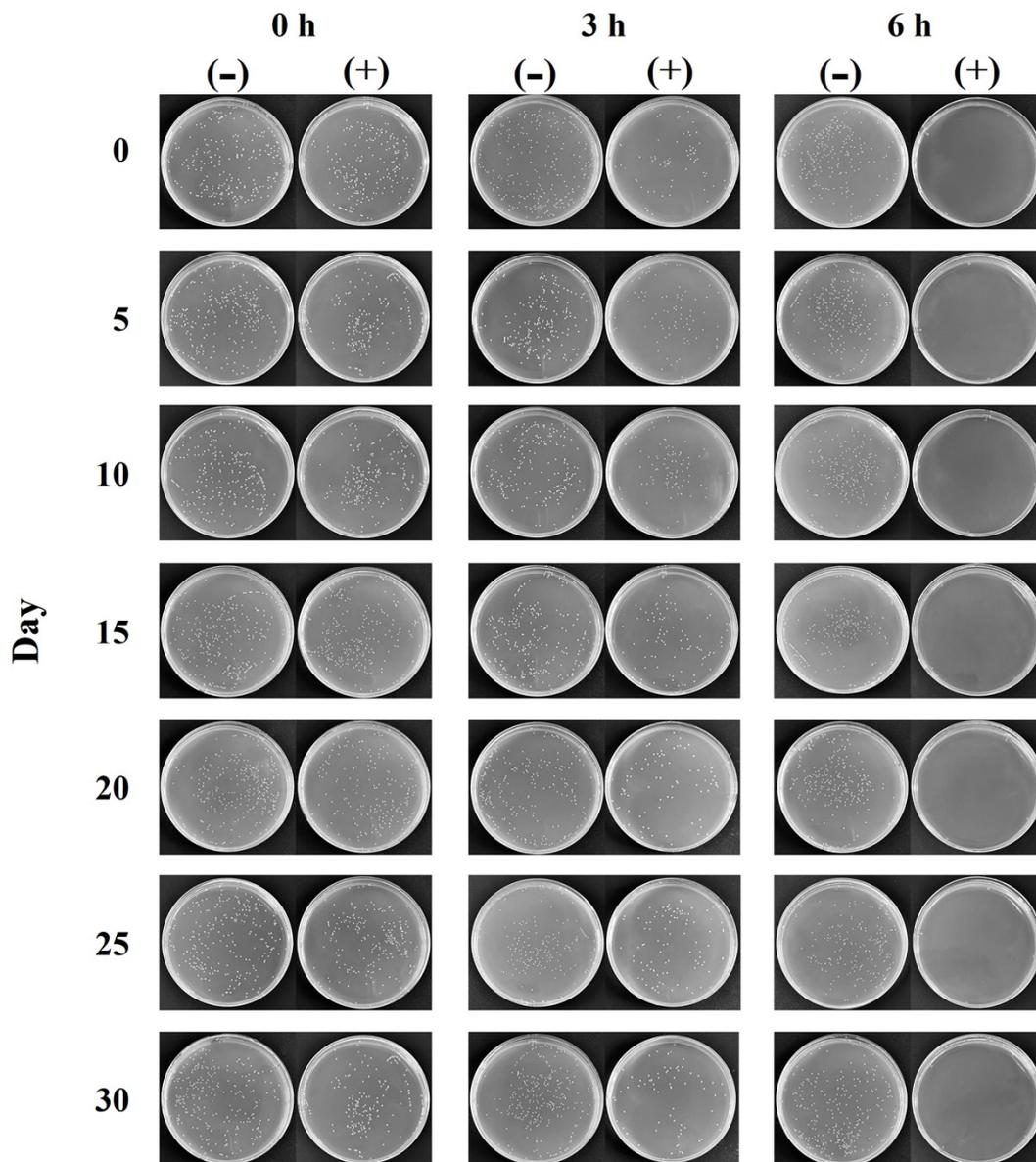


Fig. S13. The images of the colonies of *S. aureus* treated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites stored for different days. Bacteria were incubated with $\text{Fe}_3\text{O}_4@\text{PDA-Ag-CA}_2\text{R}_5$ nanocomposites with $0.6 \mu\text{g/mL}$ Ag for 0, 3, and 6 h, respectively.

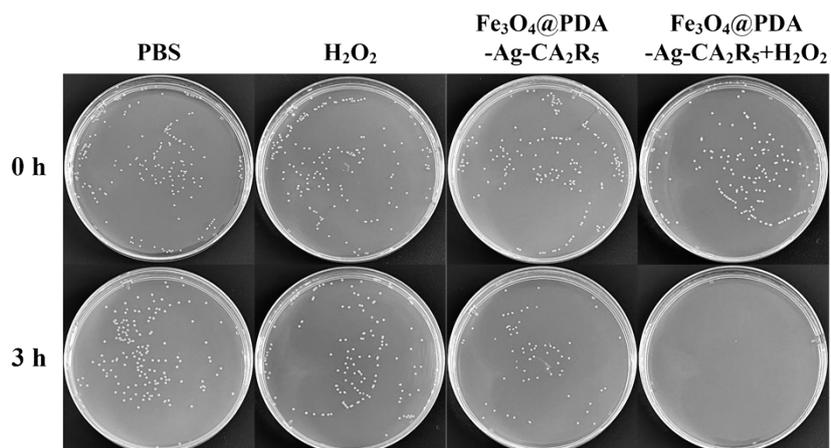


Fig. S14. The colonies of *S. aureus* treated with PBS, H₂O₂, Fe₃O₄@PDA-Ag-CA₂R₅ nanocomposites and Fe₃O₄@PDA-Ag-CA₂R₅ nanocomposites mixed with H₂O₂. The bacteria were incubated for 0 and 3 h with Fe₃O₄@PDA-Ag-CA₂R₅ nanocomposites, respectively.

Reference

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