Supplementary Information

One-pot synthesis of Ag-Fe₃O₄ nanocomposites in the absence of

additional reductant and its potent antibacterial properties

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Experimental section

Chemicals. Poly (vinyl pyrrolidone) (PVP, K-30) was purchased from Sinopharm Chemical Reagtent Co. Ltd. The other chemicals were purchased from Shantou Xilong Chemicals, Ltd. All chemicals were used without further purification.

Fabrication of Ag-Fe₃O₄ nanocomposites. One pot method was applied to synthesize the nanocomposites. 0.70 g $FeSO_4 \cdot 7H_2O$ and 1.0 g PVP were added into 80 mL deionized water. The solution was heated to 363 K. And then, 10 mmol NaOH diluted in 10 mL deionized water were mixed with the solution rapidly. After that, the mixture was maintained at 363 K in air with stirring after the addition of 10 mL solution containing 0.212 g AgNO₃ and 0.1 g PVP. The black products were separated by magnetic field and washed by deionized water and ethanol alternately several times, as well as dried at 333 K in vacuum drying oven.

The synthesis of Fe_3O_4 was carried out under 363 K through the partial oxidation of $Fe(OH)_2$ by oxygen dissolved in water with PVP as surfactant.

Ag NPs was fabricated as follows: 0.169 g and 1 g PVP were diluted into 100 mL deionized water with stirring and heated to 363 K. And then, 1 mL 1M NaOH solution and 10 mL 0.15M NaBH₄ solution were added in successively. The suspension was kept under the condition in 2h.

Characterization of Ag-Fe₃O₄ nanocomposites. X-ray diffraction (XRD) patterns of as-synthesized samples were acquired using Cu K α photons from a diffractometer (Rigaku D/MAX-2000, Japan) operated at 40 kV×30 mA with 2 θ ranging from 10° to 90°. Vibrating sample magnetometer (VSM JDM-13, China) was applied to determine the magnetic properties of NPs at room temperature. Transmission electron microscopy (TEM), high-resolution transmission electron microscopy (HRTEM) images, distributions of Ag, Fe and O atoms in nanocomposites are acquired using an F-20 (Tecnai) S-Twin microscopy operated at 200 kV with energy-dispersive X-ray spectroscopy (EDX). The UV-vis absorption of Ag, Fe_3O_4 and Ag-Fe₃O₄ nanocomposites was measured with an UV-vis analytic spectrophotometer (Specord 200, Analytik Jena AG, Germany). The chemical composition of the sample surface was identified by using X-ray photoelectron spectroscopy (XPS; PHI 5700 ESCA System, U.S.).

Preparation of *E. coli* suspension. *E. coli* was used in this study. The bacteria were inoculated aerobically at 37° C for 12 h on a rotary shaker at 150 rpm in Luria Bertani medium (LB). And then, the bacterial suspension was centrifuged at 4000 rpm for 15 min and washed twice with sterile phosphate buffer saline (PBS, pH 7.2). After that, the bacteria were diluted in a sterile PBS buffer with a concentration of $10^{8} \sim 10^{9}$ CFU/mL.

Antibacterial Activity against *E. coli.* 200 μ L of the stock cell suspension was added into 8 mL of deionized water with agitation. And then, 2 mL of nanocomposites solution containing 10 mg Ag-Fe₃O₄ NPs was mixed with the bacterial suspension. A 10 μ L sample of mixture was spread on the agar plates after the specific treatment at a given time, and the plates were inverted and incubated at 37 °C for 24 h. All measurements were performed in triplicate. The photograph of colonies of *E. coli* incubated on agar plates was taken by a camera.

0.05 g Ag-Fe₃O₄ NPs was compressed into a disc with 5 mm diameter and sterilized at 0.1 MPa for 30 min, subsequently put onto the surface of agar plates. After that, 100 μ L of diluted bacterial suspension (500-fold) were pipetted onto agar plates, which then were inverted and incubated at 37°C for 24 h.

Additional results



Fig. S1 XPS spectrum of Fe 3d.





Fig. S2 Histogram for the size distribution of the Ag-Fe₃O₄ nanocomposites.

Fig. S3 TEM image of Ag-Fe₃O₄ nanocomposites synthesized at 333 K (a) and 348 K (b).



Scheme S1 schematic depiction of the synthesis and structure of Ag-Fe $_3O_4$ nanocomposites.



Fig. S4 The antibacterial inhibition zone of Fe_3O_4 NPs (a) and Ag-Fe₃O₄ nanocomposites (b).