

Supplementary Information

Colorimetric detection of hydrogen peroxide using silver nanoparticles with three different morphologies

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Experimental Section

Materials:

All chemicals used in this study were of analytical grade and used as received without further purification. Hydrogen peroxide (H₂O₂, 30 wt.%) was obtained from Sinopharm Chemical Reagent Co. (Shanghai, China). AgNO₃, NaBH₄, trisodium citrate, hexadecyl trimethyl ammonium chloride (CTAC), and poly (vinylpyrrolidone) (PVP, weight-average molecular weight $M_w \sim 29000$ g mol⁻¹) were purchased from Sigma-Aldrich (USA).

Instrumentation: Ultraviolet-visible (UV-vis) absorption spectra were recorded on an UV-2550 Spectrophotometer (Shimadzu Corporation). Transmission electron microscope (TEM) images were obtained on a Hitachi (H-7650, 80 kV) transmission electron microscope.

Preparation of AgNPs of Different Shapes: All glasswares for preparation of triangular AgNPs were washed thoroughly with aqua regia before use. The triangular silver nanoplates were synthesized according to the method reported by Metraux and Mirkin.¹ Briefly, a solution of AgNO₃ (0.1 mM, 50 mL), and trisodium citrate (30 mM, 3 mL) were mixed under vigorously stirred for a few minutes at room temperature. Then, 3 mL of PVP (0.7 M) and hydrogen peroxide (30 wt.%, 120 μL) were added into the mixture under stirring. Finally, 300 μL of 0.1 M freshly prepared NaBH₄ in ice water was rapidly injected into the above solution under stirring for 30 min, and the solution changed gradually from colorless to yellow, red, and blue, indicating the formation of triangular silver nanoplates.

Spherical AgNPs were prepared according to the following procedure. 10 mL of 2.0×10⁻² M AgNO₃ was added drop by drop into a mixture solution of 10 mL of 0.375 M PVP (polyvinylpyrrolidone) and 10 mL of 0.01 M NaBH₄ with vigorous stirring at room temperature. After all AgNO₃ solution was added, the mixed solution was continuously stirred for 10 min more. Finally, a yellow solution was obtained.

Cubic AgNPs was prepared by the reported method.² In a typical procedure, 0.5 mL of the CTAC-Au seeds and 4.5 mL of CTAC (20 mM) aqueous solution were mixed in a 20 mL vial. After the mixture was heated at 60°C for 20 min under magnetic stirring, a specific volume of aqueous AgNO₃ solution (2 mM) and an aqueous solution of AA (50 mM) and CTAC (40 mM) were simultaneously injected at a rate of 0.2 mL/min using a syringe pump. During the injection, the reaction mixture turned from red to brownish-yellow. After 4 h, the vial was cooled in an ice-bath. The product was collected by centrifugation (14500 rpm for 15 min) and then washed with water once.

General Procedure of Colorimetric Sensing of H₂O₂: For the colorimetric sensing of H₂O₂, 900 μL of the as-prepared AgNP solution, and 50 μL of H₂O₂ solution within a range of 5 μM-5mM are added sequentially into a 1.5 mL tube. The reaction mixture is then incubated at 25 °C for 40 min, and the absorption spectra in the range of 300-800 nm are recorded.

1 G. S. Metraux and C. A. Mirkin, *Adv. Mater.* 2005, **17**, 412.

2 Y. Y. Ma, W. Y. Li, E. C. Cho, Z. Y. Li, T. Yu, J. Zeng, Z. X. Xie and Y. N. Xia, *ACS Nano* 2010, **4**, 6725.

Table S1. Determination of H₂O₂ in tap water samples and recovery tests using this method and electrochemical method (n=3).

Sample	Spiked (μM)	Detected using this method (μM)	Detected using electrochemical method (μM)	Recovery (%)
1	1	0.96	0.93	96
2	5	5.01	4.94	100.2
3	10	9.88	9.86	98.8