Supporting Information

Plasmonic rocks in Fenton reaction: catalytic sensing of organics in water via fullerene-decorated gold nanoparticles

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Materials and apparatus

Hydrogen tetrachloroaurate(III) trihydrate (HAuCl$_4$·3H$_2$O), 3-aminopropyltriethoxysilane (APTES) and potassium hydrogen phthalate were purchased from Sigma-Aldrich (USA). Fullerene (C$_{60}$) was purchased from Suzhou DCN Co., Ltd. (China). Polyvinyl pyrrolidone (PVP-K30) was purchased from Hefei TNJ Chemical Industry Co., Ltd. (China). Rhodamine B (RhB) was purchased from Tokyo Kasei Kogyo Co., Ltd. (Japan). Sodium citrate, carbon disulfide (CS$_2$) and other reagents were of analytical grade. Double-distilled water was used thoroughly. Phosphate buffer solutions (PB, 0.05M) with various pH values were prepared by mixing stock standard solutions of Na$_2$HPO$_4$ and NaH$_2$PO$_4$.

An UV–Vis spectrophotometer (UV-2450, Shimadzu) and a visible range micro-spectrometer (homemade) were used to carry out spectral measurement, transmission electron microscopy (TEM, TECRAI20, Philips) and field emission scanning electron microscopy (JSM-7800F, JEOL) were used for characterization of gold nanoparticles and films prepared.

Preparation of AuNPs and C$_{60}$ solution

Gold nanoparticles (AuNPs) with uniform size and monodispersion were prepared by the traditional Frens synthetic (citrate reduction) method.$^1$ The average diameter of the particle was determined by TEM to be 10 ± 1 nm (see Fig. S1), the concentration of the particle was calculated from its absorption spectroscopy to be ca. 15 nM.$^2$

C$_{60}$ solution (0.1 mg/mL) was prepared by the following: C$_{60}$ was first solved in CS$_2$ (1 mg/mL) and then mixed with ethanol (containing 0.1% PVP) at a volume ratio 1:10.

Fabrication of C$_{60}$@AuNPs film

A glass slide pre-treated with Pinranha solution was immersed in an ethanol solution of APTES (5%, v/v) at 60°C for 30 min. After washed by ethanol 3 times, the slide was immersed in the AuNPs solution at 30°C for 30 min. Next, the slide was washed by water 3 times, and immersed in an ethanol solution of APTES (1%, plus 1% HCl) at 60°C for 30 min, and then after washed by ethanol 3 times, immersed again in the AuNPs solution at 30°C for 30 min. The above process was repeated to obtain 10 layers of assembled AuNPs, and the slide was annealed at 500°C for 240 min to get the AuNPs film. Then, the C$_{60}$ solution (0.1 mg/mL) was spin-coated on the AuNPs film at 1000 rpm for 15 s, and the spin coating was repeated 5 times. Finally, the film was annealed at 500°C for 60 min to get the C$_{60}$@AuNPs film. The morphology of the AuNPs film and C$_{60}$@AuNPs film were determined by SEM (see Fig. S2 and S3).

Plasmonic monitoring of the Fenton reaction

As shown in Fig. S4, the C$_{60}$@AuNPs film was inserted into the measuring cell, of which a 3 mL solution of organics was filled. A 100 µL solution of 30 mM H$_2$O$_2$ was pipetted, and simultaneously, a homemade micro-spectrometer was used to measure and collect the plasmonic spectra of AuNPs at every 6 second.

References

**Fig. S1** TEM image of the prepared 10 nm gold nanoparticles.

**Fig. S2** SEM image of the prepared AuNPs film.

**Fig. S3** SEM image of the prepared C$_{60}$/AuNPs film.
Fig. S4  Schematics of the measurement setup for plasmonic monitoring of the Fenton reaction.