

## Electronic Supplementary Information (ESI) for Highly sensitive label-free colorimetric sensing of nitrite based on etching of gold nanorods

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### Experimental Section

#### *Chemicals and apparatus*

Cetyltrimethylammonium bromide (CTAB) was purchased from Bio Basic Int. All other chemicals were purchased from Sinopharm Chemical Reagent Co., Ltd, China. Solutions were prepared with deionized water (18.2 M $\Omega$ , Pall<sup>®</sup> Cascada). TEM analyses were performed on a JEM-1230 electron microscope (JEOL, Ltd., Japan) operating at 100 kV. Absorption spectra were measured on a Beckman coulter DU-800 UV/visible spectrophotometer (USA).

#### *Synthesis of GNRs and GNPs*

Different aspect ratio (length/width) of GNRs were synthesized according to a typical seed-mediated and CTAB surfactant-directed method reported elsewhere<sup>1</sup> by adjusting the concentration of AgNO<sub>3</sub>. Briefly, 7.5 ml of CTAB solution (0.1 M) was mixed with 0.25 ml of HAuCl<sub>4</sub> (0.01 mM) upon stirring, where 0.60 mL of fresh, ice-cold NaBH<sub>4</sub> solution (0.01 M) was then added, inducing the change of solution color to brown. The obtained solution was stirred for another 2 min and then was kept in a 26 °C for 2 h. Then, after mixing 0.2, 0.4 or 0.6 ml of AgNO<sub>3</sub> solution (10 mM) and 12.0 ml of HAuCl<sub>4</sub> solution (50 mM) with 95 ml of 0.10 M CTAB water solution at room temperature, 0.48 ml ascorbic acid (0.2 M) was added with gentle stirring. Immediately, the growth solution changed the color from dark yellow to colorless. 0.2 ml of the seed solution was subsequently added to the growth solution at room temperature. The solution was then left undisturbed for 20 h and the resulting colloid of GNRs was stored for further use. TEM image showed the aspect ratio of GNRs synthesized by addition of 0.2 ml of AgNO<sub>3</sub> solution (10 mM) to be 1.3:1. Other two synthesized GNR were not characterized by TEM. Theoretically, the more AgNO<sub>3</sub> was used, the more aspect ratio of GNRs was.<sup>2</sup> We conclude that the other two aspect ratio of GNRs with more aspect ratio. AuNPs ( $\Phi$  =13 nm) colloids were synthesized by reducing HAuCl<sub>4</sub> using citrate as reductant and stabilizer.<sup>3</sup>

#### **Optimization of experimental conditions**

### Effect of aspect ratio of GNR

The effect of aspect ratio of GNR was investigated by mixing of 20  $\mu\text{M}$   $\text{NO}_2^-$ , 200  $\mu\text{l}$  GNRs and 800  $\mu\text{l}$  HCl solution. The solution was incubated at 55  $^\circ\text{C}$  for 20 min. Only the GNRs with an aspect ratio of 1.3:1 produce an obvious color change from bluish green to red. So the GNRs with an aspect ratio of 1.3:1 were chosen.

### Effect of HCl concentration

The effect of HCl concentration on the decrease of absorption area was shown in Fig. S1. The value decreased at high concentration of HCl may be due to the oxidation of GNR by dissolved oxygen which resulted in a high background and the aggregation of GNRs which decreased the etching rate by  $\text{NO}_2^-$ . 1.0 M HCl was chosen in following experiments.

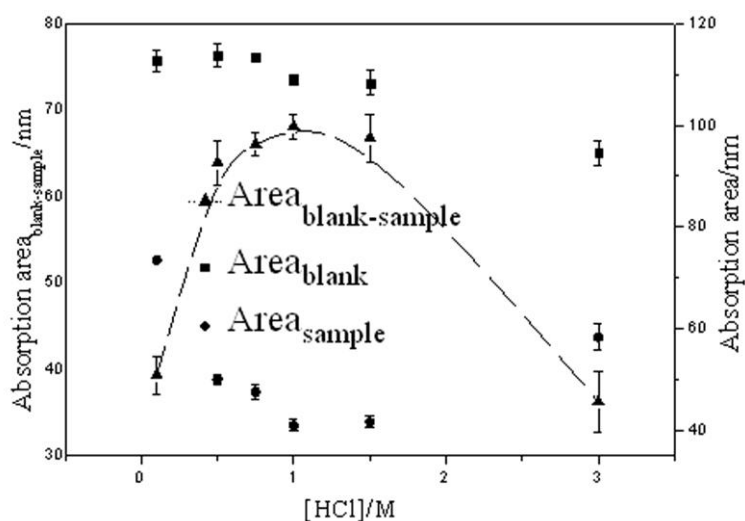


Fig. S1 The effect of HCl concentration on the decrease of absorption area

### Effect of incubation time

The effect of incubation time on the decrease of absorption area was shown in Fig. S2. We chose an incubation temperature of 55  $^\circ\text{C}$  in following experiments.

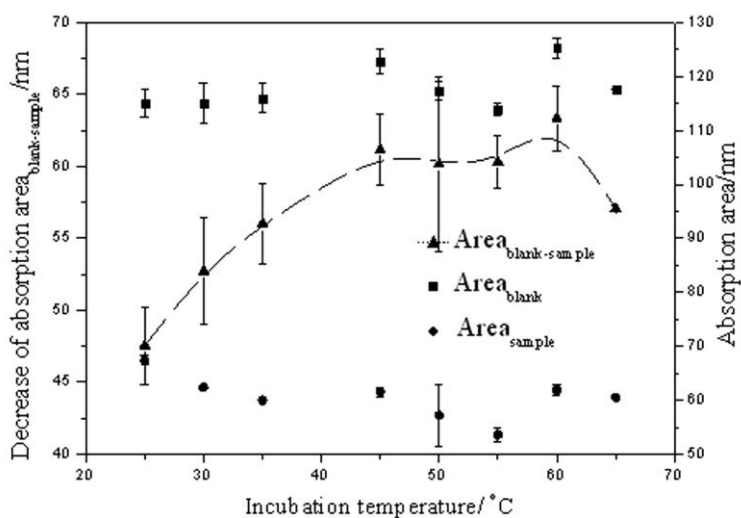


Fig. S2 The effect of incubation temperature on the decrease of absorption area

### Effect of incubation time

The effect of incubation time on the decrease of absorption area was shown in Fig. S3. A incubation time of 20 min was chosen.

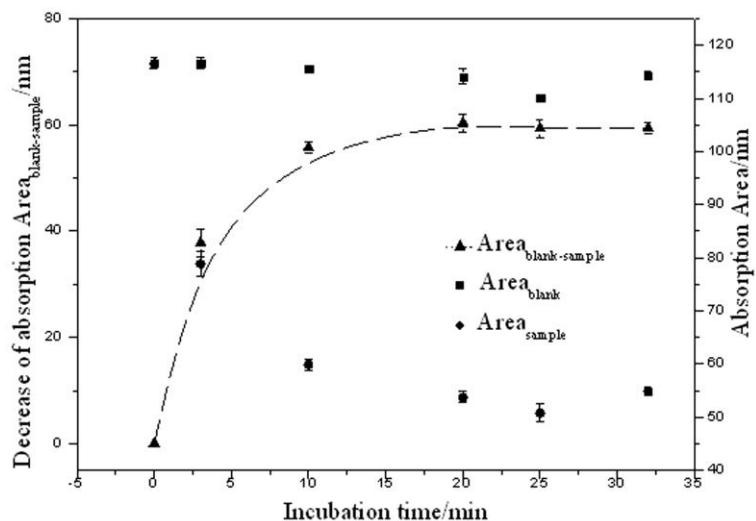


Fig. S3 The effect of incubation time on the decrease of absorption area

### Reference

1. H. Cong, R. Toftegaard, J. Arnbjerg and P. R. Ogilby, *Langmuir*, 2010, **26**, 4188.
2. B. Nikoobakht and M. A. El-Sayed, *Chemistry of Materials*, 2003, **15**, 1957.
3. G. Frens, *Nature, Phys. Sci.*, 1973, **241**, 20.