Supporting information

Ni@Au Nanoparticles for Surface Enhanced Raman Spectroscopy Based Ultrasensitive Magnetic Immunoassay on Aflatoxin B1

Congwei Fang, Chao Wei, Minmin Xu*, Yaxian Yuan, Renao Gu, Jianlin Yao*

1. Elemental analysis of EDAX

![EDAX images](image)

**Figure S1** EDAX images of Ni nanoparticles (a), Ni-Au seeds (b), and Ni@Au nanoparticles(c), respectively.

2. (a) Optimization of experimental conditions for SERS-immunoassay with immune Fe$_3$O$_4$@Au

It indicated that the optimal ratio was 1:1 (spectrum 1).

![SERS spectra](image)

**Figure S2** The SERS spectra of samples with different volume ratios (immune-magnetic beads vs. labeled immunoassays gold) (1) 1.0:1.0; (2)1.0:0.5; (3)1.0:1.5

(b) Competitive immunoassay of AFB$_1$ based on SERS by using immune Fe$_3$O$_4$@Au

From the fitted curve (Figure S4), one estimated that the IC$_{50}$ was 0.10 pg·mL$^{-1}$. 
Figure S3 SERS spectra of immunoassay for AFB1 with different concentrations: (a-h: 0; 1 fg·mL\(^{-1}\); 10 fg·mL\(^{-1}\); 100 fg·mL\(^{-1}\); 1 pg·mL\(^{-1}\); 10 pg·mL\(^{-1}\); 100 pg·mL\(^{-1}\); 1 ng·mL\(^{-1}\).)

Figure S4 Calibration curve with the plot of band intensities at 1584 cm\(^{-1}\) as the function of the logarithm of AFB1 concentrations. Notes: This is the result of the three experiments.

3. LC-MS measurements on the AFB1 and the calibration curve
Figure S5 The calibration curve of LC-MS detection for AFB₁ (1-20 ng·mL⁻¹)

4. The process of detection on AFB₁ in maize:

The maize meal was homogenized and dilution to prepare maize juice. Typically, different concentrations of AFB₁ solutions were added to 4 mL of maize juice for preparing AFB₁ contained maize solutions. Then, these maize juice were centrifuged at 5000 rpm for 20 min. Then the solid material was removed by centrifugation, and the supernatant was diluted for testing. 0.1 mL of the supernatant was extracted and diluted to 0.5 mL to ensure the final concentration was 1 fg·mL⁻¹, 10 fg·mL⁻¹, 100 fg·mL⁻¹, 10 pg·mL⁻¹, respectively. The final samples were tested by competitive magnetic immunoassay based on SERS. As for establish standard curves, we can obtain the concentrations of AFB₁ through multistage dilution of the samples.