Supplementary information

A novel and high performance enzyme-less sensing layer for electrochemical detection of methyl parathion based on BSA templated Au-Ag bimetallic nanoclusters

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Preparation of MP spiked Soil, Food, and Water samples

Soil samples were collected from different sites of an agricultural land. The soil samples were mixed carefully, then an amount equivalent to 30 g of the soil sample was dried at 60 ^{o}C for 2 h in an oven. The dried soil was dissolved in 200 mL of deionized water. The produced solution was then filtered through a Whatman No. 1 filter paper and centrifuged for 30 min, and again filtered through the filter paper, the filtered solution was collected into a 250 mL volumetric flask and diluted to the mark with ultrapure water [1, 2].

Apple, cabbage, spinach, and lettuce samples were purchase from local markets in Tehran. About 1.000 g of the plant foodstuff was first ashed for 6 h at 500 ◦C in a crucible. After cooling, the ash was carefully moistened with 5 mL of 1:1 concentrated nitric acid:H_2O and the mixture were heated on a hotplate to near dryness. The residue was dissolved in 20 mL of triply distilled water. The solution was filtered using filter paper (Whatman No. 1) and the filtration was collected into a 50.0 mL volumetric flask and diluted to the mark with ultrapure water [3, 4]. Suitable aliquots of the prepared solution were analyzed by the proposed method for determination of MP.

The water samples include waste water, river water and tap water were directly used with any preparation.

Effect of deposition potential, accumulation time and instrumental parameters on the voltammetric currents

Moreover, for achieving the best voltammetric response and maximum $\frac{Signal}{Noise}$ ratio, instrumental parameters include voltage step, pulse amplitude, SW frequency and resting time were investigated and the optimized results are shown in Table 1S.

Table 1S. Optimum values for the studied instrumental parameters.

Instrumental parameter	Unite	Range studied	Optimum value
Voltage step	mV	1-10	5
Pulse amplitude	mV	10-150	110
SW frequency	Hz	10-100	60
Resting time	s	0-60	10

3.6. Selectivity, stability, repeatability, and reproducibility of Au-Ag@BSA/GCE

Fig. 1s shows determination of 5.0 $\mu molL^{-1}$ MP in the present of 50 $\mu molL^{-1}$ p-nitro phenol and nitrobenzene, which indicates the presence of these molecules cannot change the oxidation current of MP more than 5%.

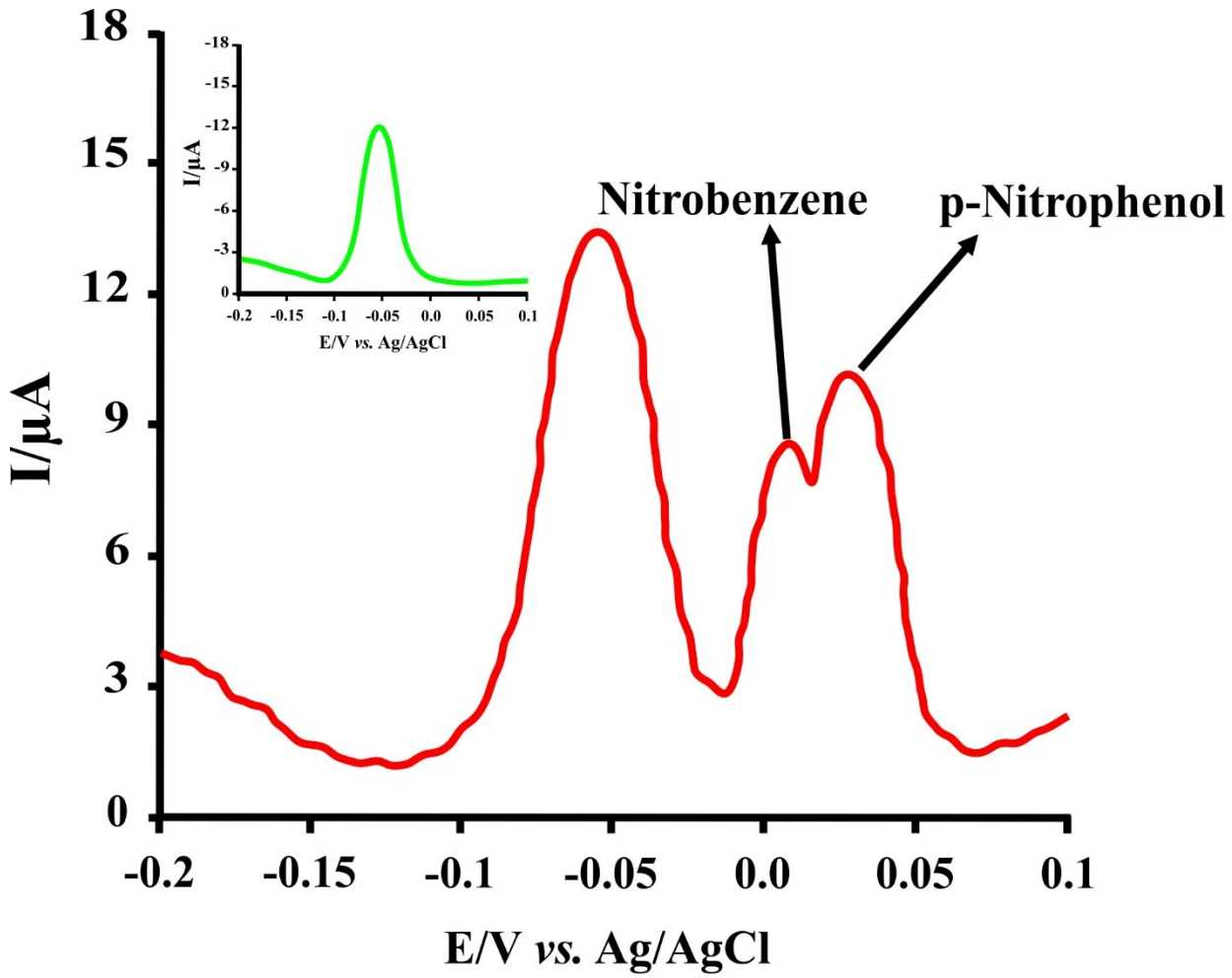

Fig. 1s SWASVs of Au-Ag@BSA/GCE in the present of 5.0 $\mu molL^{-1}$ MP and 50 $\mu molL^{-1}$ p-nitro phenol and nitrobenzene. (Insert: SWASVs of Au-Ag@BSA/GCE in the present of 5.0 $\mu molL^{-1}$ MP and absent of p-nitro phenol and nitrobenzene)

Refference:

1. M. Shariati-Rad, M. Irandoust and S. Mohammadi, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 2015, **149**, 190-195.
2. M. Rezaei. *Analytical & Bioanalytical Electrochemistry*, 2016, **8**, 287-303.
3. A. A. Ensafi, T. Khayamian and S. S. Khaloo, *International journal of food science & technology*, 2008, **43**, 416-422.
4. A. Afkhami, T. Madrakian, S. J. Sabounchei, M. Rezaei, S. Samiee and M. Pourshahbaz, *Sensors and Actuators B: Chemical*, 2012, **161**, 542-548.