

Supplementary Materials: Sensitive and Selective Electrochemical Detection of Epirubicin as Anticancer drug Based on Nickel Ferrite Decorated with Gold Nanoparticles

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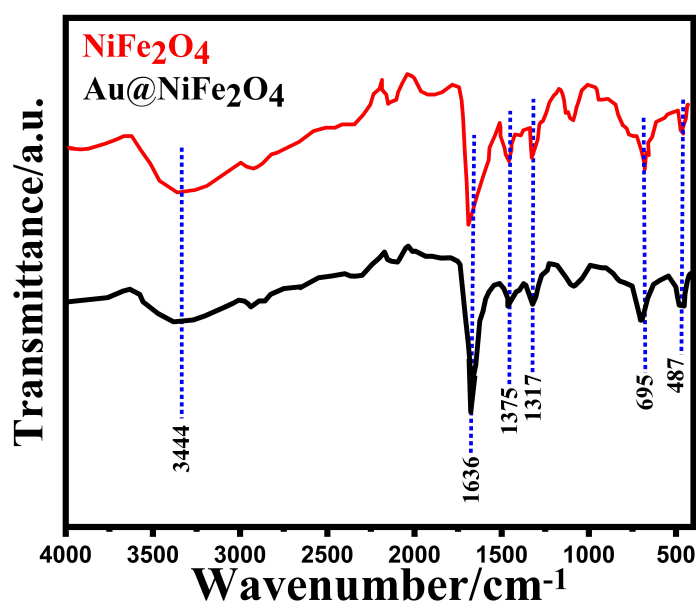


Figure S1. FTIR spectra of the NiFe_2O_4 and $\text{Au@NiFe}_2\text{O}_4$ nanocomposites.

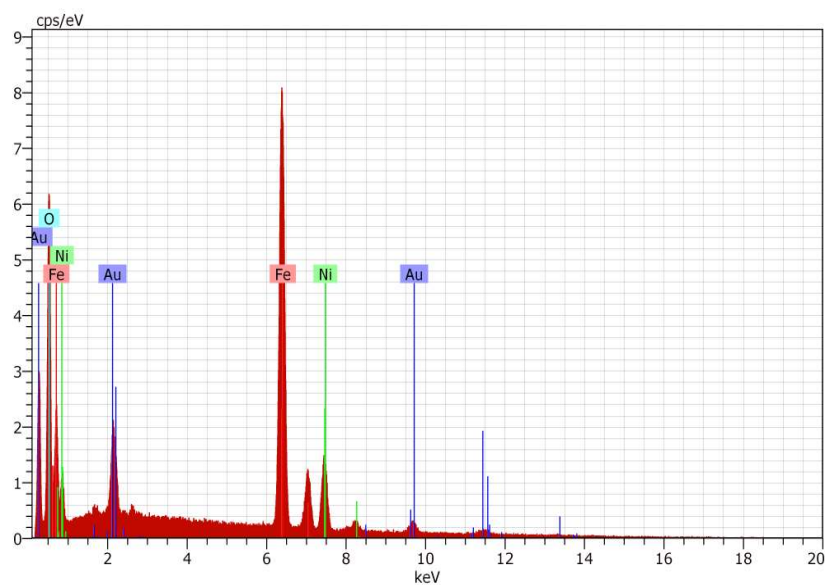


Figure S2. EDX analysis of the Au@NiFe₂O₄ nanocomposite.

Table S1. Percentage of elements present in the Au@NiFe₂O₄ nanocomposite.

El	Series	norm. C (wt.%)	Atom. C (at.%)	Error (%)
Fe	K-series	51.15	36.59	1.3
O	K-series	20.73	51.76	2.4
Au	L-series	15.69	3.18	0.5
Ni	K-series	12.43	8.46	0.4
Total		100	100	

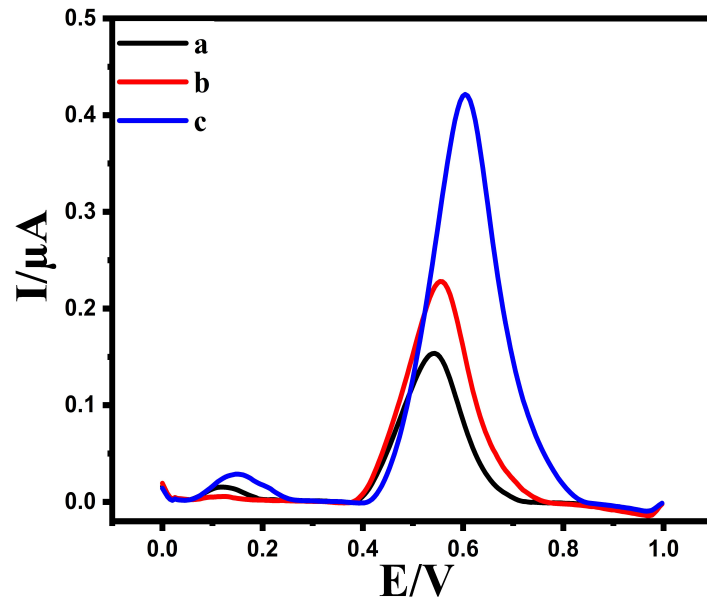


Figure S3. DPVs of the Au@NiFe₂O₄/SPE, the NiFe₂O₄/SPE and the bare electrode in the presence of 0.5 μ M EPR containing a 0.1 M BR buffer.

$$I_p = 2.69 \times 10^5 ACn^{3/2}D^{1/2}v^{1/2} \quad (S1)$$

where I_p is the anodic or cathodic peak current (A), A is the electroactive area (cm^2), C is the molar concentration of the redox substance, n is the number of the transferred electron in the redox reaction, D is the diffusion coefficient of redox probe molecule ($\text{cm}^2 \text{s}^{-1}$) and v represents the scan rate (V s^{-1}).

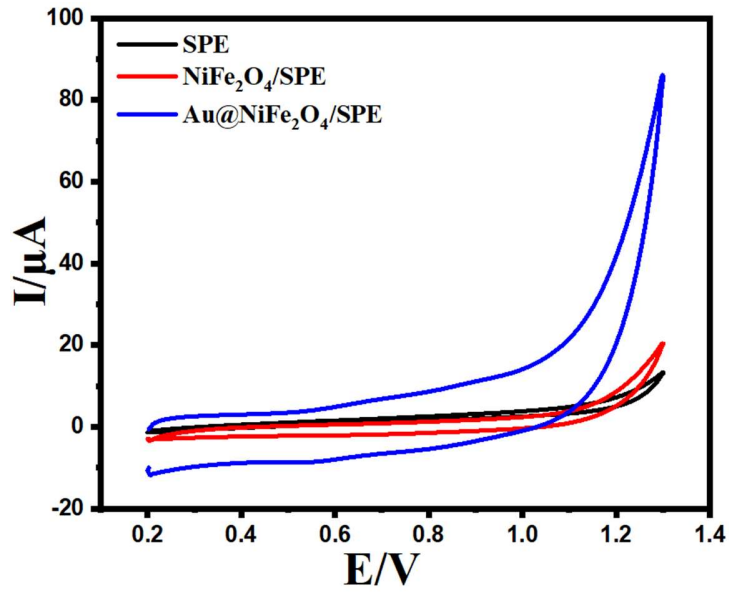


Figure S4. The CVs of the bare electrode, the NiFe₂O₄/SPE and the Au@NiFe₂O₄/SPE in the absence of EPR in B-R at pH 4.0.

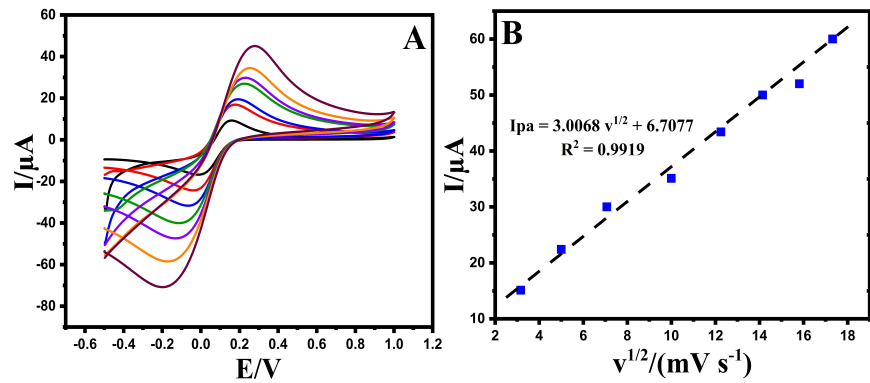


Figure S5. (A) CVs of the Au@NiFe₂O₄/SPE in the presence of 5.0 mM [Fe(CN)₆]^{3-/4-} containing 0.1 M KCl at various scan rates from 10 to 400 mV/s, (B) The plot of the corresponding peak current against the square root of the scan rate.

$$K^{\circ} = \frac{RT}{F^2 R_{ct} A C} \quad (S2)$$

where T is the thermodynamic temperature (298.15 K), R is the global gas constant (8.314 J K⁻¹ mol⁻¹), F is the Faraday constant (96,485 C mol⁻¹), R_{ct} indicates electron transfer resistance (Ω), A is the electrode surface area (cm²), C is the [Fe(CN)₆]^{3-/4-} solution concentration (5.0 mM) and K⁰ represents the rate constant of a standard heterogeneous electron transfer (cm s⁻¹).

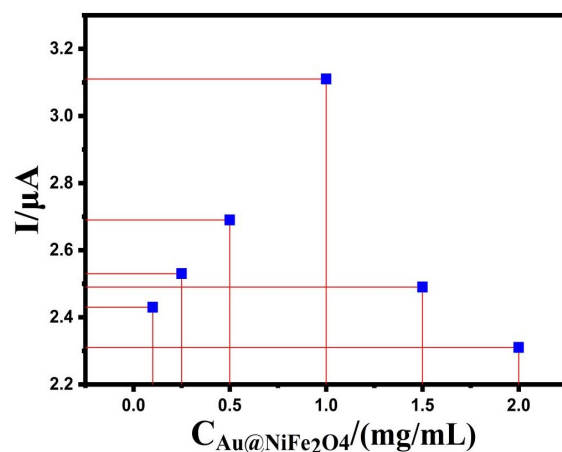


Figure S6. Effect of $\text{Au@NiFe}_2\text{O}_4$ concentration on EPR response using the $\text{Au@NiFe}_2\text{O}_4/\text{SPE}$ with $5.0 \mu\text{M}$ EPR in the presence of 0.1 BR buffer at $\text{pH } 4.0$.

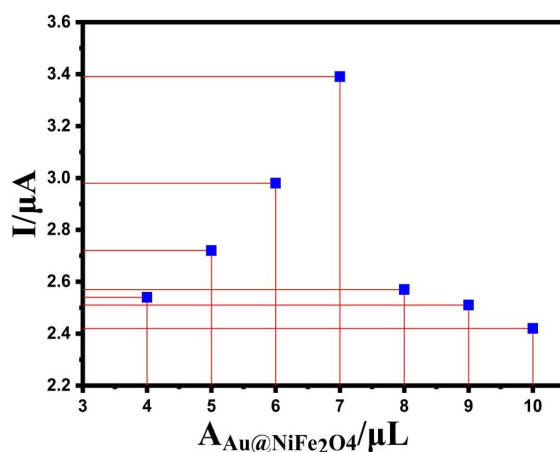


Figure S7. Effect of $\text{Au@NiFe}_2\text{O}_4$ amount on EPR response using the $\text{Au@NiFe}_2\text{O}_4/\text{SPE}$ with $5.0 \mu\text{M}$ EPR in the presence of 0.1 BR buffer at $\text{pH } 4.0$.

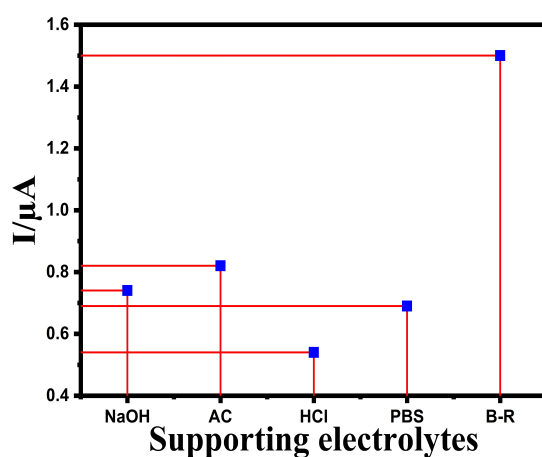


Figure S8. Effect of the $\text{Au@NiFe}_2\text{O}_4/\text{SPE}$ in the presence of $1.0 \mu\text{M}$ EPR with various supporting electrolytes.

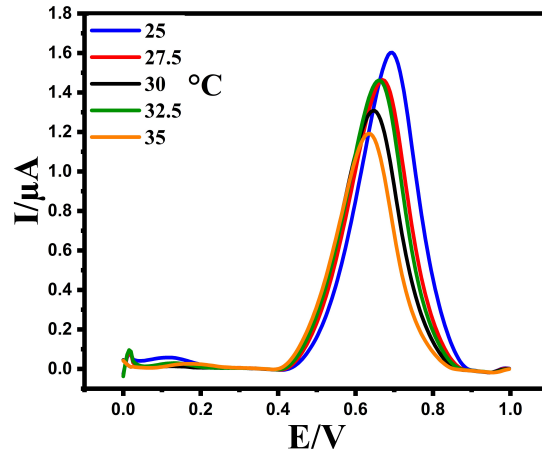


Figure S9. Effect of solution temperature on EPR response using the Au@NiFe₂O₄/SPE and the DPV method with 1.0 μM EPR in the presence of a 0.1 BR buffer at pH 4.0.

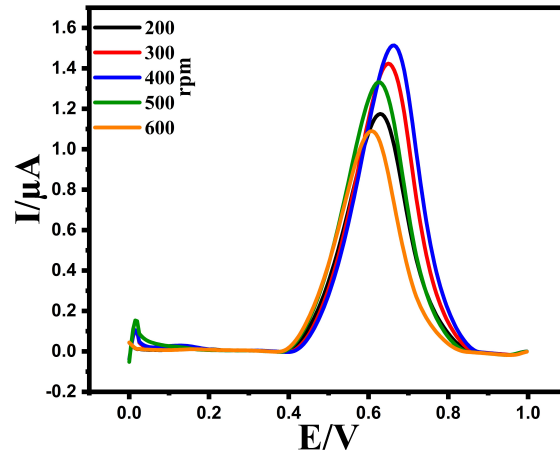


Figure S10. Effect of solution stirring rates on EPR response using the Au@NiFe₂O₄/SPE and the DPV method with 1.0 μM EPR in the presence of a 0.1 BR buffer at pH 4.0.

Laviron's theory:

$$E_{pa} = E^{\circ} + \left(\frac{RT}{\alpha n F} \right) \ln \left(\frac{RT k^{\circ}}{\alpha n F} \right) + \left(\frac{RT}{\alpha n F} \right) \ln v \quad (S3)$$

where E° is the formal redox potential, α is the charge transfer coefficient, n is the number of electrons transferred, k° is the standard heterogeneous rate constant, v is the scan rate and the other symbols have their usual meanings. The value of αn is calculated as 0.77 from the slope of E_{pa} vs. $\ln v$. Generally, α is assumed to be 0.5 for a reversible electrode process.

Cottrell's equation :

$$I = n F A C D^{\frac{1}{2}} \pi^{\frac{-1}{2}} t^{\frac{-1}{2}} \quad (S4)$$

where D ($\text{cm}^2 \text{s}^{-1}$) shows the analyte diffusion coefficient; the analyte bulk concentrations (mol cm^{-3}) are shown by C ; F is referred to as the Faraday constant, which equals $96,485 \text{ CM}$; A represents the geometric areas of the electrodes (0.2 cm^2); and n is the number of transferred electrons.

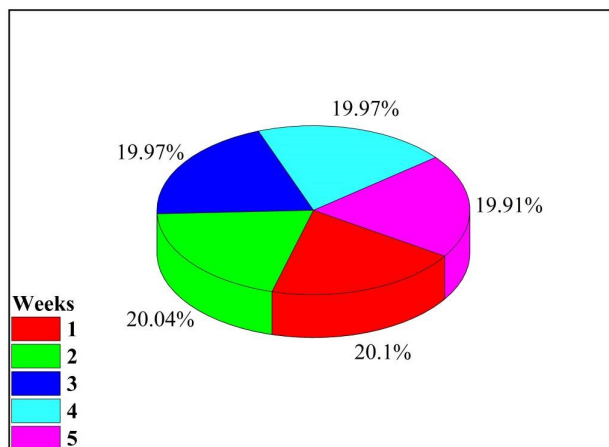


Figure S11. Long-term response stability of the Au@NiFe₂O₄ electrode exposed to 0.5 μM EPR over five weeks.