Electronic Supplementary Information

An ultra-sensitive 2D electrochemical sensor based on a PtNPs@graphene/Nafion nanocomposite for determination of α_1 -AR antagonist silodosin in human plasma

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The electroactive surface area of proposed sensor was performed by CV in 0.5 mM $K_3Fe(CN)_6$ as a probe redox system at different scan rates according to the Randles-Sevcik equation¹;

$$I_p = 2.69 \times 10^5 \, AC n^{3/2} D^{1/2} v^{1/2} \tag{1S}$$

Where I_p is the peak current (A), A is the electroactive area (cm²), C is the molar concentration of the redox species, n is the number of transferred electron in the redox reaction, D is the diffusion coefficient of redox probe (cm² s⁻¹) and v is the scan rate (V s⁻¹). The $[Fe(CN)_6]^{3-/4-}$ redox system is generally preferred to calculate the electroactive surface area of bare/modified electrode in electrochemical characterization.² The number of transferred electron (n) is 1 and diffusion constant (D) is 7.6×10⁻⁶ cm² s⁻¹ for 0.50 mM probe molecule in 1 M KNO₃ electrolyte. From the slope of the linear plot of I_p vs. v, the electroactive surface areas of GCE and PtNPs@GRP/NFN/GCE were calculated to be 0.33 cm² and 0.40 cm², respectively.



Fig. S1 CVs of 0.50 mM K₃Fe(CN)₆ in 0.1 M KNO₃ at various scan rates (a-g) (10, 25, 50, 75, 100, 150, 200 mV s⁻¹) on GCE (Inset: the slope of I_{pa} vs. $v^{1/2}$ for 0.50 mM K₃Fe(CN)₆ on GCE).



Fig. S2 CVs of 0.5 mM K₃Fe(CN)₆ in 0.1 M KNO₃ at various scan rates (a-g) (10, 25, 50, 75, 100, 150, 200 mV s⁻¹) on PtNPs@GRP/NFN/GCE (Inset: the slope of I_{pa} vs. $v^{1/2}$ for 0.50 mM K₃Fe(CN)₆ on PtNPs@GRP/NFN/GCE).

The heterogeneous electron transfer rate constant, k^o , was also performed on PtNPs@GRP/NFN/GCE using the Nicholson method,³ which is applicable for reversible system. According to the following equation developed by Nicholson,

$$\psi = k^o \left[\frac{\pi D n v F}{RT} \right]^{-1/2} \tag{2S}$$

Where ψ is a kinetic parameter, D is the diffusion coefficient of redox probe for $[Fe(CN)_6]^{3-/4-}$ (D=7.6×10⁻⁶ cm² s⁻¹ in supporting electrolyte solution), n is the number of transferred electron in the redox reaction, v is the scan rate (V s⁻¹), F,R and T is the Faraday constant, R is the gas constant and T is the temperature. k^o was determined by cyclic voltammetry using peak potential seperation vs. scan rates ($\Delta E_p - v$) in redox probe solution. k^o value was calculated to be 3.01×10^{-3} by the use of Eq. 2S for 0.5 mM [$Fe(CN)_6$]^{3-/4-} solution.



Fig. S3 AdsDPVs of blank (black line) and 0.10 μ M standard SLN solutions (blue line) in the presence of KNO₃ (red line), Na₂SO₄ (purple line), CaCl₂ (turquoise line), ascorbic acid (orange

line), urea (green line) and glucose (pink line) on PtNPs@GRP/NFN/GCE (Inset: Baseline corrected voltammograms for SLN).

References

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