Electronic Supplementary Information

An ultra-sensitive 2D electrochemical sensor based on a PtNPs@graphene/Nafion nanocomposite for determination of α1-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 K3Fe(CN)6 as a probe redox system at different scan rates according to the Randles-Sevcik equation1;

\[
I_p = 2.69 \times 10^5 ACn^{3/2}D^{1/2}v^{1/2}
\]  

(15)

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 \([Fe(CN)]^{3−/4−}\) 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 K$_3$Fe(CN)$_6$ in 0.1 M KNO$_3$ 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. $\nu^{1/2}$ for 0.50 mM K$_3$Fe(CN)$_6$ on GCE).

**Fig. S2** CVs of 0.5 mM K$_3$Fe(CN)$_6$ in 0.1 M KNO$_3$ 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. $\nu^{1/2}$ for 0.50 mM K$_3$Fe(CN)$_6$ on PtNPs@GRP/NFN/GCE).
The heterogeneous electron transfer rate constant, $k^0$, was also performed on PtNPs@GRP/NFN/GCE using the Nicholson method,\textsuperscript{3} which is applicable for reversible system. According to the following equation developed by Nicholson,

$$\psi = k^0 \left[ \frac{\pi D n v F}{R T} \right]^{-1/2}$$  \hspace{1cm} (2S)

Where $\psi$ is a kinetic parameter, $D$ is the diffusion coefficient of redox probe for $[Fe(CN)_6]^{3−/4−}$ (D=7.6×10$^{-6}$ cm$^2$ 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. $k^0$ was determined by cyclic voltammetry using peak potential separation vs. scan rates ($\Delta E_p - v$) in redox probe solution. $k^0$ 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.

![Graph](image_url)

**Fig. S3** AdsDPVs of blank (black line) and 0.10 μM standard SLN solutions (blue line) in the presence of KNO$_3$ (red line), Na$_2$SO$_4$ (purple line), CaCl$_2$ (turquoise line), ascorbic acid (orange line), and uric acid (dark blue line) in PBS (pH 7.4) with 1.0 mM K$_3$Fe(CN)$_6$ and 10 mM K$_4$Fe(CN)$_6$. The oxidation waves of $[Fe(CN)_6]^{3−/4−}$ were assigned at 0.78 V and 0.91 V vs. Ag/AgCl (saturated KCl).
line), urea (green line) and glucose (pink line) on PtNPs@GRP/NFN/GCE (Inset: Baseline corrected voltammograms for SLN).

References

