Supporting Information

Designed three-in-one peptides with anchoring, antifouling and recognizing capabilities for highly sensitive and low-fouling electrochemical sensing in complex biological media

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S-1. Static water contact angles

![Static water contact angles images](image)

**Figure S1.** Contact angle characterization of the PEDOT-citrate film within phosphate buffer solutions of various pH (a, pH 1; b, pH 4; c, pH 7; d, pH 11).

S-2. Investigation of the designed peptide

![Graphs and peptide sequences](image)

**Figure S2.** (A) The relationship between the net charge of the peptide and pH. (B) Zeta potential of the designed multifunctional peptide (peptide3). Peptide1, YVEYHLCRAKAKAKAK; peptide2, YVEYHLCREKEKEKEK; peptide3, YVEYHLCREKEKEKEKAKAKAK.
S-3. ATR-FTIR spectroscopy

**Figure S3.** ATR-FTIR spectra of the PEDOT-citrate and PEDOT-citrate/peptide surfaces.

S-4. Structure of the designed multifunctional peptide

**Figure S4.** Structure of the designed multifunctional peptide with sequence of YVEYHLCREKEKEKEKAKAKAKAK used in present work.
S-5. DPV response to two different probes

Figure S5. DPV curves were recorded at different modified electrodes in PBS (10 mM, pH 7.4) containing 0.1 M KCl, 5.0 mM [Fe(CN)₆]³⁻/⁴⁻ (A) and [Ru(NH₃)₆]³⁺ (B). a, bare GCE; b, GCE/PEDOT-citrate; c, GCE/PEDOT-citrate/peptide; d, GCE/PEDOT-citrate/peptide/APN.

S-6. Optimization of sensing conditions

Figure S6. Optimization of the peptide concentration (a), APN incubation time (b). Error bars represent the standard deviations of three repeated determinations (n =3).
S-7. Antifouling ability of different surfaces in human serum solution

Figure S7. The antifouling performance of the bare, PEDOT-citrate, PEDOT-citrate/peptide \(_3\) modified GCE in different concentration of human serum solution (V/V) (a), and longtime antifouling performance against 24 h incubation in 10 % human serum solution (b).

S-8. Antifouling ability of different surfaces in FBS solution

Figure S8. Comparative antifouling performance of the bare, PEDOT-citrate, PEDOT-citrate/peptide \(_x\) modified GCE in FBS samples (V/V). Peptide\(_1\), YVEYHLCRAKAKAKAK; peptide\(_2\), YVEYHLCREKEKEKEK; peptide\(_3\), YVEYHLCREKEKEKEKAKAKAK.
S-9. Cell adhesion investigation

Figure S9. Fluorescence microscopy images of PEDOT-citrate/peptide3 modified electrodes after incubation in \(10^4\) cells \(\cdot\) mL\(^{-1}\) of HepG2 (a) and HeLa (b) cells.

S-10. Stability of the biosensor

Figure S10. (a) Stability of the PEDOT-citrate/peptide3 biosensor with CV at a scan of 0.10 V \(\cdot\) s\(^{-1}\). (b) The DPV response changes [\(\Delta I\)] of five different biosensors for the detection of 1\(\mu\)g \(\cdot\) mL\(^{-1}\) APN, and (c) the detection of 1\(\mu\)g\(\cdot\)mL\(^{-1}\) APN with the same biosensors. (\(\Delta I=I_{\text{target}}-I_0\)) (d) Stability of the prepared biosensor stored at PBS (10 mM, pH 7.4). The CV and DPV were record in PBS (10 mM, pH 7.4) containing 5.0 mM [Fe(CN)\(_6\)]\(^{3-/4+}\) and 0.1 M KCl.

S-11. Reusability of the biosensor
**Figure S11.** The reusability of the modified electrode for APN detection with the concentration of $5\mu g \cdot mL^{-1}$. Error bars represent the standard deviations of three repeated determinations ($n = 3$).

**S-12. Tables S1, Tables S2**

**Table S1.** Static water contact angle values of bare, PEDOT-citrate modified and PEDOT-citrate/peptide$_3$ modified GCE.

<table>
<thead>
<tr>
<th>Test points</th>
<th>Bare GCE</th>
<th>GCE/PEDOT-citrate</th>
<th>GCE/PEDOT-citrate/peptide$_3$</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>63.44</td>
<td>46.39</td>
<td>29.56</td>
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<tr>
<td>2</td>
<td>63.02</td>
<td>47.04</td>
<td>29.21</td>
</tr>
<tr>
<td>3</td>
<td>62.57</td>
<td>46.76</td>
<td>28.95</td>
</tr>
<tr>
<td>Average</td>
<td>63.01±0.4</td>
<td>46.73±0.3</td>
<td>29.24±0.3</td>
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</tbody>
</table>

**Table S2.** Comparison of various detection methods for APN assay.

<table>
<thead>
<tr>
<th>Analytical</th>
<th>Linear range ($\mu g \cdot mL^{-1}$)</th>
<th>Detection limit</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>methods</td>
<td>Colorimetric</td>
<td>5-15</td>
<td>0.42 μg · mL⁻¹</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------</td>
<td>------</td>
<td>---------------</td>
</tr>
<tr>
<td>Fluorescence</td>
<td>0-6 × 10⁻³</td>
<td>33 pg · mL⁻¹</td>
<td></td>
</tr>
<tr>
<td>Fluorescence</td>
<td>0.01-0.5</td>
<td>0.8 ng · mL⁻¹</td>
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<tr>
<td>Fluorescence</td>
<td>0-0.1</td>
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</tr>
<tr>
<td>Electric chemistry</td>
<td>Not mentioned</td>
<td></td>
<td>0.30 mU</td>
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<tr>
<td></td>
<td>0.001-15</td>
<td>0.4 ng · mL⁻¹</td>
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</table>

This work

References


