A novel glucose sensor using lutetium phthalocyanine as redox mediator in reduced graphene oxide conducting polymer multifunctional hydrogel

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A novel glucose sensor using lutetium phthalocyanine as redox mediator in reduced graphene oxide conducting polymer multifunctional hydrogel

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Supporting Information (SI)
Table 1. UV-Visible absorption data for MFH and LuPc$_2$ thin films

<table>
<thead>
<tr>
<th>Sample</th>
<th>N (nm)</th>
<th>B (nm)</th>
<th>Benzenoid to quinoid transitions (nm)</th>
<th>$\pi$-radical (nm)</th>
<th>Q (nm)</th>
<th>RV (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LuPc$_2$</td>
<td>317</td>
<td>390</td>
<td>-</td>
<td>543</td>
<td>706</td>
<td>938</td>
</tr>
<tr>
<td>PAA-rGO/VS-PANI/LuPc$_2$</td>
<td>-</td>
<td>342</td>
<td>430</td>
<td>546</td>
<td>712</td>
<td>-</td>
</tr>
<tr>
<td>PAA/VS-PANI/LuPc$_2$</td>
<td>-</td>
<td>356</td>
<td>432</td>
<td>543</td>
<td>702</td>
<td>-</td>
</tr>
<tr>
<td>PAA-rGO/LuPc$_2$</td>
<td>-</td>
<td>385</td>
<td>-</td>
<td>559</td>
<td>718</td>
<td>-</td>
</tr>
</tbody>
</table>
FTIR spectra of (a) PAA-rGO/VS-PANI/LuPc₂-MFH, (b) PAA/VS-PANI/LuPc₂-MFH, (c) PAA-rGO/LuPc₂-MFH.
Cyclic voltammograms (CVs) of PAA-rGO/VS-PANI/LuPc₂/GOx-MFH in 5 mM of Fe(CN)₆³⁻/⁴⁻ containing 0.1 M NaCl for different scan rates (a–e); 5-100 mVs⁻¹; (Inset) Dependence of peak current on scan rates.
Nyquist plots ($Z_{im}$ vs. $Z_{re}$) of PAA-rGO/VS-PANI/LuPc$_2$/GOx-MFH (a) and PAA/VS-PANI/LuPc$_2$/GOx-MFH (b) in the presence of PBS containing 0.1M NaCl.

Equivalent circuit model for the fabricated biosensor where $R_s$: the uncompensated solution resistance; $R_{et}$ is the electron transfer resistance; Warburg diffusion element (W) and $C_{dl}$ is the double layer capacitance. Based on the model, good agreement was achieved over the frequency range 10 Hz and 2MHz between the simulated and experimental results.
Cyclic voltammogram of (A) PAA/VS-PANI/LuPc$_2$/GOx-MFH, (B) PAA-rGO/LuPc$_2$/GOx-MFH for (a) 0 mM glucose (b) 4 mM glucose in 0.1M PBS (pH 7.0)
Optimisation of PAA-rGO/VS-PANI/LuPc2/GOx-MFH biosensor performance

Optimisation studies were performed with the PAA-rGO/VS-PANI/LuPc2/GOx-MFH biosensor in stirred solution was found to be dependent on pH. Fig. SI-5 shows the effect of pH on the oxidation current of glucose at the PAA-rGO/VS-PANI/LuPc2/GOx-MFH biosensor. Initially the current value rises at pH 2.0 and then found to be decreased; later at around pH 7.0, the oxidation current increases steeply, then reaches a maximum value. Hence 0.1 M PBS (pH 7.0) is chosen as a medium buffer for further determination of glucose.

The effect of potential on the steady-state current for the PAA-rGO/VS-PANI/LuPc2/GOx-MFH biosensor is studied. The applied potential of +0.3 V to +0.6 V in 0.1 M PBS (pH 7.0) does not show significant variation in the response current of glucose and hence +0.3 V is chosen as the applied potential for amperometric detection of glucose concentration.

Effect of pH on the current response of glucose at PAA-rGO/VS-PANI/LuPc2/GOx-MFH biosensor
Amperometric response of (a) 4 mM (b) 6 mM at PAA/VS-PANI/LuPc2/GOx-MFH biosensor (repetitive measurements)
Amperometric response of (a) glucose (4 mM); (b) ascorbic acid (0.1 mM); (c) uric acid (0.5 mM); (d) glucose (4 mM) at PAA/VS-PANI/LuPc2/GOx-MFH biosensor (Interference measurement)
Amperometric responses of real samples (a) glucose, (b) juice 1, (c) juice 2, (d) human serum, at PAA/VSPANI/LuPc2/GOx-MFH biosensor at an applied potential of +0.3 V.

**Table 2.** Amperometric responses of real samples

<table>
<thead>
<tr>
<th>Real samples</th>
<th>Added (according to specification in the label) (mM)</th>
<th>Found (mM)</th>
<th>Recovery (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>4</td>
<td>4.13</td>
<td>103.25</td>
</tr>
<tr>
<td>Juice 1</td>
<td>7.5</td>
<td>7.78</td>
<td>103.76</td>
</tr>
<tr>
<td>Juice 2</td>
<td>2.5</td>
<td>2.44</td>
<td>97.6</td>
</tr>
<tr>
<td>Human serum</td>
<td>-</td>
<td>3.86</td>
<td>-</td>
</tr>
</tbody>
</table>