Highly Sensitive Non-Enzymatic Detection of Glucose at MWCNT-CuBTC Composite Electrode

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The electroactive surface area of the MWCNT-Cu-BTC-Epoxy composite electrode was determined based on the classical method involving potassium ferrocyanide K3[Fe(CN)6] in 1 M KNO3 supporting electrolyte using cyclic voltammetry recorded at different scan rates in according to the Randles – Sevcik equation[30]. The cyclic voltammograms are presented in Figure 1S. The redox couples of copper are manifested in 1 M KNO3 supporting electrolyte and affected the oxidation and reduction process for ferro/ferricyanides and the anodic peaks recorded at the potential value about +0.83 V vs SCE and respective, the cathodic peaks recorded at +0.63 V vs SCE increased in the presence of ferro/ferricyanide. The results considered for the electroactive surface area determination are presented in Table 1S.
Figure 1. S. Cyclic voltammograms of the MWCNT-CuBTC composite electrode in 4 mM K₃[Fe(CN)₆] and 1 M KNO₃ supporting electrolyte at different scan rates: 0.025; 0.05; 0.1; 0.2; 0.3 Vs⁻¹.

Table 1. S. Apparent diffusion coefficient and the electroactive surface area of MWCNT- CuBTC composite electrode.

<table>
<thead>
<tr>
<th>Scan rate, Vs⁻¹</th>
<th>ΔIa,mA*</th>
<th>Apparent diffusion coefficient/cm²s⁻¹</th>
<th>Overall apparent diffusion coefficient, cm²s⁻¹</th>
<th>Electroactive surface area, cm²</th>
<th>Geometrical area cm²</th>
<th>Theoretical diffusion coefficient, cm²s⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>0.60</td>
<td>3.24·10⁻⁴</td>
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<tr>
<td>0.05</td>
<td>0.81</td>
<td>2.96·10⁻⁴</td>
<td>3.21·10⁻⁴</td>
<td>1.357</td>
<td>0.196</td>
<td>6.7·10⁻⁶</td>
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<tr>
<td>0.2</td>
<td>1.18</td>
<td>3.14·10⁻⁴</td>
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<tr>
<td>0.3</td>
<td>1.70</td>
<td>3.26·10⁻⁴</td>
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<td></td>
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<tr>
<td>0.3</td>
<td>2.15</td>
<td>3.50·10⁻⁴</td>
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</tr>
</tbody>
</table>

*ΔI is anodic and cathodic peak current corresponding to the oxidation and the reduction of ferro/ferricyanide system minus the backround current in 1 M KNO₃ supporting electrolyte, recorded at Eₐ=0.83 V vs SCE and Eᵦ=0.63 V vs SCE

Taking into account the reversibility condition for the redox ferro/ferricyanide system:
ΔE=Eₐ-Eᵦ=200 mV higher than 59 mV
ΔIₐ/ΔIᵦ=1.1-1.2

It can be seen that the electrode surface morphology affected the oxido/reduction process of this redox system.

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