Supporting Information

for

Biomimetic synthesis of Ag-coated glasswing butterfly arrays as ultra-sensitive SERS substrates for efficient trace detection of pesticides

Guochao Shi, Mingli Wang, Yanying Zhu, Yuhong Wang, Xiaoya Yan, Xin Sun, Haijun Xu and Wanli Ma


Additional theoretical and experimental information
1 Enhancement factor (EF) calculation.

![SERS spectrum of 10^{-6} M CV solution acquired from Ag-Gb.-20 substrate. (b) Normal Raman spectrum of 10^{-2} M CV solution.](image)

**Figure S1:** (a) SERS spectrum of 10^{-6} M CV solution acquired from Ag-Gb.-20 substrate. (b) Normal Raman spectrum of 10^{-2} M CV solution.

2 The calculated EF was by the following equation (1) [1]:

\[
G_{\text{SERS}} = \left| \frac{E_{\text{loc}}(\omega)}{E_{\text{inc}}(\omega)} \right|^4
\]

where the \( E_{\text{loc}}(\omega) \) and \( E_{\text{inc}}(\omega) \) represent the E and E\( _0 \) in the 3D-FDTD simulation, respectively.

3 The RSD value was calculated according to the following equation (2) [2]:

\[
RSD = \sqrt{\frac{\sum_{i=1}^{n} (I_i - \bar{I})^2}{n-1}}
\]

where the \( \bar{I} \) represents the average intensity of the Raman signal, \( n \) is the number of the measured spectrum, \( I_i \) is the Raman intensity of each spectrum at a characteristic peak.
4 Point-by-point reproducibility of Ag-G.b.-20 substrate.

**Figure S2:** (a) Raman mapping of the 1532 cm\(^{-1}\) peak. (b) The RSD of Raman intensities of 915, 1172 and 1532 cm\(^{-1}\) (C\(_{CV}\)=10\(^{-7}\) M) for an area of 7 μm ×7 μm on a Ag-G.b.-20 substrate.

5 The concentration converted from mg-to-ml to mass-to-area ratio:

In our experiment, the detection of 10\(^{-10}\) mg/ml acephate was based on 10 μL acephate ethanol solution adsorbed on the Ag-G.b.-20 substrate with a cover area of approximately 0.5 cm\(^2\). By unit conversion, 10\(^{-10}\) mg/ml was approximately equaled to 2×10\(^{-6}\) ng cm\(^{-2}\). Meanwhile, the concentration converted from mass-to-area ratio to mg per kilogram was roughly calculated according to the reported work [3].

**Table S1:** Linear relationships between acephate concentrations (10\(^{-5}\) mg mL\(^{-1}\)-10\(^{-10}\) mg mL\(^{-1}\)) and Raman intensities at characteristic peaks of acephate.

<table>
<thead>
<tr>
<th>Peak/cm(^{-1})</th>
<th>Linear function</th>
<th>R(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1078</td>
<td>y=0.179x+6.155</td>
<td>0.986</td>
</tr>
<tr>
<td>1185</td>
<td>y=0.170x+5.990</td>
<td>0.966</td>
</tr>
<tr>
<td>1576</td>
<td>y=0.170x+6.851</td>
<td>0.961</td>
</tr>
</tbody>
</table>
6 RSD values of 1185 and 1576 cm$^{-1}$ of acephate.

**Figure S3:** The corresponding intensity distributions at 1185 and 1576 cm$^{-1}$ of 10$^{-8}$ mg/ml acephate molecules from 25 Raman spectra.

**References**