**Supporting Information**

**Using low-cost disposable immunosensor based on flexible PET screen-printed electrode modified with carbon black and gold nanoparticles for sensitive detection of SARS-CoV-2**

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Figure S1: CV response obtained for bare PET-SPE (black line), CB/PET-SPE (red line) and the 10th voltammetric cycle of AuNP-CB/PET-SPE (blue line) based on the application of 0.1 mol L−1H2SO4 as supporting electrolyte, potential range of −0.2V to 1.5 V, and scan rate of 50 mVs−1.

Randles-Sevcik equation (1):

(1)

where *I*p is the peak current (A), *n* is the number of electrons transferred during the redox process, *A* is the electroactive area (cm2), *D* is the [Fe(CN)6]3– diffusion coefficient in the respective media (7.6 × 10−6 cm2 s−1), *C* is the [Fe(CN)6]3– concentration (mol cm−3), and *v* isthe scan rate (V s−1).

Nicholson’s method equation (2):

(2)

where π = 3.1415, *F* is the Faraday constant (96,485 C mol−1), *R* is the universal gas constant (8.314 J K−1 mol−1), *T* is the thermodynamic temperature (298 K), and ψ is a kinetic parameter obtained from Equation 3 below proposed by Lavagnini *et. al* [1]:

(3)

where Δ*E*P is the peak-to-peak separation based on the cyclic voltammograms in Fig. S2. The *k*0 values were obtained by the angular coefficients of the resulting curves: 3.31×10−3 cm s−1 for PET-SPE, 4.2×10−3 cm s−1 for CB/PET-SPE, and 7.8×10−3 cm s−1 for AuNPs-CB/PET-SPE; the results obtained point to an increase in reversibility as the nanomaterials are incorporated onto the PET-SPE surface.

Mapa

Descrição gerada automaticamente

Figure S2: Cyclic voltammograms obtained from the application of 0.10 mol L–1 KCl solution in the presence of 2.0 mmol L–1 [Fe(CN)6]3– using **(A)** PET-SPE, **(B)**CB/PET-SPE, **(C)**AuNPs/PET-SPE and **(D)** AuNPs-CB/PET-SPE at different potential scan rates (10 − 100 mV s−1). (**E**) *I*p *vs.* ν1/2 plot. (**F**) Ψ *vs* 32.79ν*−*1/2 plot (Factor 32.79 represents the numeric value of [πDnF/(RT)]−1/2).

PET-SPE: Ψ = (−0.096 ± 0.002) + (3.31 ± 0.09)×10−4ν−1/2 (r = 0.998)

*I*PA = (1.3 ± 0.2)×10−5 + (1.69 ±0.07)×10−4*ν*1/2 (r = 0.995)

*I*PC = (−1.3 ±0.2)×10−5 + (−1.38 ± 0.09)×10−4*ν*1/2 (r = 0.990)

CB/PET-SPE: Ψ = (−0.106 ± 0.004) + (4.20 ± 0.20)×10−4ν−1/2 (r = 0.994)

*I*PA = (1.2 ± 0.1)×10−5+ (1.94 ± 0.5)×10−4*ν*1/2 (r = 0.993)

*I*PC = (−1.4 ± 0.2)×10−5 + (−1.90 ± 0.1)×10−4*ν*1/2 (r = 0.989)

AuNP/PET-SPE: Ψ = (−0.127 ± 0.003) + (5.53 ± 0.02)×10−4ν−1/2 (r = 0.998)

*I*PA = (7.5 ± 0.2)×10−5+ (2.4 ± 0.1)×10−4*ν*1/2 (r = 0.993)

*I*PC = (−1.0 ± 0.3)×10−5 + (−2.1 ± 0.1)×10−4*ν*1/2 (r = 0.994)

AuNPs-CB/PET-SPE:Ψ = (−0.112 ± 0.010) + (7.80 ± 0.50)×10−4ν−1/2 (r = 0.988)

*I*PA = (*−*0.4 ± 0.3)×10−5+ (3.3 ± 0.1)×10−4*ν*1/2 (r = 0.996)

*I*PC = (*−*0.1 ± 0.2)×10−5 + (−2.8 ± 0.2)×10−4*ν*1/2 (r = 0.996)



Figure S3: Five-parameter logistic curves for (A)10 min and (B) 120 min incubation periods obtained from the application of SP (in the concentration range of 7.65×10−15 to 7.65×10−6 g mL−1) in 0.1 mol L−1 PBS (pH 7.4) in the presence of 4.0 mmol L−1[Fe(CN)6]4−/3−.

Table S1: Cost estimate of manufacturing the AuNP-CB/PET-SPER immunosensor per unit.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Material** | **Origin** | **Total amount** | **Price (in USD)** | **Amount**  **(200 units)** | **Price**  **(200 units)**  **(in USD)** |
| AuNPs | Lab synthesis | 92.59 mL | 2.69 | 2 mL | 0.058 |
| Carbon black | Vulcan XC72R/CABOT | 1000 g | 0.90 | 2 g | 0.0018 |
| Cystamine | nFinitu/C.I.I | 25 g | 71.76 | 3.8575 mg | 0.011 |
| Glutaraldehyde | 25%, 1.0 L | 250 g | 9.12 | 0.125 g | 0.0045 |
| BSA | nFinitu | 25 g | 178.06 | 0.05 g | 0.356 |
| Anti-SP Ab | Sino Biological | 100 mg | 749.64 | 5 mg | 37.48 |
| Spike protein | Sino Biological | 100 mg | 838.67 | 0.385 mg | 3.23 |
| Carbon ink / 200 SPE | | | | | |
| Nail polish | Cora© | 27 g | 1.08 | 27 g | 1.08 |
| Graphite powder | Fischer Chemical | 18.9 g | 2.24 | 18.9 g | 2.24 |
| Silver ink | EMS | 1.75 g | 12.59 | 1.75 g | 12.59 |
|  |  |  |  | **Total** | **57.05** |
|  |  |  |  | **Total / Unit** | **0.285** |

**References**

[1] I. Lavagnini, R. Antiochia, F. Magno, An Extended Method for the Practical Evaluation of the Standard Rate Constant from Cyclic Voltammetric Data, Electroanalysis 16(6) (2004) 505-506. <https://doi.org/10.1002/elan.200302851>