TABLE

Table S1. The factors and their level in Box-Behnken experimental design for AA

Batch no.	Coded variable levels			Natural variable levels			Peak current of AA (μA)
	Z_1	Z_2	Z_3	Z_1	Z_2	Z_3	
1	+1	+1	0	10	12	0.08	2.25 ± 0.04[(a)]
2	0	+1	-1	6	12	0.01	2.37 ± 0.01
3	0	-1	+1	6	4	0.15	1.91 ± 0.01
4	0	0	0	6	8	0.08	2.39 ± 0.04
5	0	0	0	6	8	0.08	2.41 ± 0.04
6	-1	0	+1	2	8	0.15	1.89 ± 0.02
7	+1	0	-1	10	8	0.01	2.30 ± 0.02
8	0	+1	+1	6	12	0.15	2.08 ± 0.01
9	0	0	0	6	8	0.08	2.47 ± 0.01
10	0	-1	-1	6	4	0.01	2.16 ± 0.01
11	+1	0	+1	10	8	0.15	1.94 ± 0.01
12	+1	-1	0	10	4	0.08	1.93 ± 0.01
13	-1	-1	0	2	4	0.08	1.88 ± 0.01
14	-1	0	-1	2	8	0.01	2.05 ± 0.01
15	-1	+1	0	2	12	0.08	1.98 ± 0.00

[a]*Mean ± Standard error (n = 4)*

Table S1 shows the order of experiments according to Box-Behnken experimental design for AA. The rightmost column provides the values of peak current corresponding to each experiment.

Table S2. The factors and their level in Box-Behnken experimental design for PA

Batch no.	Coded variable levels			Natural variable levels			Peak current of PA (μA)
	Z_1	Z_2	Z_3	Z_1	Z_2	Z_3	
1	+1	+1	0	10	12	0.08	4.48 ± 0.28[a]
2	0	+1	-1	6	12	0.01	4.95 ± 0.06
3	0	-1	+1	6	4	0.15	3.21 ± 0.19
4	0	0	0	6	8	0.08	5.29 ± 0.31
5	0	0	0	6	8	0.08	5.18 ± 0.26
6	-1	0	+1	2	8	0.15	3.13 ± 0.18
7	+1	0	-1	10	8	0.01	4.71 ± 0.28
8	0	+1	+1	6	12	0.15	3.79 ± 0.25
9	0	0	0	6	8	0.08	5.42 ± 0.11
10	0	-1	-1	6	4	0.01	4.09 ± 0.26
11	+1	0	+1	10	8	0.15	3.30 ± 0.19
12	+1	-1	0	10	4	0.08	3.30 ± 0.13
13	-1	-1	0	2	4	0.08	3.13 ± 0.18
14	-1	0	-1	2	8	0.01	3.66 ± 0.24
15	-1	+1	0	2	12	0.08	3.41 ± 0.22

[a]*Mean ± Standard error (n = 4)*

Table S2 shows the order of experiments according to Box-Behnken experimental design for PA. The rightmost column provides the values of peak current corresponding to each experiment.

Table S3. The factors and their level in Box-Behnken experimental design for CA

Batch no.	Coded variable levels			Natural variable levels			Peak current of CA (μA)
	Z_1	Z_2	Z_3	Z_1	Z_2	Z_3	
1	+1	+1	0	10	12	0.08	3.42 ± 0.43[a]
2	0	+1	-1	6	12	0.01	4.08 ± 0.05
3	0	-1	+1	6	4	0.15	2.30 ± 0.25
4	0	0	0	6	8	0.08	3.96 ± 0.52
5	0	0	0	6	8	0.08	3.91 ± 0.33
6	-1	0	+1	2	8	0.15	2.16 ± 0.23
7	+1	0	-1	10	8	0.01	3.59 ± 0.46
8	0	+1	+1	6	12	0.15	2.82 ± 0.35
9	0	0	0	6	8	0.08	3.99 ± 0.21
10	0	-1	-1	6	4	0.01	3.12 ± 0.39
11	+1	0	+1	10	8	0.15	2.42 ± 0.26
12	+1	-1	0	10	4	0.08	2.39 ± 0.10
13	-1	-1	0	2	4	0.08	2.22 ± 0.24
14	-1	0	-1	2	8	0.01	2.70 ± 0.34
15	-1	+1	0	2	12	0.08	2.50 ± 0.29

[a]*Mean ± Standard error (n = 4)*

Table S3 shows the order of experiments according to Box-Behnken experimental design for CA. The rightmost column provides the values of peak current corresponding to each experiment.

Table S4. Estimated effects and coefficients for the models

Term	AA		PA		CA	
	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value
Constant	2.42	0.000	5.29	0.000	3.95	0.000
z_1	0.08	0.000	0.31	0.000	0.28	0.000
z_2	0.10	0.000	0.38	0.000	0.37	0.000
z_3	-0.13	0.000	-0.48	0.000	-0.45	0.000
z_1^2	-0.25	0.000	-1.03	0.000	-0.86	0.000
z_2^2	-0.16	0.000	-0.68	0.000	-0.45	0.000
z_3^2	-0.13	0.000	-0.56	0.000	-0.37	0.000
z_1z_2	0.05	0.000	0.23	0.000	0.19	0.017
z_1z_3	-0.05	0.000	-0.22	0.000	-0.16	0.043
z_2z_3	-0.01	0.083	-0.03	0.534	-0.06	0.462

Table S4 presents estimated effects and coefficients of second-order polynomial equations. All the statistical and mathematical calculations were conducted using Minitab version 16.

Table S5. Effect of interferents ($NaNO_3$) on peak current ErGO/GCE

Interferent : analyte (M/M)	AA		PA		CA	
	I_p	RE (%)	I_p	RE (%)	I_p	RE (%)
0 : 1	2.3 ± 0.07[(*)]	0.00	5.61 ± 0.35	0.00	3.07 ± 0.30	0.00
100 : 1	2.21 ± 0.09	-3.70	5.71 ± 0.50	1.73	3.21 ± 0.24	4.57
400 : 1	2.40 ± 0.11	4.53	5.74 ± 0.29	2.18	3.20 ± 0.13	4.52
1000 : 1	2.38 ± 0.05	3.45	5.72 ± 0.13	1.93	3.18 ± 0.06	3.70
1900 : 1	2.41 ± 0.01	4.91	5.77 ± 0.10	2.82	3.18 ± 0.18	3.81
3100 : 1	2.41 ± 0.05	4.93	5.68 ± 0.42	1.17	3.15 ± 0.20	2.62

[(*)] *Mean ± Standard error (n = 4)*

Table S5 shows that $NaNO_3$ does not interfere the peak currents of AA, PA and CA.

Table S6. Effect of interferents (K_2CO_3) on peak current ErGO/GCE

Interferent : analyte (M/M)	AA		PA		CA	
	I_p	RE (%)	I_p	RE (%)	I_p	RE (%)
0 : 1	2.41 ± 0.02	0.00	5.24 ± 0.17	0.00	4.14 ± 0.16	0.00
100 : 1	2.40 ± 0.01	-0.55	5.22 ± 0.11	-0.55	3.99 ± 0.21	-0.55
400 : 1	2.41 ± 0.04	-0.31	5.18 ± 0.26	-0.31	4.01 ± 0.33	-0.31
1000 : 1	2.41 ± 0.04	-0.31	5.18 ± 0.26	-0.31	4.01 ± 0.33	-0.31
1900 : 1	2.4 ± 0.04	-0.55	5.18 ± 0.12	-0.55	4.04 ± 0.18	-0.55
3100 : 1	2.37 ± 0.01	-1.81	5.15 ± 0.06	-1.81	4.02 ± 0.14	-1.81

Table S6 shows that K_2CO_3 does not interfere the peak currents of AA, PA and CA.

Table S7. Effect of interferents ($CaCl_2$) on peak current ErGO/GCE

Interferent : analyte (M/M)	AA		PA		CA	
	I_p	RE (%)	I_p	RE (%)	I_p	RE (%)
0 : 1	2.36 ± 0.03	0.00	5.09 ± 0.15	0.00	4.12 ± 0.27	0.00
100 : 1	2.31 ± 0.03	-2.22	5.02 ± 0.26	-1.30	3.93 ± 0.32	-4.67
400 : 1	2.27 ± 0.01	-3.85	5.01 ± 0.10	-1.43	3.96 ± 0.19	-3.99
1000 : 1	2.28 ± 0.02	-3.35	5.05 ± 0.14	-0.67	3.99 ± 0.20	-3.20
1900 : 1	2.25 ± 0.01	-4.44	4.98 ± 0.22	-2.01	3.99 ± 0.18	-3.12
3100 : 1	2.26 ± 0.02	-4.22	5.01 ± 0.17	-1.49	3.96 ± 0.19	-4.02

Table S7 shows that $CaCl_2$ does not interfere the peak currents of AA, PA and CA.

Table S8. Effect of interferents $(NH_4)_2SO_4$ on peak current ErGO/GCE

Interferent : analyte (M/M)	AA		PA		CA	
	I_p	RE (%)	I_p	RE (%)	I_p	RE (%)
0 : 1	2.18 ± 0.06	0.00	5.08 ± 0.03	0.00	3.37 ± 0.14	0.00
100 : 1	2.09 ± 0.04	-4.05	5.02 ± 0.09	-1.17	3.40 ± 0.06	0.98
400 : 1	2.17 ± 0.03	-0.53	4.86 ± 0.05	-4.37	3.33 ± 0.12	-1.28
1000 : 1	2.17 ± 0.01	-0.36	4.96 ± 0.14	-2.46	3.31 ± 0.16	-1.77
1900 : 1	2.13 ± 0.08	-2.48	4.95 ± 0.41	-2.59	3.25 ± 0.24	-3.65
3100 : 1	2.17 ± 0.04	-0.72	4.97 ± 0.28	-2.27	3.22 ± 0.11	-4.47

Table S8 shows that $(NH_4)_2SO_4$ does not interfere the peak currents of AA, PA and CA.

Table S9. Effect of interferents (glucose) on peak current ErGO/GCE

Interferent : analyte (M/M)	AA		PA		CA	
	I_p	RE (%)	I_p	RE (%)	I_p	RE (%)
0 : 1	2.22 ± 0.02	0.00	4.71 ± 0.04	0.00	3.97 ± 0.19	0.00
10 : 1	2.18 ± 0.01	-1.75	4.71 ± 0.33	0.00	4.01 ± 0.36	0.87
40 : 1	2.15 ± 0.01	-2.86	4.86 ± 0.15	3.23	4.06 ± 0.16	2.07
100 : 1	2.18 ± 0.01	-1.86	4.56 ± 0.15	-3.17	3.72 ± 0.18	-6.27
190 : 1	2.13 ± 0.02	-3.95	4.64 ± 0.18	-1.59	4.06 ± 0.15	2.28
310 : 1	2.14 ± 0.01	-3.38	4.69 ± 0.09	-0.46	4.14 ± 0.09	4.16

Table S9 shows that glucose does not interfere the peak currents of AA, PA and CA.

Table S10. Effect of interferents (glutamic acid) on peak current ErGO/GCE

Interferent : analyte (M/M)	AA		PA		CA	
	I_p	RE (%)	I_p	RE (%)	I_p	RE (%)
0 : 1	2.12 ± 0.02	0.00	4.71 ± 0.04	0.00	3.97 ± 0.19	0.00
10 : 1	2.18 ± 0.00	2.77	4.70 ± 0.34	-0.24	3.81 ± 0.37	-4.13
40 : 1	2.15 ± 0.01	1.73	4.86 ± 0.15	3.23	4.06 ± 0.16	2.07
100 : 1	2.18 ± 0.01	2.83	4.50 ± 0.18	-4.50	4.03 ± 0.20	1.44
190 : 1	2.13 ± 0.02	0.59	4.64 ± 0.18	-1.59	4.06 ± 0.10	2.28
310 : 1	2.14 ± 0.01	1.18	4.69 ± 0.09	-0.46	4.14 ± 0.09	4.16

Table S10 shows that glutamic acid does not interfere the peak currents of AA, PA and CA.

Table S11. Effect of interferents (benzoic acid) on peak current ErGO/GCE

Interferent : analyte (M/M)	AA		PA		CA	
	I_p	RE (%)	I_p	RE (%)	I_p	RE (%)
0 : 1	1.89 ± 0.03	0.00	4.25 ± 0.25	0.00	3.45 ± 0.47	0.00
10 : 1	1.93 ± 0.06	1.84	4.28 ± 0.27	0.78	3.6 ± 0.46	4.51
40 : 1	1.94 ± 0.05	2.67	4.23 ± 0.28	-0.50	3.55 ± 0.63	2.99
100 : 1	1.92 ± 0.03	1.28	4.39 ± 0.37	3.29	3.54 ± 0.54	2.61
190 : 1	1.95 ± 0.03	2.79	4.21 ± 0.35	-0.99	3.55 ± 0.53	2.87
310 : 1	1.91 ± 0.02	0.68	4.39 ± 0.08	3.38	3.6 ± 0.06	4.25

Table S11 shows that benzoic acid does not interfere the peak currents of AA, PA and CA.

FIGURE

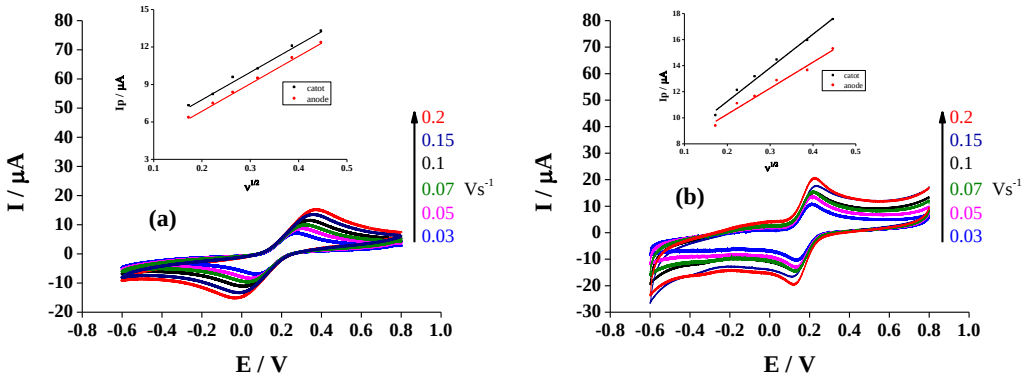

Figure S1. Cyclic voltammograms (CVs) in 1 mM $K_3[Fe(CN)_6]/K_4[Fe(CN)_6]$ at various scan rates of GCE (a) and ErGO/GCE (b).

Figure S1 presents CVs in in 1 mM $K_3[Fe(CN)_6]/K_4[Fe(CN)_6]$ at various scan rates to calculate the effective surface area of electrodes.

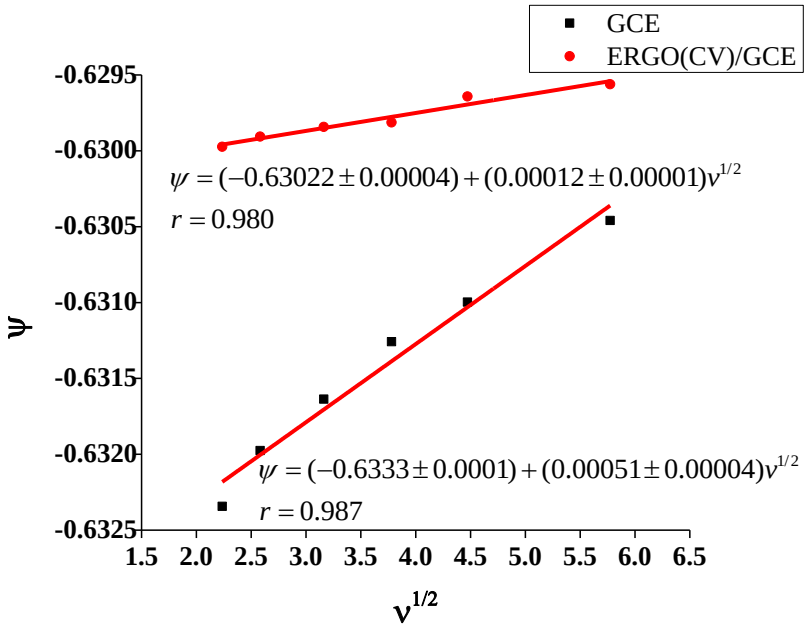

Figure S2. The plot of the kinetic parameter ψ and $\nu^{1/2}$.

Figure S2 presents the plot of the kinetic parameter ψ *vs.* $\nu^{1/2}$ to obtain the heterogeneous electron transfer rate constant.

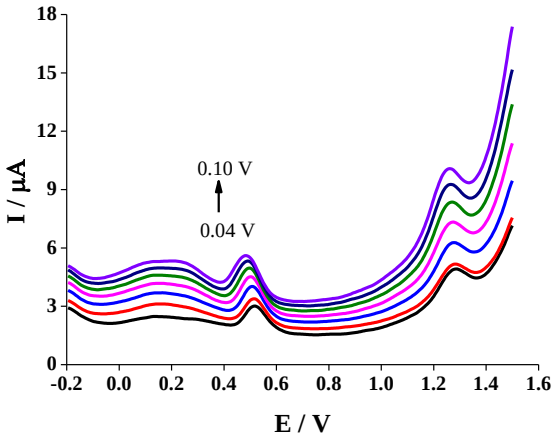

Figure S3. DP-ASV curves at different pulse amplitude (ΔE).

Figure S3 shows DP-ASV curves using the pulse amplitude in the range of 0.04 V to 0.10 V. The pulse amplitude of 0.06 V that provides a symmetric peak with low RSD (0.6 %).

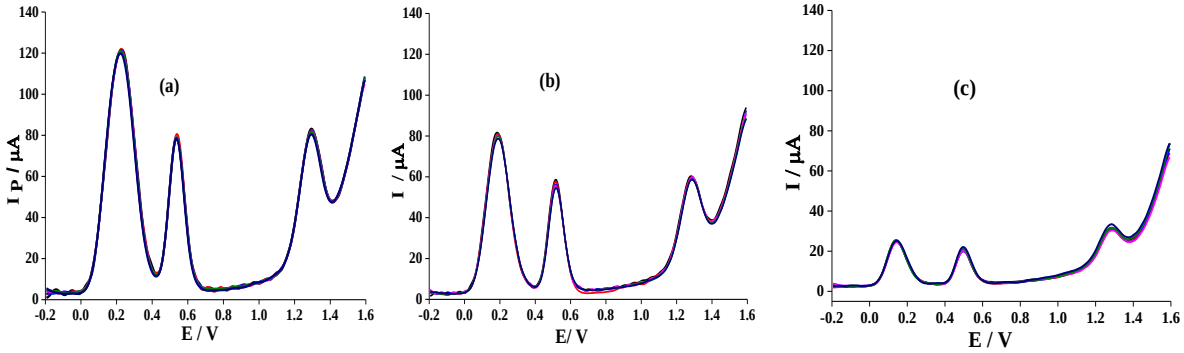

Figure S4. DP-ASV curves of C_{AA} = 100 µM; C_{PA} = C_{CA} = 10 µM (a) and C_{AA} = 50 µM, C_{PA} = C_{CA} = 5 µM (b) and C_{AA} = 10 µM, C_{PA} = C_{CA} = 1 µM (c).

Figure S4 represents the DP-ASV curves of AA, PA and CA in which each signal was obtained by successive measurements for nine times.