Electronic Supplementary Material (ESI) for RSC Advances.

Enzymeless biosensor based on β-NiS@rGO/Au nanocomposites for simultaneous detection of Ascorbic acid, Epinephrine and Uric acid

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1. Energy dispersive spectrum

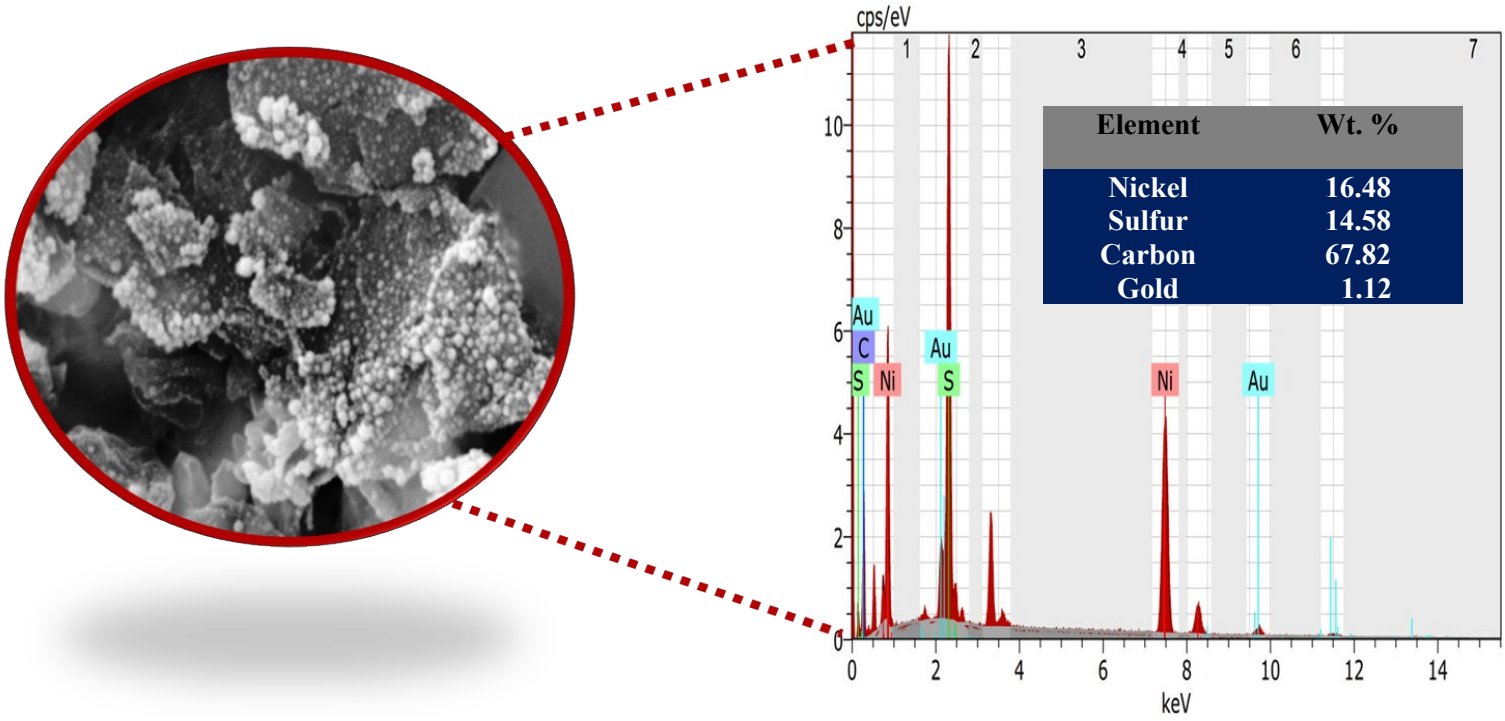


Fig. S1 EDX spectrum for β-NiS@rGO/AuNS hybrid composites with elemental atomic weight (%)

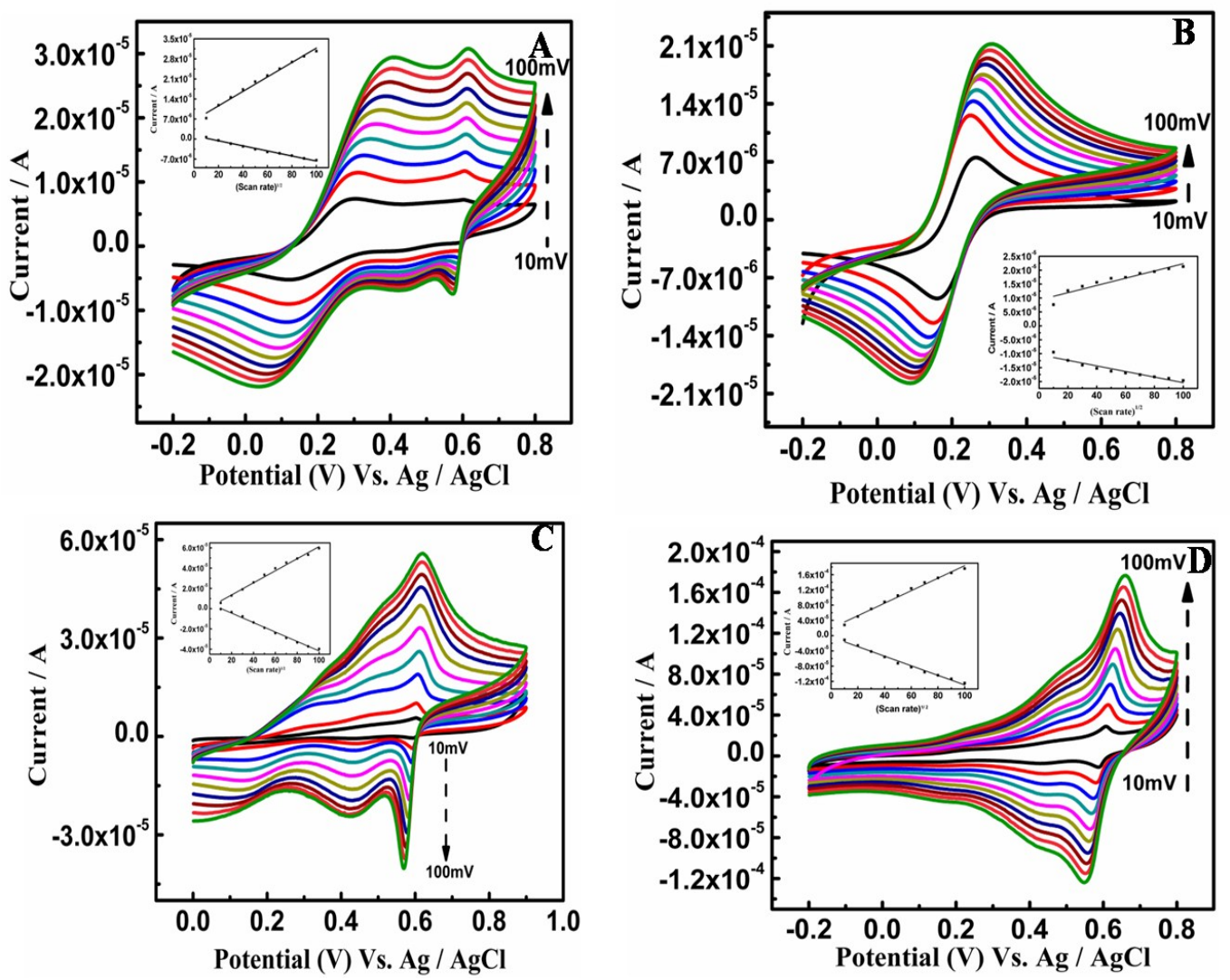


Fig. S2 CV behavior (A) β-NiS (B) GO (C) β-NiS@rGO (D) β-NiS@rGO/AuNS nano composites for different scan rate 10-100 mVs^{-1} in presence of 1 mM $[Fe(CN)_6]^{3-/4-}$ in 0.1 M KCl : Inset figure shows calibration curve of current versus square root of scan rate.

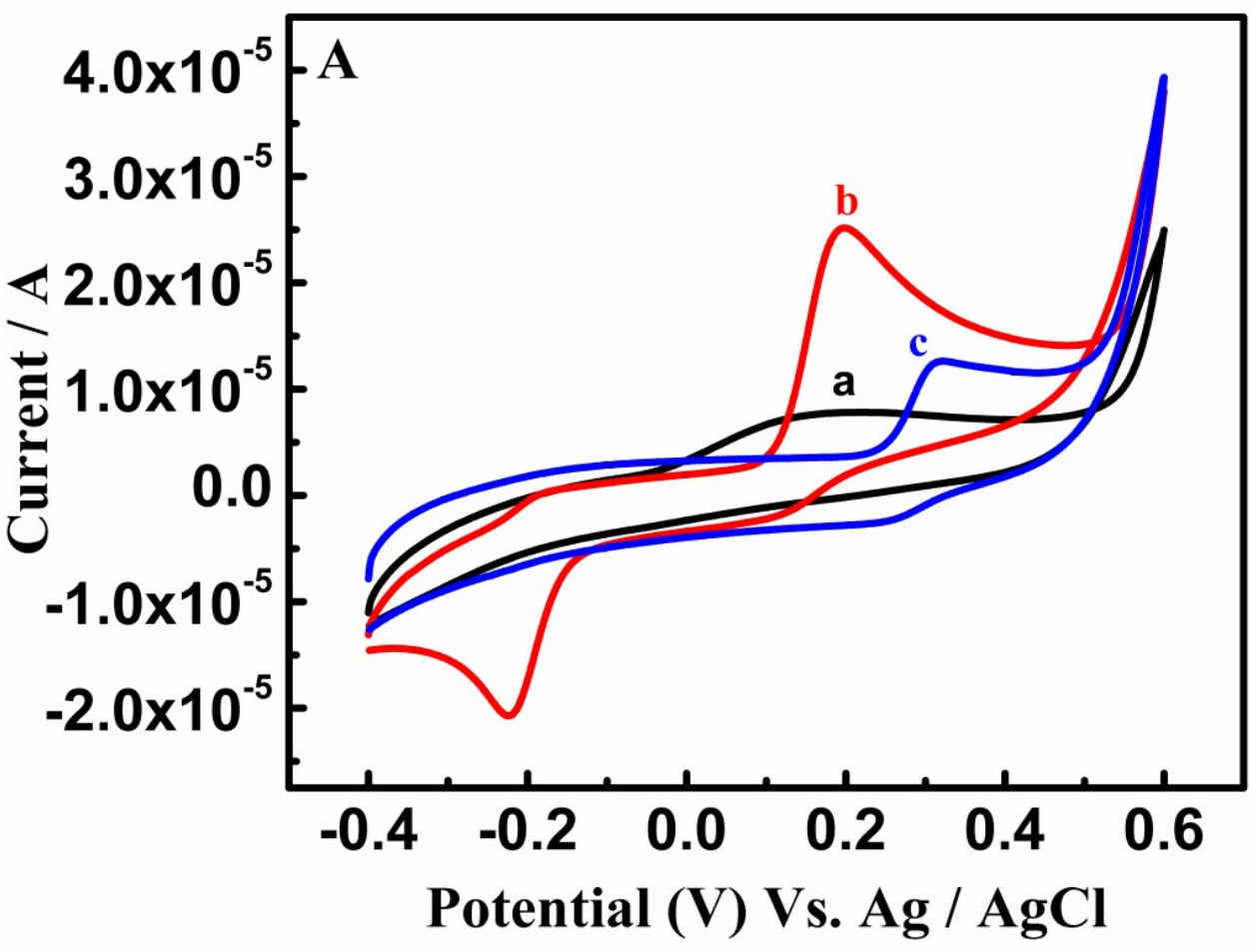


Fig. S3 500 µM of individual analyte of curve (a) AA (b) EP (c) UA in PBS (pH7.0) for the β-NiS@rGO/AuNS/GCE.

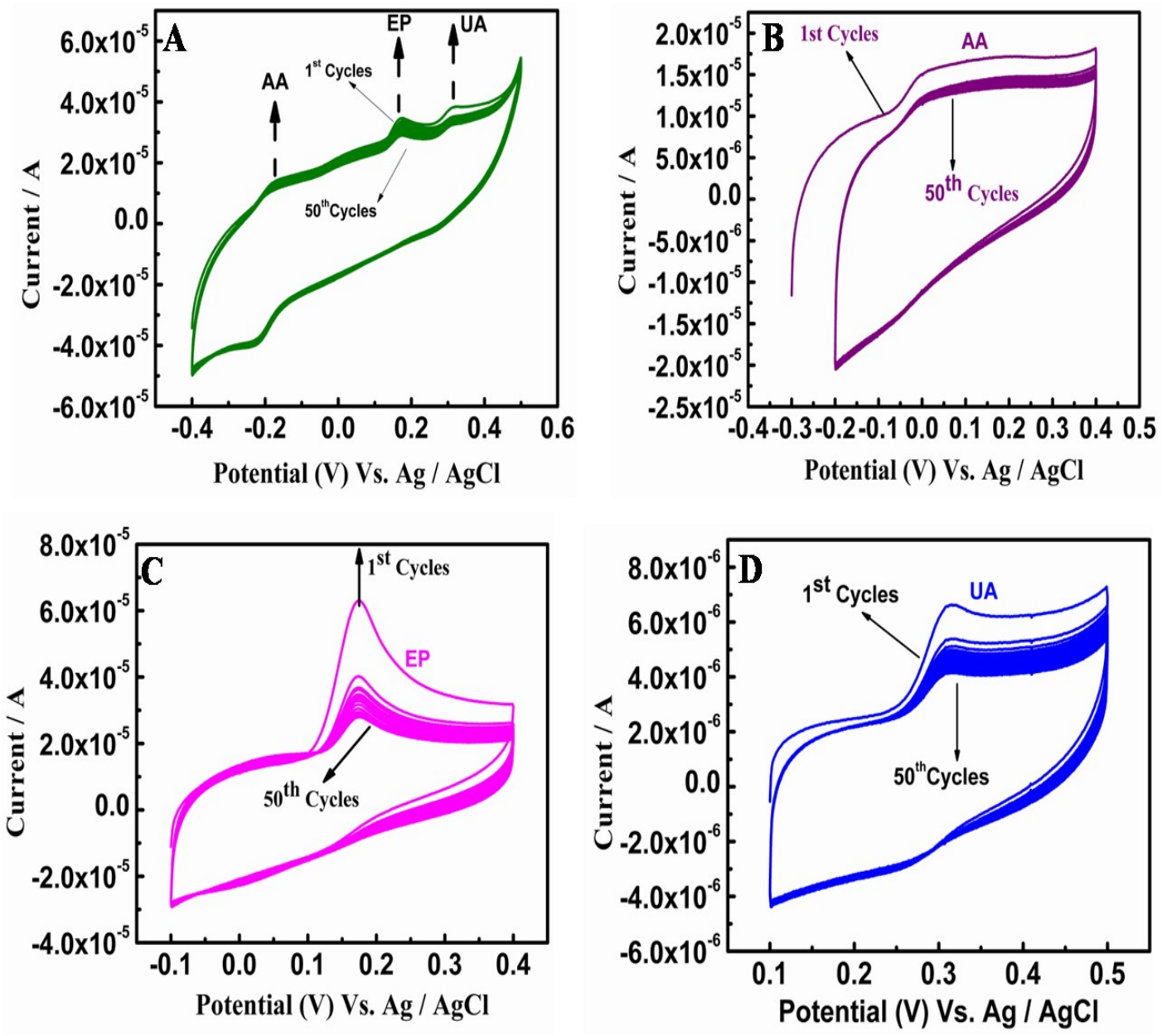


Fig. S4 stability studies (A) Simultaneous bahavior of AA, EP and UA (B) Individual behavior of AA (C) EP (d) UA on β-NiS@rGO/AuNS hybrid consecutive 50 cycles at scan rate 50mVs^{-1} presence of 1mM analyte in 0.1M PBS at (pH 7.0).

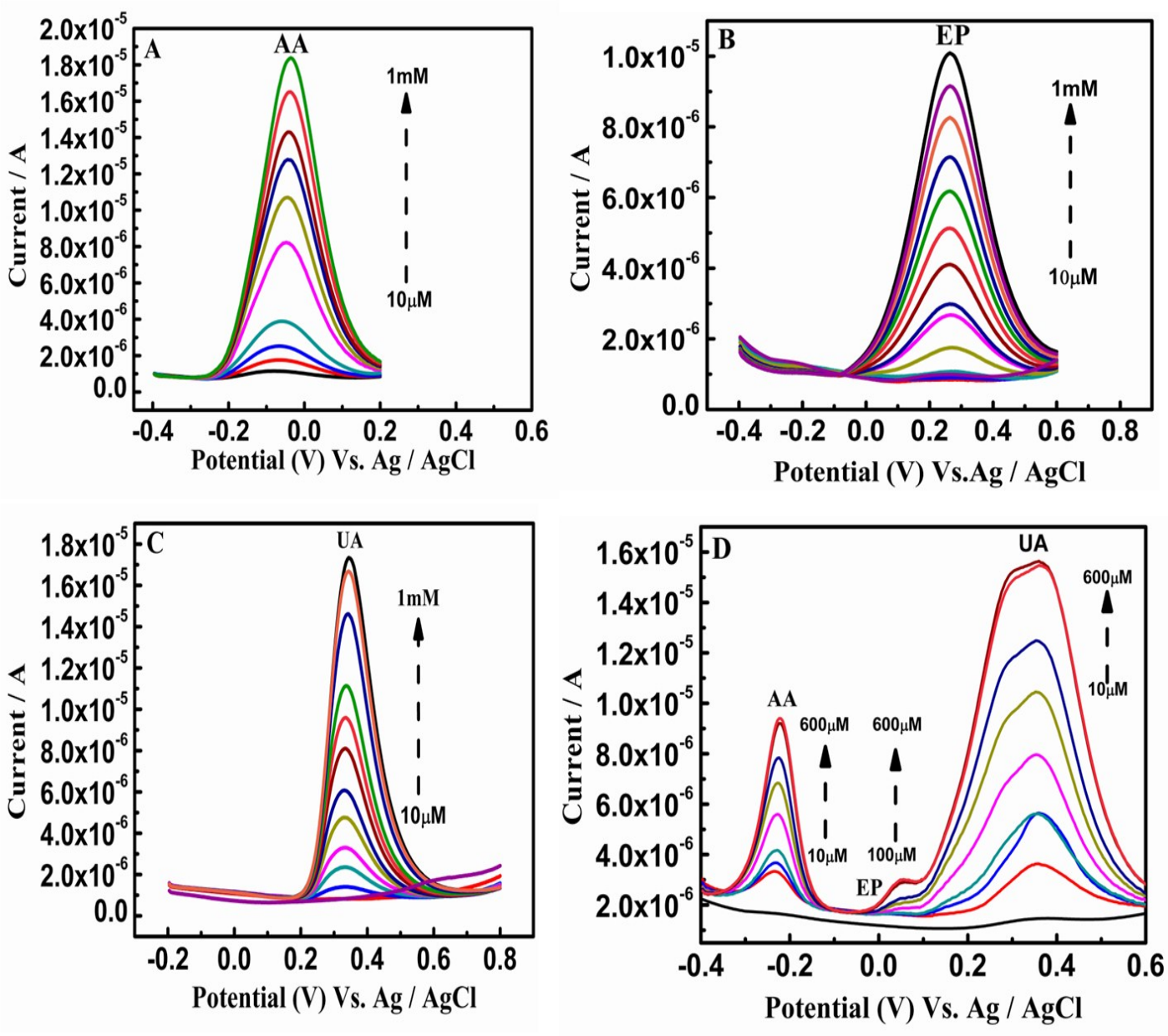


Fig. S5 SWV curves (A) Individual detection of AA 10 µM-1 mM, (B) EP 10 µM-1 mM and (C) UA 10 µM-1 mM (D) Simultaneous detection of AA 10 µM-600 µM, EP 100 µM-600 µM and UA 10 µM-600 µM on modified β-NiS@rGO composite for each analyte in 0.1M PBS (pH 7.0)

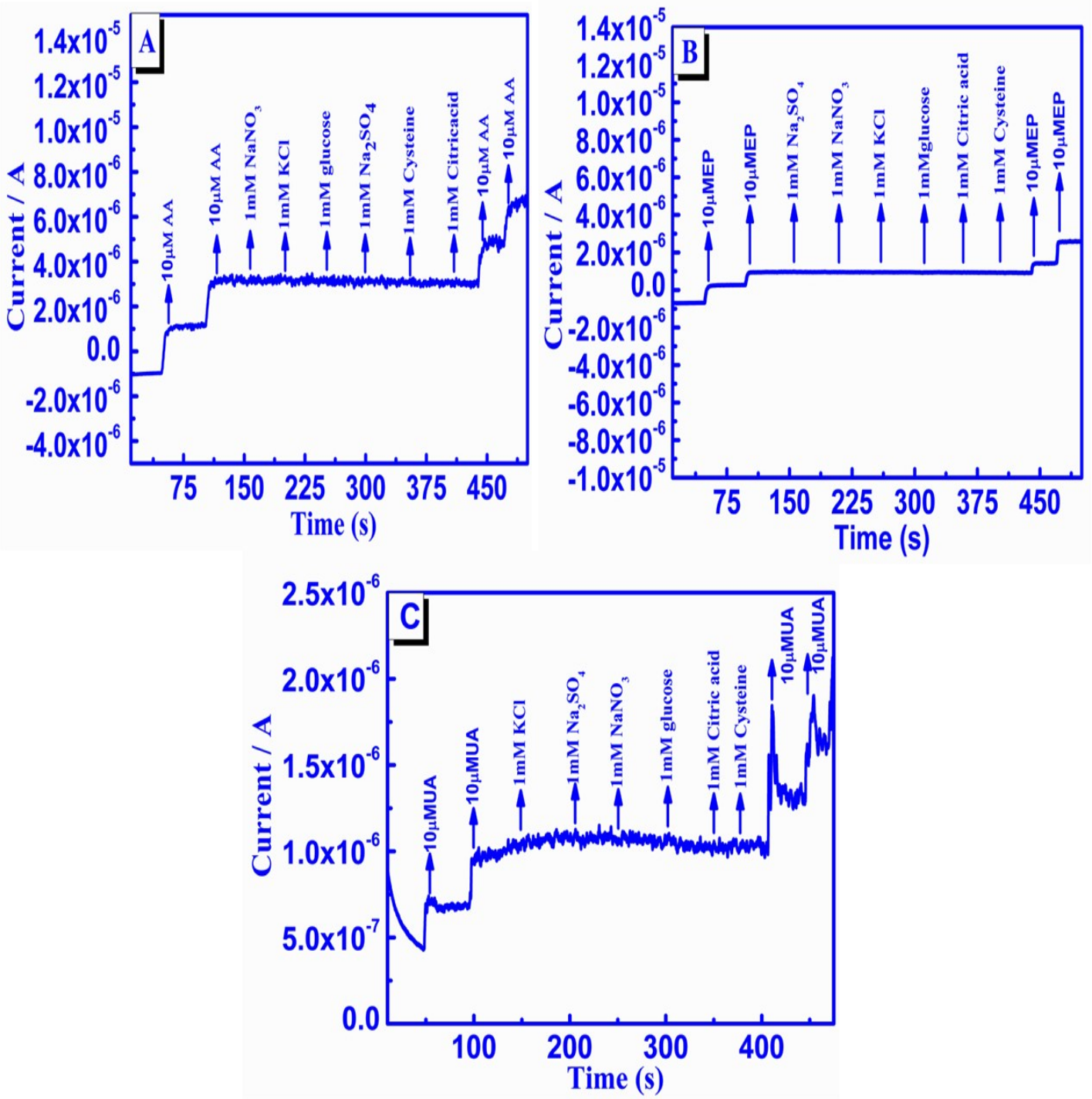
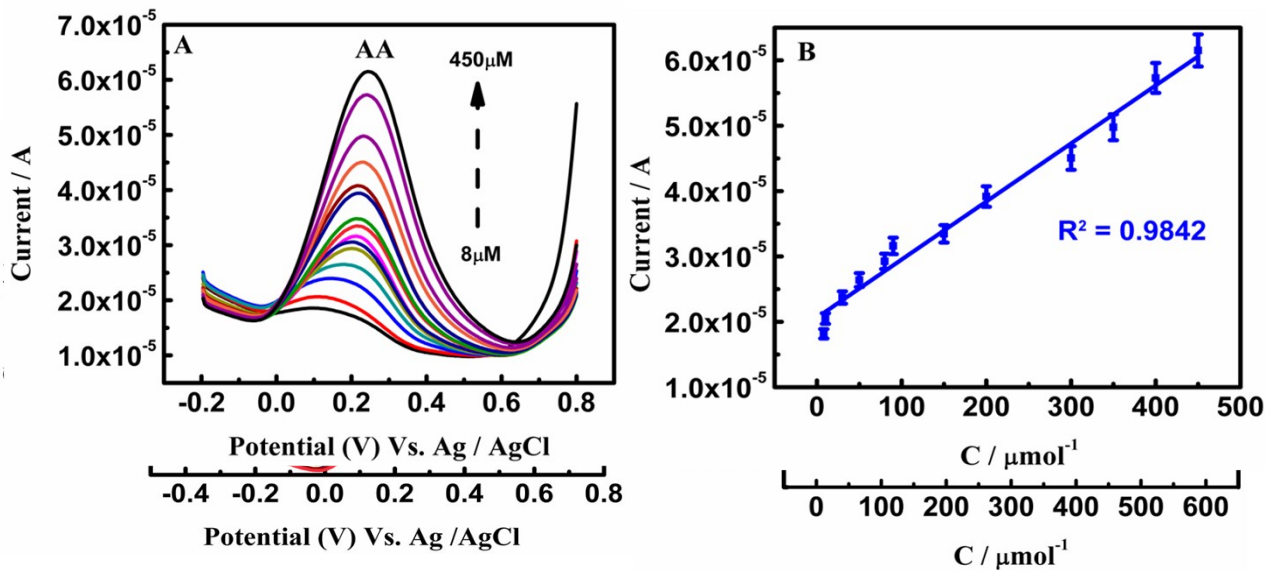

A
Current / A
Time (s)
10μM AA
10μM AA
1mM NaNO3
1mM KCl
1mM glucose
1mM Na2SO4
1mM Cysteine
1mM Citricacid
10μM AA
10μM AA
B
Current / A
Time (s)
10μMEP
10μMEP
1mM Na2SO4
1mM NaNO3
1mM KCl
1mMglucose
1mM Citric acid
1mM Cysteine
10μMEP
10μMEP
C
Current / A
Time (s)
10μMUA
10μMUA
1mM KCl
1mM Na2SO4
1mM NaNO3
1mM glucose
1mM Citric acid
1mM Cysteine
10μMUA
10μMUA

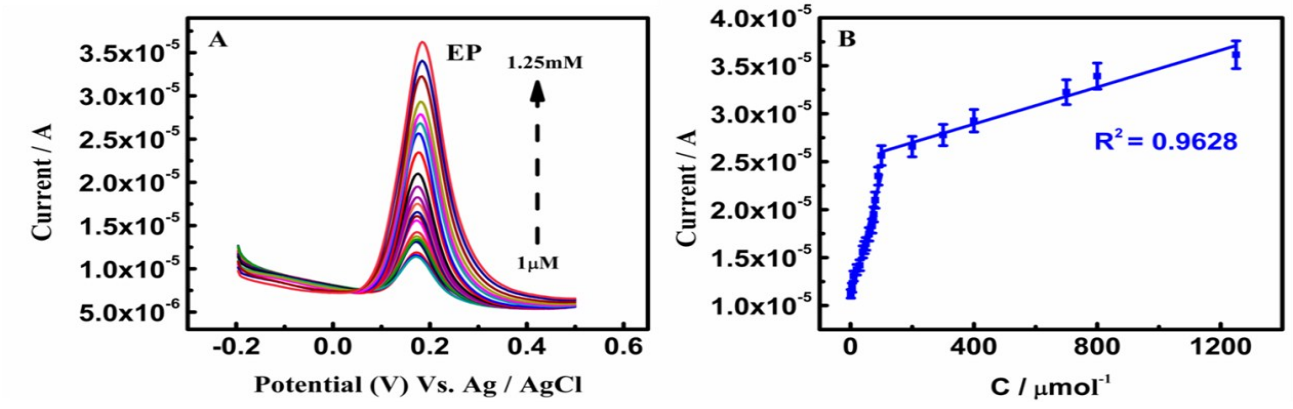
Fig. S6 Choronoamperometry responses of β-NiS@rGO/AuNS/GCE hybrid upon the successive addition of (a) 10 µM AA (b) 10 µM EP (c) 10 µM UA and 1 mM of other interfering substances into stirring PBS (0.1 M, pH 7.0),The applied fixed potential at 0.119, 0.150, and 0.294V for AA, EP and UA respectively.

(1) Vitamin C with biotin tablet

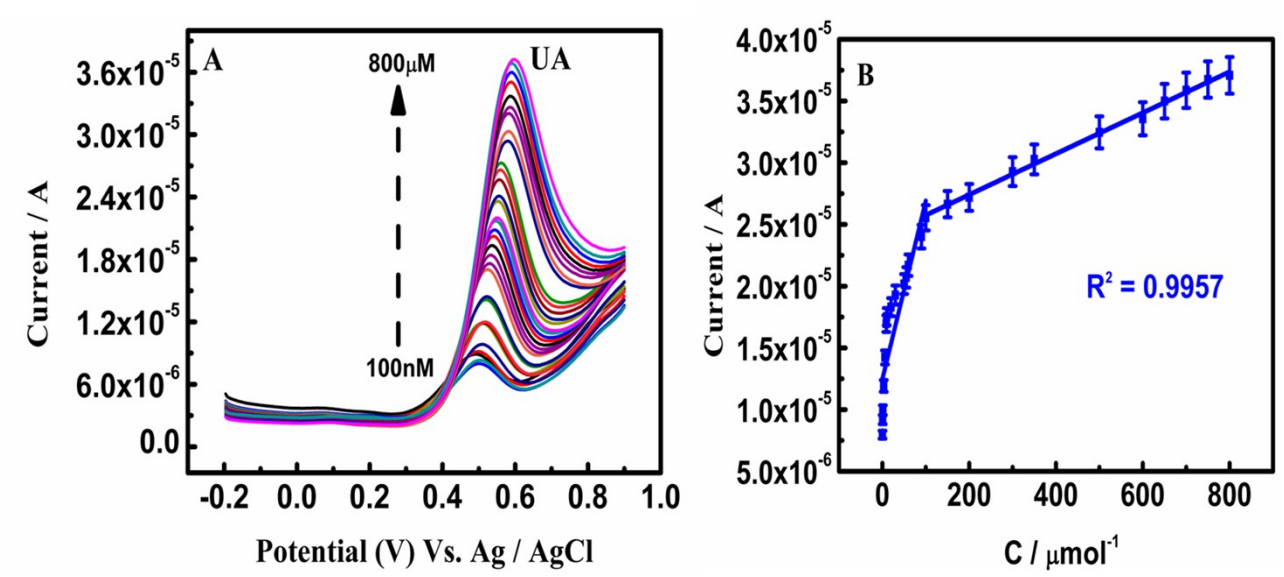


(2) Lemon fruit extract

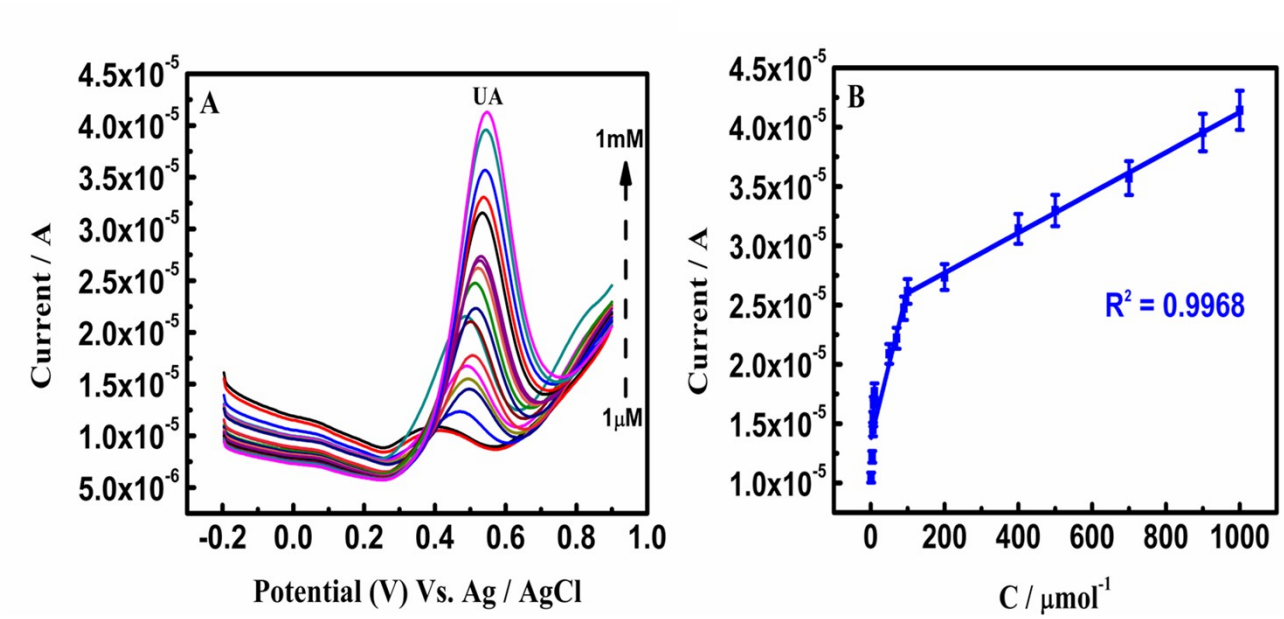
(3) Epinephrine hydrochloride injection



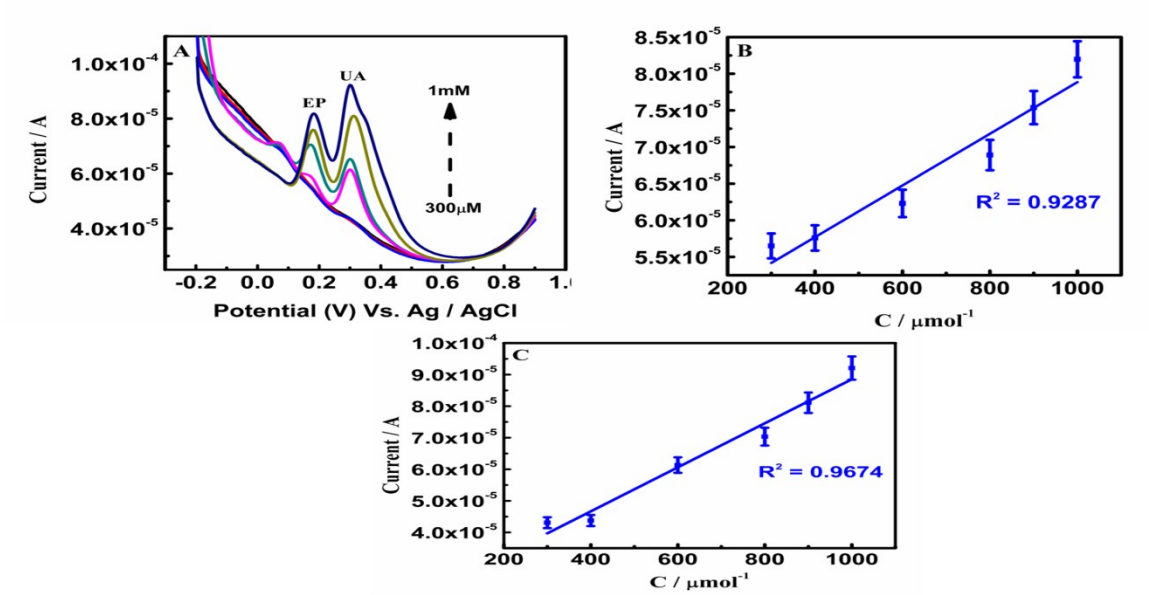
(4) Fresh human urine 1



(5) Fresh human urine 2



(6) Human serum



(7)

(8)

(9)

(10)

(7) Human blood

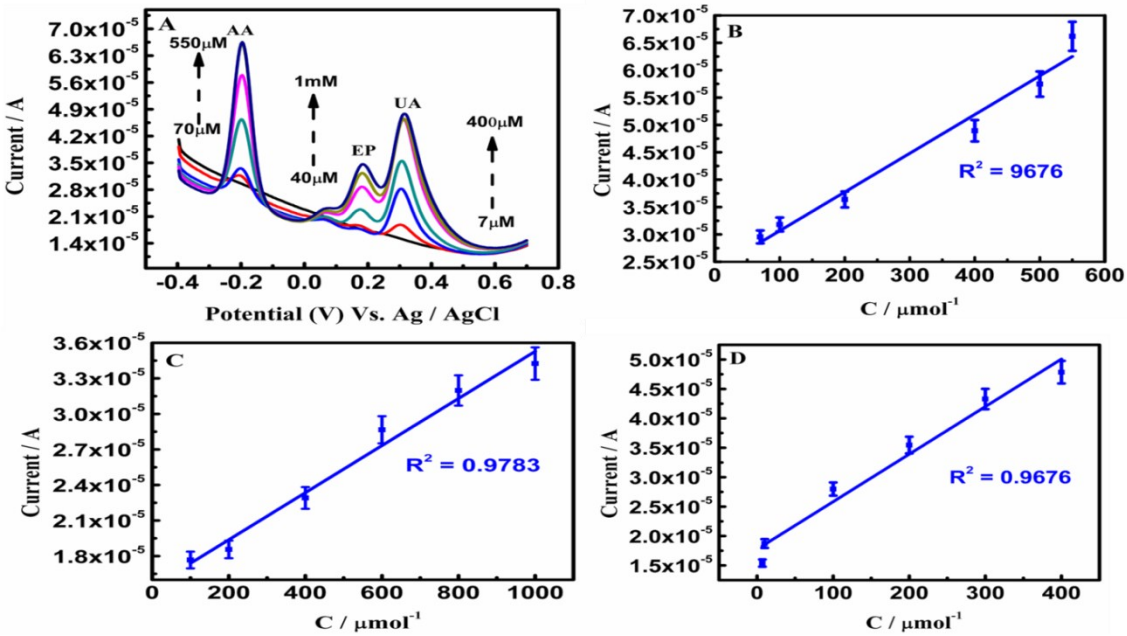


Fig. S7 SWV linear range response & calibration curve for practical utility of (1) Vitamin C with biotin tablet: AA (8-450 µM), (2) Lemon extract: AA (8 µM-600 µM) (3) EP hydrochloride injection : EP (1 µM-1.25 mM), (4) Fresh human urine 1: UA(100nM -800 µM), (5) Fresh human urine 2 : UA(1 µM-1 mM), (6) Human serum : EP, UA(300 µM-1 mM), (7) Human blood : AA(70 µM-550 µM), EP(40 µM- 1mM), UA(7 µM-400 µM).

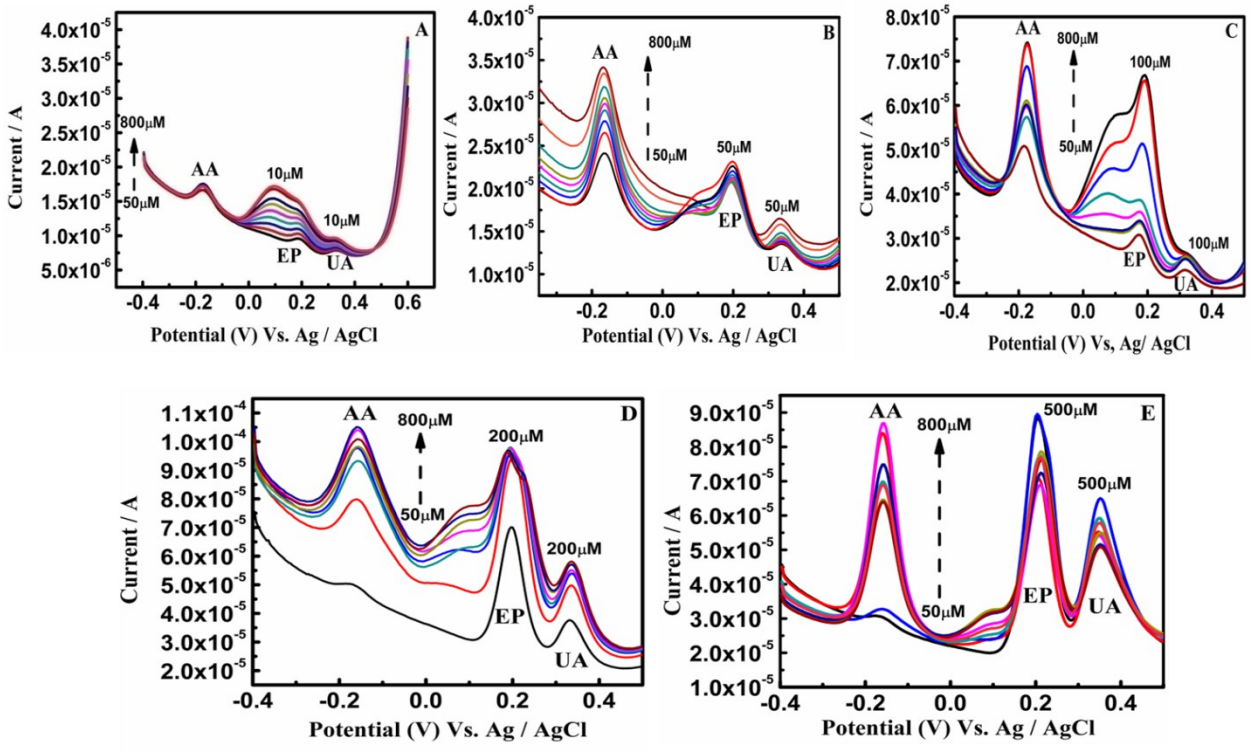


Fig. S8 SWV of constant concentration of EP, UA(10,50,100, 200 &500µM) and variable concentration of AA (50µM – 1mM)

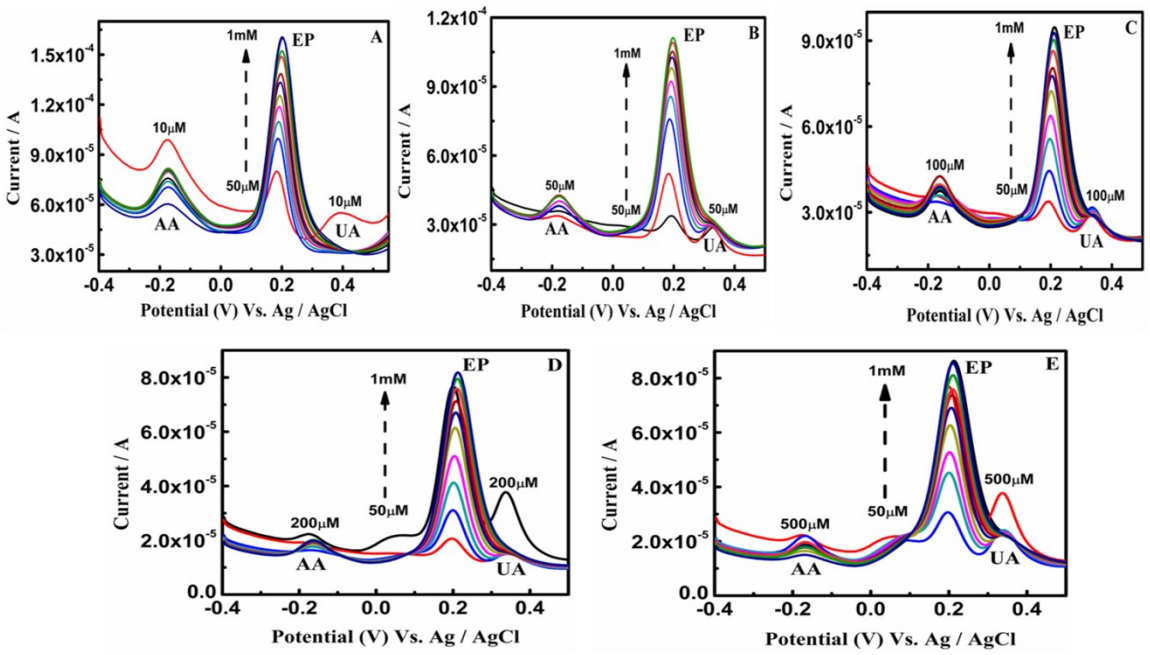


Fig.S9 SWV of constant concentration of AA, UA(10,50,100, 200 &500µM) and variable Concentration of EP (50µM – 1mM)

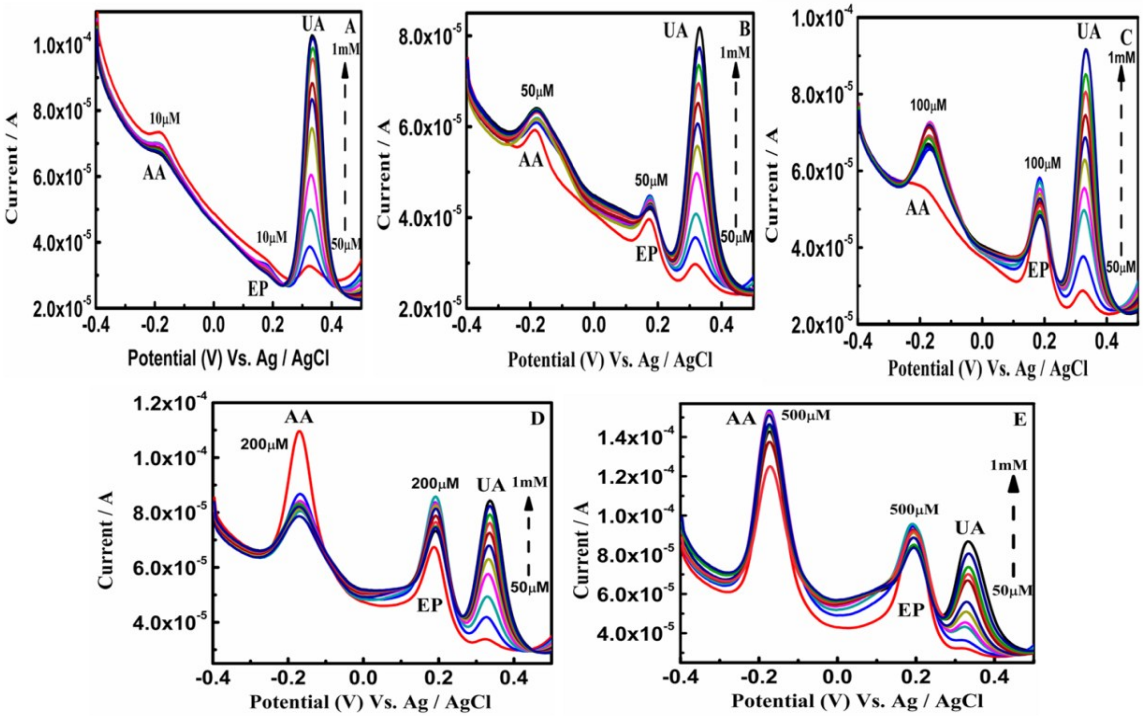


Fig.S10 SWV of constant concentration of AA, EP (10,50,100, 200 &500µM) and variable co ncentration of UA (50µM – 1mM)

S Table 1: Analytical performance of the different modified electrodes for the simultaneous determination of AA, EP and UA.

	Electrode material	Linear range(µM)			Detection limit(µM)			Ref
		AA	EP	UA	AA	EP	UA	
1	Caffeic acid / GCE	20 - 1000	2 - 80	5 - 300	7.0×10^{-6}	2.0×10^{-7}	6.0×10^{-7}	1
2	Poly (p-xylenolsulfonephthalein) / GCE	10 - 1343	2 - 390	0.1 - 560	4	0.1	80	2
3	RuOHCF/MWCNT/GCE	0.2 - 15	0.1 - 10	0.90 - 250	0.08	0.05	0.59	3
4	Poly(Adizol Black B) / GCE	2 – 1.970	0.1 - 64	0.1 – 1.700	0.01	0.007	0.02	4
5	PMG/MWCNT/GCE	0.4 -100	0.1 - 100	0.3 - 90	0.23	0.08	0.12	5
6	Poly(DA)-nanogold/GCE	40 -1000	1.0 - 80	0.8 - 100	5.0	0.1	0.06	6
7	Au-NPs/poly(BCG)/GCE	5.0 - 1320	4.0 - 903	7.0 - 1500	0.2	0.01	0.004	7

8	poly(p-aminophenol)/GCE	6.0 - 70.0	0.4 - 8.0	0.4 - 8.0	1.0×10^{-6}	6.5×10^{-9}	1.8×10^{-7}	8
9	β-NiS@rGO-Au / GCE	1μM – 1mM	2μM – 1mM	100nM – 1mM	682nM	1.3μM	6nM	This work

S Table 2: Analytical performance of the different real biological sample for the simultaneous determination of AA, EP and UA on β-NiS@rGO/AuNS hybrid.

Voltammetric analysis of AA, EP, UA recovery test performed in Vitamin C tablet, Epinephrine hydrochloride injection, Human urine, blood, serum, lemon extract with β-NiS@rGO / Au , pH = 7.0

Sample	Added (μM) [AA, EP, UA]	Obtained (μM) [AA, EP, UA]	Recovery (%) [AA, EP, UA]
Vitamin C tablet	250, –, –	250, –, –	100, –, –
Fresh human urine 1	– , –, 9	– , –, 9.05	– , –, 100.5
Fresh human urine 2	– , –, 30	– , –, 31	– , –, 103.3

– , 1000, 400	– , 975, 405	– , 97.5, 101.25
– , 500, –	– , 500, –	– , 100, –
200, – , –	190, – , –	95, –, –
7, 20, 6	7, 21.5, 6.6	100, 107.5, 110

References:

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