Supplementary information

Electrodeposition synthesis of reduced graphene oxide-carbon nanotube hybrids on indium tin oxide electrode for simultaneous electrochemical detection of ascorbic acid, dopamine and uric acid

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Preparation of GO

GO was prepared from natural graphite powder through a modified Hummers' method.[1] In a typical run, 1 g of graphite powder was added into 23 mL of H_2SO_4 (98%), then the mixture was stirring at room temperature for 24 h. After that, 0.1 g of $NaNO_3$ was introduced into the mixture and then the mixture was stirring for 30 min. Subsequently, the mixture was kept below 5 ºC by ice bath, and 3 g of $KMnO_4$ was slowly added into the mixture. After being heated to 35~40 ºC, the mixture was stirring for 10 min, and then 46 mL of water was added into above mixture during 25 min, followed by stirring for another 25 min. Finally, 140 mL of water and 10 mL of 30 wt% H_2O_2 were added into the mixture to stop the reaction. The unexploited graphite in the resulting mixture was removed and GO was obtained by thorough washing with water and centrifugation.

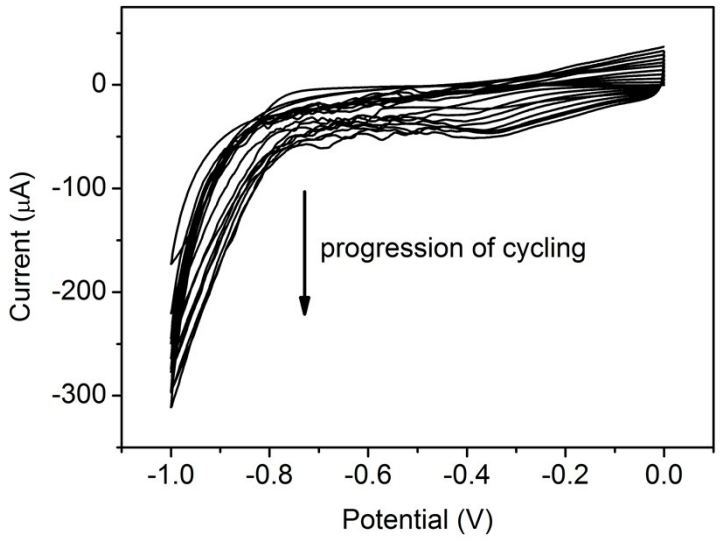

Fig. S1 CVs of ITO electrode with 10 potential cycles in GO-CNT dispersion. (scan rate: 50 mV s^{-1})

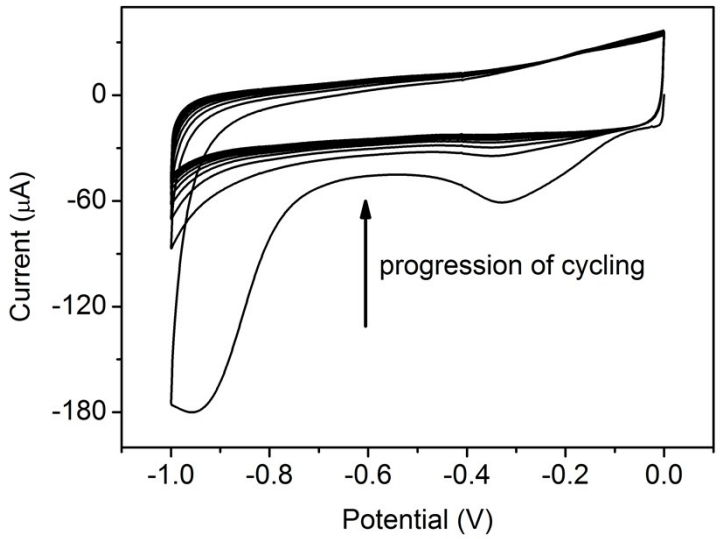

Fig. S2 CVs of GO-CNT/ITO electrode with 10 potential cycles in 0.2 M PBS/pH 6.5. (scan rate: 50 mV s^{-1})

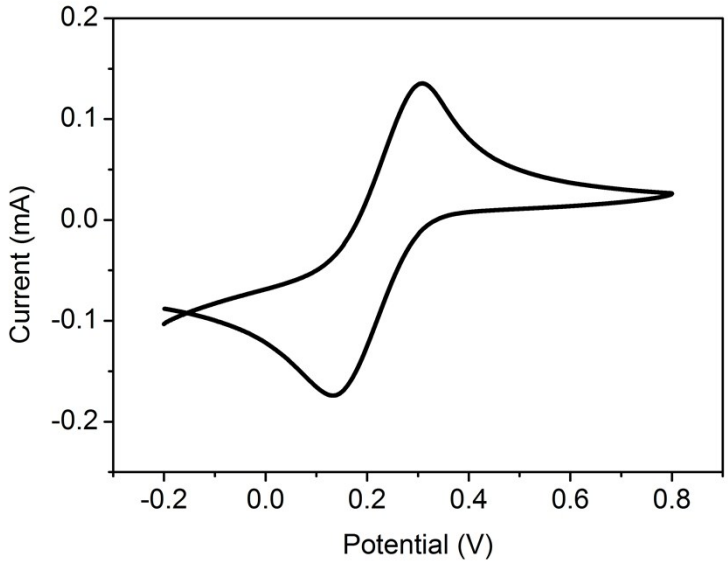

Fig. S3 Cyclic voltammogram of CNT/ITO electrode in potassium ferricyanide solution. (scan rate: 0.1 V s^{-1})

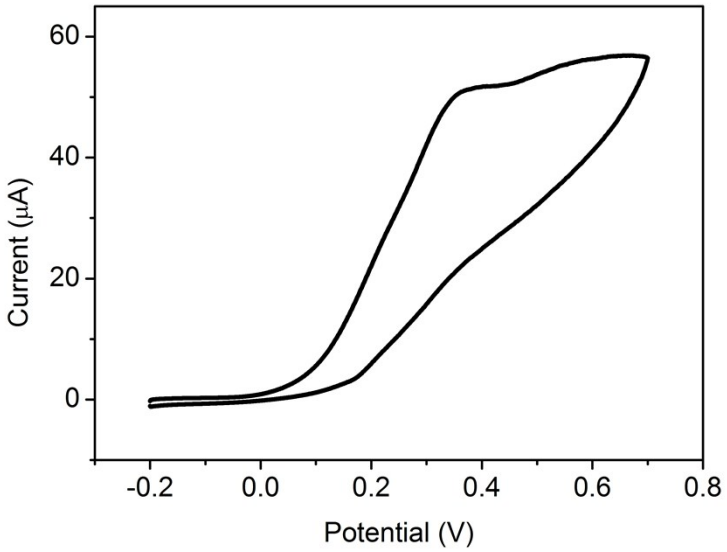

Fig. S4 Cyclic voltammogram of CNT/ITO electrode in 0.1 M PBS (pH 7.0) containing 1 mM AA, 0.1 mM DA and 0.1 mM UA. (scan rate: 50 mV s^{-1})

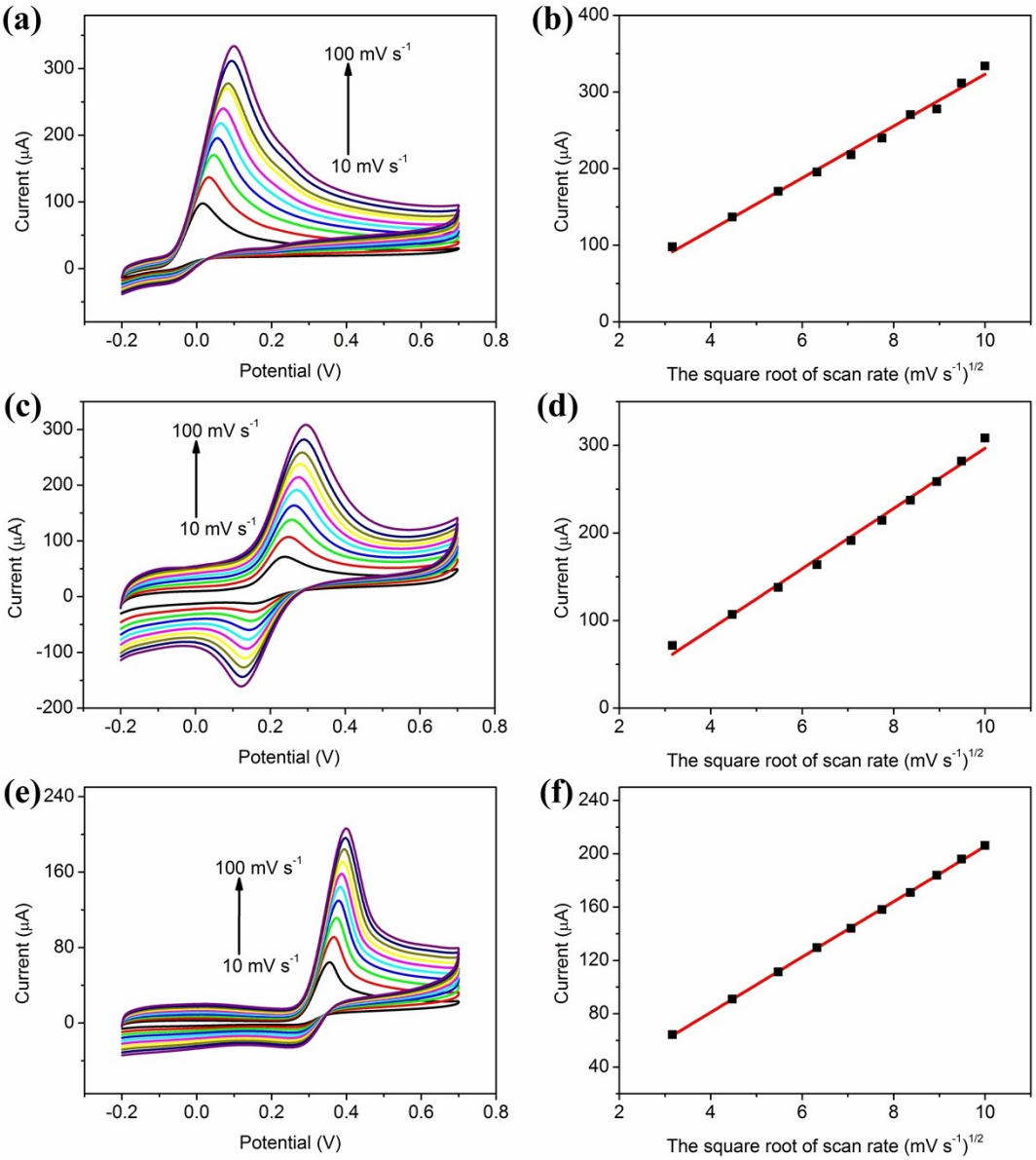

Fig. S5 (a) Cyclic voltammograms of rGO-CNT/ITO electrode at scan rates from 10 to 100 mV s^{-1} (in 0.1 M PBS/ pH 7.0 with 1 mM AA); (b) calibration plot of the square root of scan rate versus oxidation peak current. (c) CVs of rGO-CNT/ITO electrode at scan rates from 10 to 100 mV s^{-1} (in 0.1 M PBS/ pH 7.0 with 0.1 mM DA); (d) calibration plot of the square root of scan rate versus oxidation peak current. (e) CVs of rGO-CNT/ITO electrode at scan rates from 10 to 100 mV s^{-1} (in 0.1 M PBS/ pH 7.0 with 0.1 mM UA); (f) calibration plot of the square root of scan rate versus oxidation peak current.

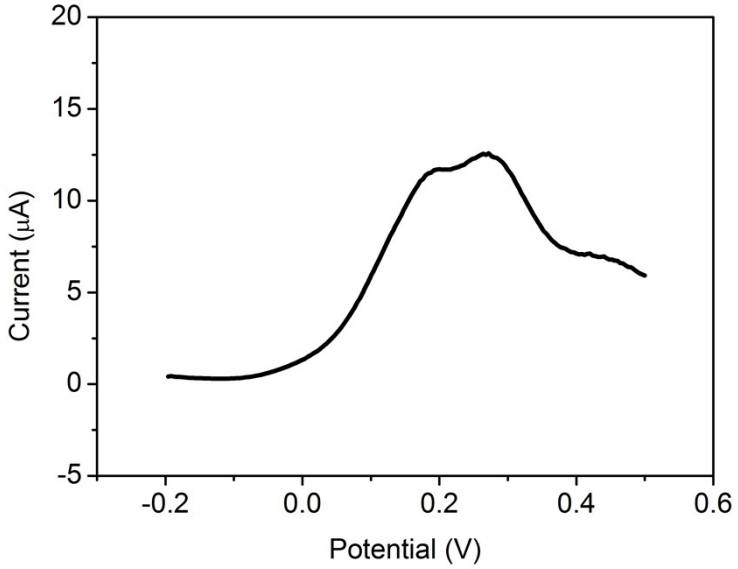

Fig. S6 DPV of CNT/ITO electrode in 0.1 M PBS (pH 7.0) containing 1 mM AA, 0.1 mM DA and 0.1 mM UA.

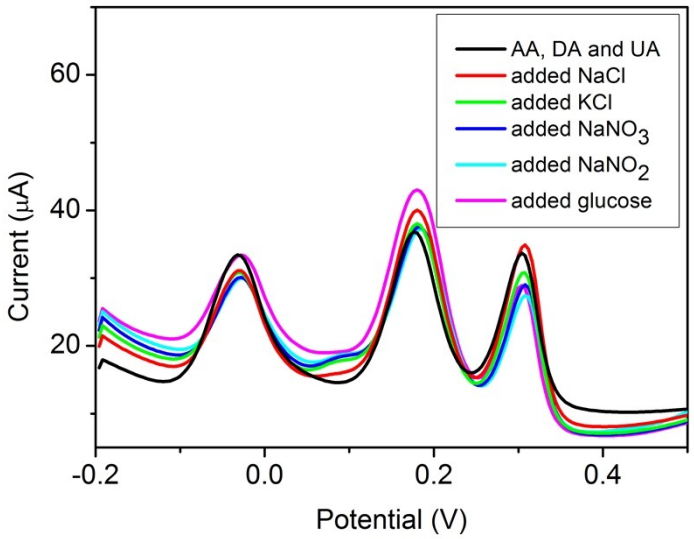

Fig. S7 DPVs of rGO-CNT/ITO electrode in 0.1 M PBS (pH 7.0) containing 100 μM AA, 3 μM DA and 5 μM UA (black line), and successively added 50 mM NaCl (red line), 50 mM KCl (green line), 50 mM $NaNO_3$ (blue line), 50 mM $NaNO_2$ (watchet line), 20 mM glucose (pink line).

Table S1 Comparison of results from this work and literature regarding performance of simultaneous electrochemical detection of AA, DA and UA assays based on rGO-based or CNT-based materials.

Electrode material	Linear range (μM)			Detection limit (μM)			Ref.[h]
	AA	DA	UA	AA	DA	UA	
SWCNH[a]/GCE[b]	30-400	0.2-3.8	0.06-10	5	0.06	0.02	3
HCNTs[c]/GCE	7.5-180	2.5-105	6.7-65	0.92	0.8	1.5	11
NG[d]/GCE	5-1300	0.5-170	0.1-20	2.2	0.25	0.045	12
MWCNT[e]/CCE[f]	15-800	0.5-100	0.55-90	7.71	0.31	0.42	29
ERGO[g]/GCE	500-2000	0.5-60	0.5-60	250	0.5	0.5	34
rGO/GCE	0.7-5	0.1-100	2-600	0.7	0.1	1	35
rGO-CNT/ITO	10-200	0.2-8	0.2-16	5.31	0.04	0.17	This work

[a] SWCNH-single-walled carbon nanohorn.

[b] GCE-glassy carbon electrode.

[c] HCNTs-helical carbon nanotubes.

[d] NG-nitrogen doped graphene.

[e] MWCNT-multi walled carbon nanotube.

[f] CCE-carbon-ceramic electrode.

[g] ERGO-electrochemically reduced graphene oxide.

[h] Please refer to Ref. number in the paper.

Table S2 Detection of AA, DA and UA at rGO-CNT/ITO in urine sample.

	Diluted urine sample (μM)	**C_{added} (μM)**	**$C_{detected}$ (μM)**	**Recovery (%)**
AA	0	100	95.7	95.7
DA	0	5	5.12	102.4
UA	10.51	5	15.33	96.4

Reference

1 W. S. Hummers Jr, and R. Offeman, *J. Am. Chem. Soc.*, 1958, **80**, 1339-1339.