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Flexible and conductive titanium carbide–carbon nanofibers for the simultaneous determination of ascorbic acid, dopamine and uric acid

Qiaohui Guo*, Tingting Wu, Lijuan Liu, Haoqing Hou, Shuiliang Chen, Li Wang*

Department of Chemistry and Chemical Engineering, Jiangxi Normal University,

Nanchang, Jiangxi 330022, China

*Corresponding Author: Qiaohui Guo, Ph.D.

Tel: (+86) 791-8812-0389; Fax: (+86) 791-8812-0536

E-mail address:guoqiaohui@jxnu.edu.cn

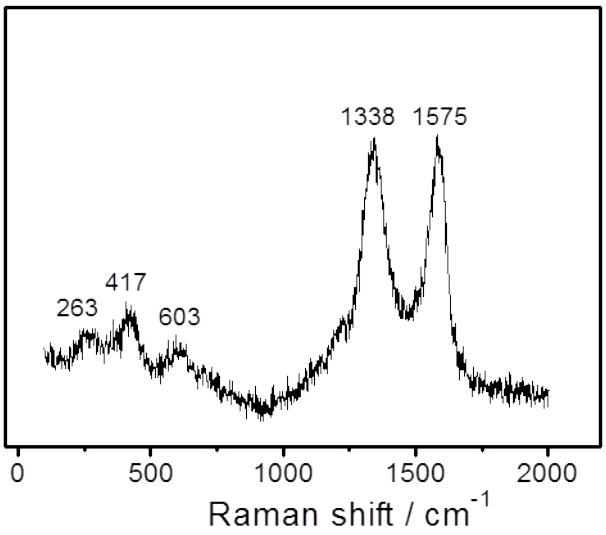


Fig. S1. Raman spectrum of TCNFs.

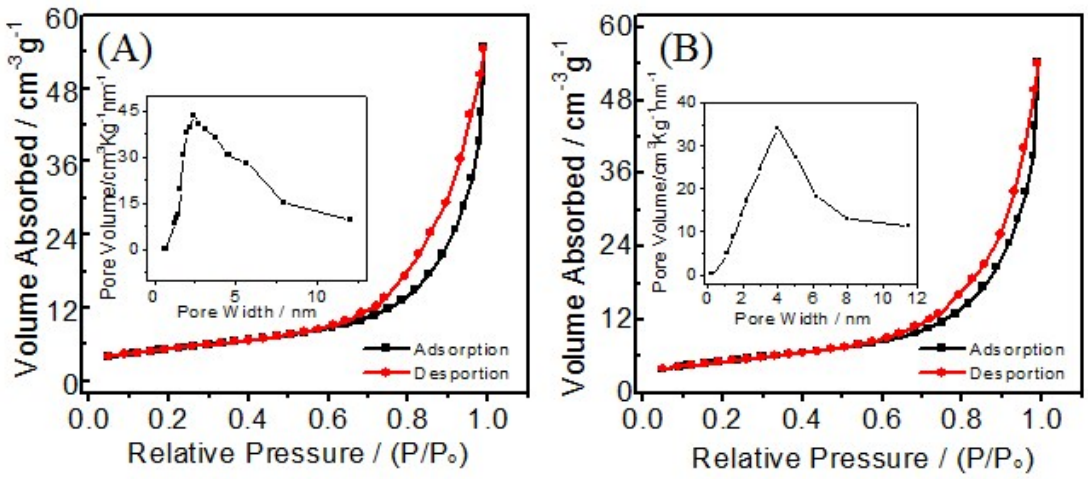


Fig. S2 Nitrogen adsorption-desorption isotherms of CNFs (A) and TCNFs (B); Inset is the pore size distribution, respectively.

Table S1 Physicochemical parameters of TCNFs nanohybrids.

Sample	S_{BET} (m^2g^{-1})	V_t (Lg^{-1})	S_{mic} (m^2g^{-1})	V_{mic} (mLg^{-1})	d (nm)
TCNFs	169.2	0.2885	57.3	0.0786	3.8
CNFs	135.6	0.2352	46.5	0.0758	4.2

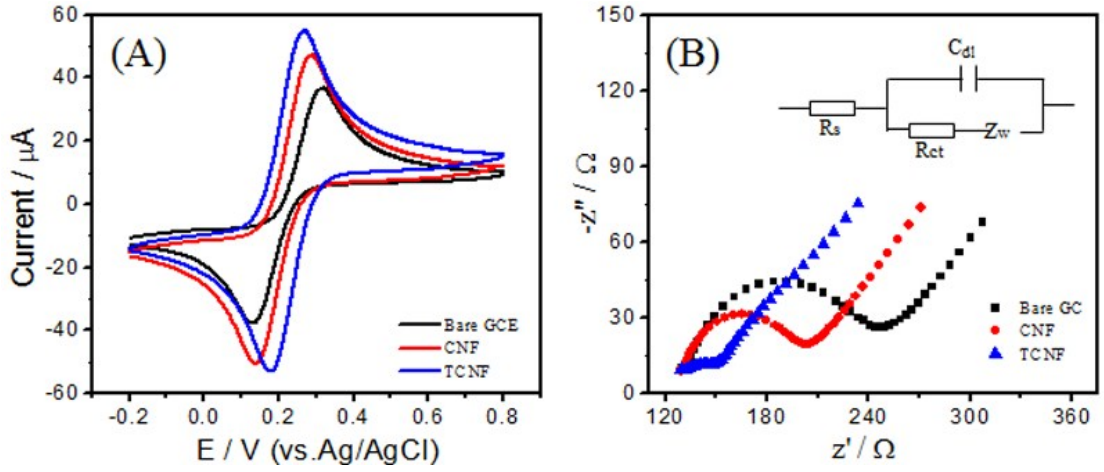


Fig. S3 CV curves (A) and EIS plots (B) of bare GC, CNFs and TCNFs.

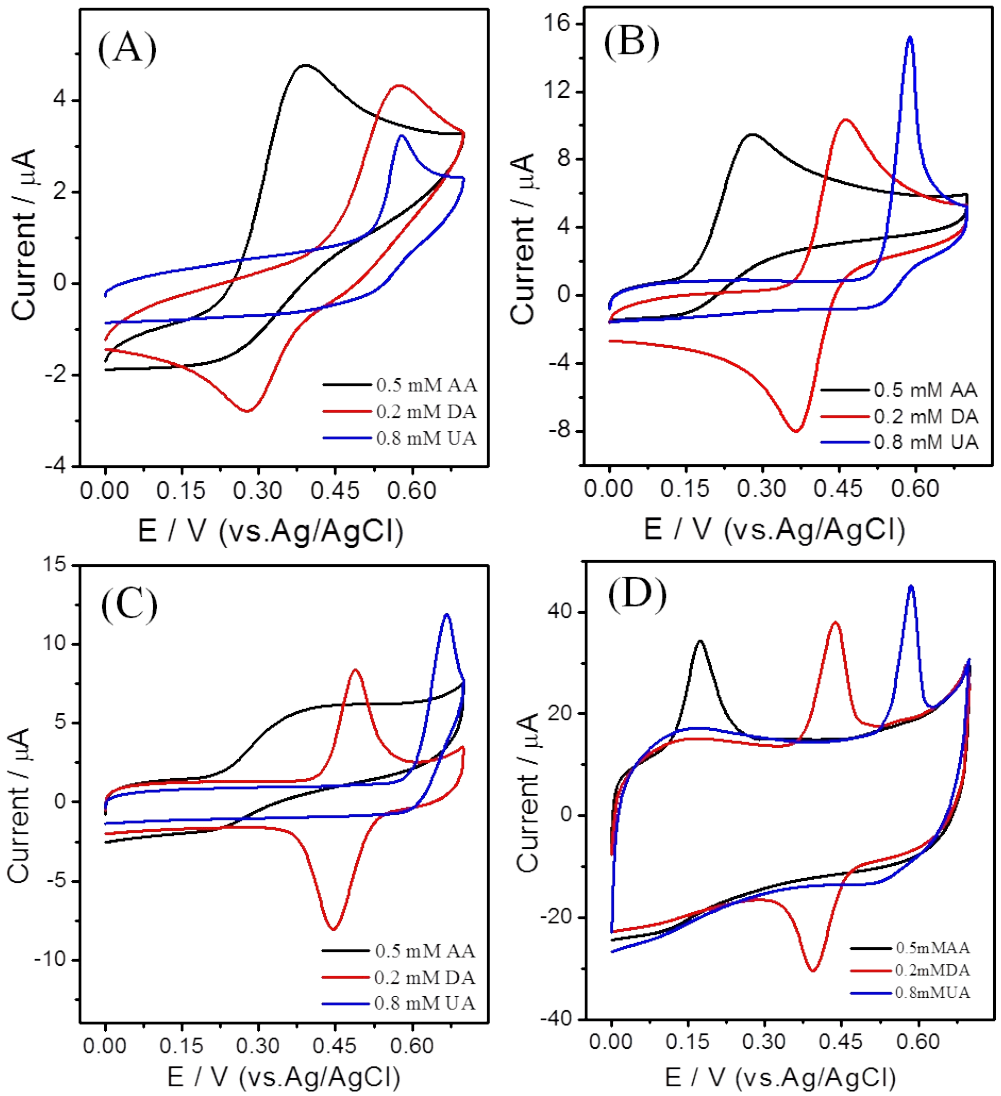


Fig. S4 CVs of individual determination of three analytes at bare GC (A), CNFs (B), TiC NPs (C) and TCNFs (D) in 0.1 M PBS (pH 3.5) containing of 0.5 mM AA, 0.2 mM DA and 0.8 mM UA at 50 mVs^{-1}.

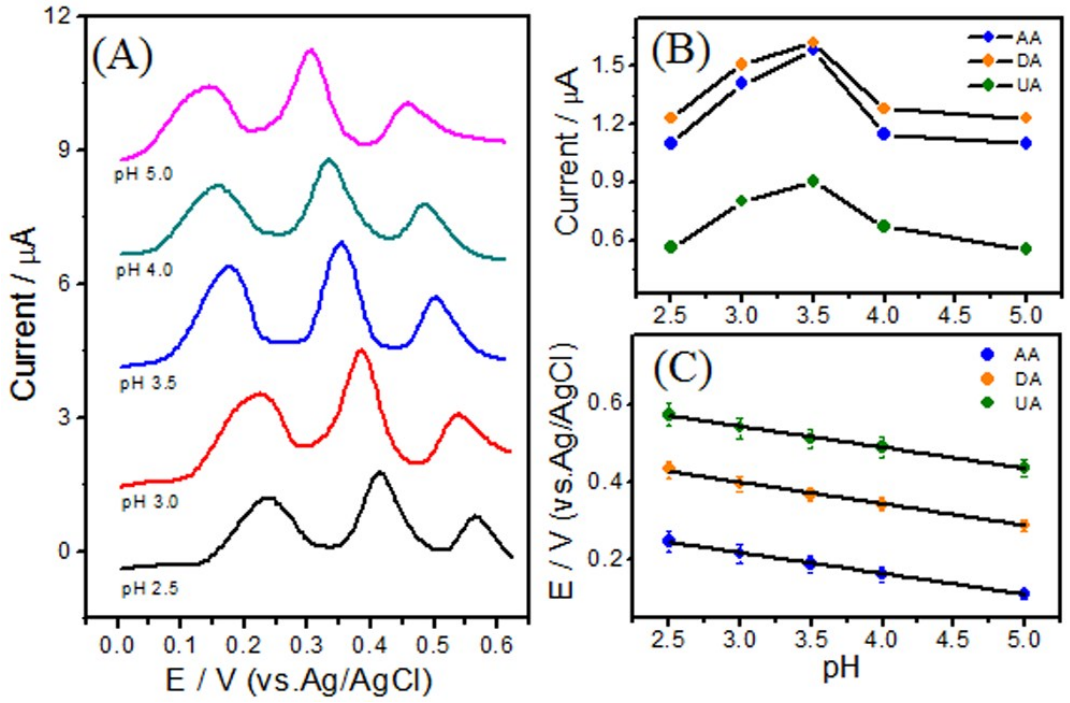


Fig. S5 (A) DPVs of a mixture of 0.2 mM AA, 0.1 mM DA and 0.15 mM UA at TCNFs in 0.1 M PBS of various pHs. Plots of pH vs peak current (B) and E_{pa} (C) of AA, DA and UA.

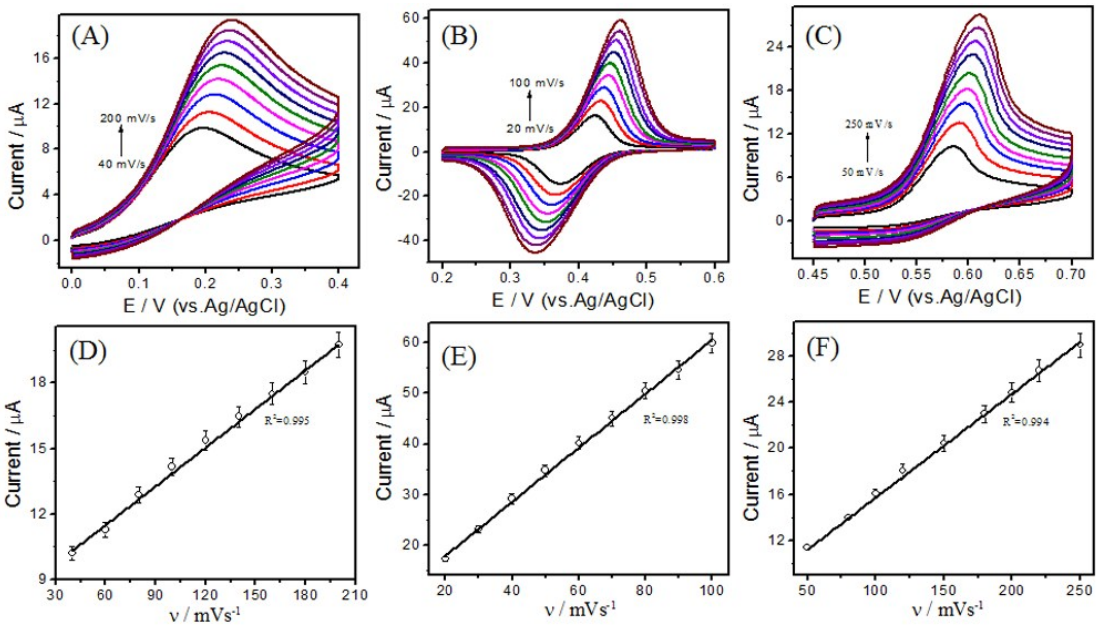
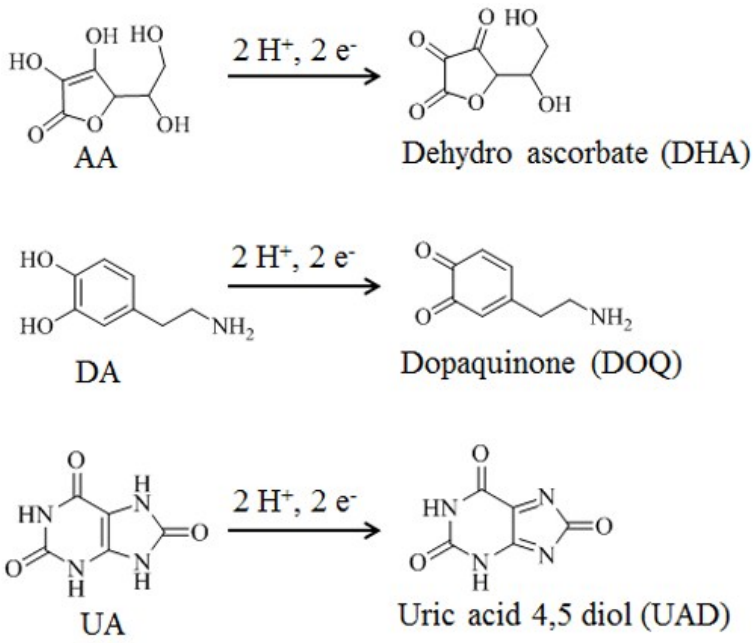


Fig. S6 Cyclic voltammograms of TCNFs in 0.1 M PBS (pH 3.5) containing 1.0 mM AA (A), 0.2 mM DA (B) and 0.5 mM UA (C) at various scan rates. Plots of anodic peak currents (i_{pa}) of AA (D), DA (E) and UA (F) vs scan rate.



Scheme S1. A scheme to illustrate the reaction mechanism of AA, DA and UA at TCNFs.

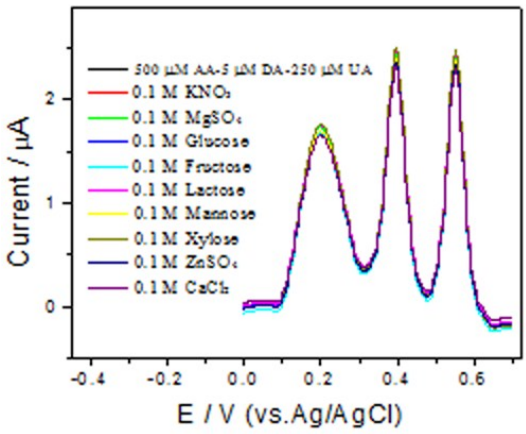


Fig. S7 DPV responses of TCNFs in 0.1 M PBS (pH 3.5) containing 500 µM AA, 5 µM DA and 250 µM UA with successive addition 0.1 M of KNO_3, $MgSO_4$, $ZnSO_4$, $CaCl_2$, glucose, lactose, sucrose, fructose and mannose.

Table S2 Performances of different electrodes for simultaneous detection of AA, DA and UA.

Electrodes	Peak separation (mV)			Linear range (μM)			Detection limit (μM)			Ref.
	ΔE_1	ΔE_2	ΔE	AA	DA	UA	AA	DA	UA	
GO/MWNT	240	70	310	5-300	5-500	3-60	1.0	1.5	1.0	[1]
Pt NS/C_{60}	176	132	308	10-1800	0.5-212	9.5-1187	0.43	0.07	0.63	[2]
PdPt/rGO	184	116	300	40-1200	4-200	4-400	0.61	0.04	0.1	[3]
PdAg/Rgo	204	128	332	1-4100	50-112	3-186	0.19	0.02	0.65	[4]
HNP-PtTi	200	140	340	20-1000	4-500	10-1000	24.0	3.2	5.3	[5]
NiCu/C	150	130	280	20-2500	0.25-40	0.5-110	5.0	0.01	0.1	[6]
GEF/CFE	210	100	310	74-2305	1.4-126	4-371	73	1.4	4.0	[7]
e-FGP	-	-	-	20-400	0.5-35	0.5-35	2.0	0.02	0.01	[8]
PG	180	130	310	9-2314	5-710	6-130	6.45	2.0	4.82	[9]
PM-GR	140	200	340	75-2275	12-278	4-250	18	0.63	0.59	[10]
TCNFs	250	170	420	1-1500	0.05-160	1-875	0.3	0.02	0.3	This work

Table S3 Determination of AA in vitamin C tablets, DA in injection solution and UA in human urine sample using standard addition method.

	Determined (μM)	Added (μM)	Found (μM)	Recovery (%)	RSD (%)
AA in vitamin C tablets	48.56	50.00	98.68	100.12	3.2
		100.00	147.88	99.54	2.9
		200.00	247.15	99.43	3.5
DA injection solution	5.10	20.00	24.78	98.73	3.1
		50.00	55.25	100.27	3.7
		100.00	153.06	98.68	2.8
Human urine samples	12.10	100.00	110.12	98.21	3.4
		200.00	209.05	98.56	3.1
		300.00	305.21	97.79	3.8

References

[1] Y.J. Yang and W.K. Li, *Biosens. Bioelectron.*, 2014, **56**, 300–306.

[2] X. Zhang, L.X. Ma and Y.C. Zhang, *Electrochim. Acta*, 2015, **177**, 118–127.

[3] J.Yan, S. Liu, Z. Zhang, G. He, P. Zhou, H. Liang, L.Tian, X. Zhou and H. Jiang, *Colloid Surf. B,* 2013, **111**, 392–397.

[4] L.X. Chen, J.N. Zheng, A.J. Wang, L.J. Wu, J.R. Chen and J.J. Feng, *Analyst*, 2015, **140**, 3183–3192.

[5] D. Zhao, G. Yu, K.Tian and C.Xu, *Biosens. Bioelectron.*, 2016, **82**, 119–126.

[6] W.Y. He, Y. Ding, L.F. Ji, X. Zhang and F.C. Yang, *Sens. Actuators B: Chem.,* 2017, **241**, 949–956.

[7] J. Du, J. Yue, R. Ren, F. Yao, Z. Jiang, F. Yang and P. Y. Du, *Biosens. Bioelectron.*, 2014, **53**, 220–224.

[8] W.H. Cai, T. Lai, H.J. Du and J.S. Ye, *Sens. Actuators B: Chem.*, 2014, **193**, 492–500.

[9] S.P. Qi, B. Zhao, H.Q. Tang and X.Q. Jiang, *Electrochim. Acta*, 2015, **161**, 395–402.

[10] X.F. Liu, L. Zhang, S.P. Wei, S.H. Chen, X. Ou and Q.Y. Lu, *Biosens. Bioelectron*., 2014, **57**, 232–238.