Supporting Information

Uniform distributed and in situ iron-nitrogen co-doped porous carbon derived from pork liver for rapid and simultaneous detection of dopamine, uric acid, and paracetamol in human blood serum

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■Experimental section

Preparation and Characterization of C/N, N-C. C/N was synthesized by the polymerization of dopamine. Ammonia aqueous solution (0.75 mL, 28%) was mixed with ethanol (40 mL) and deionized water (90 mL) under mild stirring at room temperature for 30 min. Dopamine hydrochloride (0.5 g) was dissolved in deionized water (10 mL), injected into the above mixture solution and kept for 24 h. The products were obtained by the centrifugation, washed with water for three times, and dried at 60 ℃ under vacuum for 8 hours. Under the nitrogen protection, the products were calcined at 800 ℃ for 2 h in a tubular atmosphere furnace with a heating rate of 1℃ min^{-1} and than the products were labeled as C/N.

N-C was prepared by adding 5% nitric acid overnight to remove the Fe from N/Fe-C.

Physical characterization. The scanning electron microscopy (SEM) images were achieved with a Gemini microscope (Hitachi, S-4800, Japan, acceleration voltage 10 kV). Transmission electron microscopy (TEM) was conducted on Tecnai

G2 F20 U-TWIN (FEI, America, acceleration voltage 200 kV). The change of nanoparticle size was characterized by X-ray diffraction (XRD) on a Philips 1130 X-ray diffractometer (40 kV, 25 mA, Cu KR radiation, λ 1.5418 Å). X-ray photoelectron spectroscopy (XPS) was collected with a Kratos AXIS Ultra DLD X-ray photoelectron spectroscopy (XPS) system (Al Ka source, 1486.6 eV) to investigate the elemental distribution of N/Fe-C. Raman spectra were recorded on an iHR550 Raman microscope (HORIBA scientific, excitation source 532 nm solid laser). Brunauer-Emmett-Teller (BET) surface area was measured using a sorptometer (ASAP-2420, Micromeritics, USA, 77 K). Fourier transform infrared (FTIR) spectra were measured on a Nicolet 6700 FTIR instrument in the range of 400-4000 cm^{-1}.

Results and discussion

The electrochemical impedance spectroscopy (EIS) was used to study the interface properties of different electrodes materials. The electron transfer kinetics of $[Fe(CN)_6]^{3-/4-}$(1 mmol L^{-1}, with 0.1 mol L^{-1} KCl) at N/Fe-C/GCE with different calcination temperature (500-900 ℃) were shown in Fig. S2a. The *Ret* values for different electrodes were in the order of N/Fe-C-500/GCE > N/Fe-C-600/GCE > N/Fe-C-700/GCE > N/Fe-C-800/GCE > N/Fe-C-900/GCE. N/Fe-C calcinated at different temperatures was used for electrode modification and then DA, UA and PA (0.1 mmol L^{-1}) in PBS solution (0.1 mol L^{-1}, *p*H 7.0) were detected by DPV (seen in Fig. S2b). Well-defined oxidation peaks of DA, UA and PA on N/Fe-C-800/GCE were observed at 189, 314 and 380 mV, respectively. However, overlapping and weak peaks were presented on the other electrodes. Then, the results of impedance scanning and DPV indicated that the electroconductivity and redox performances of N/Fe-C-800 were the best.
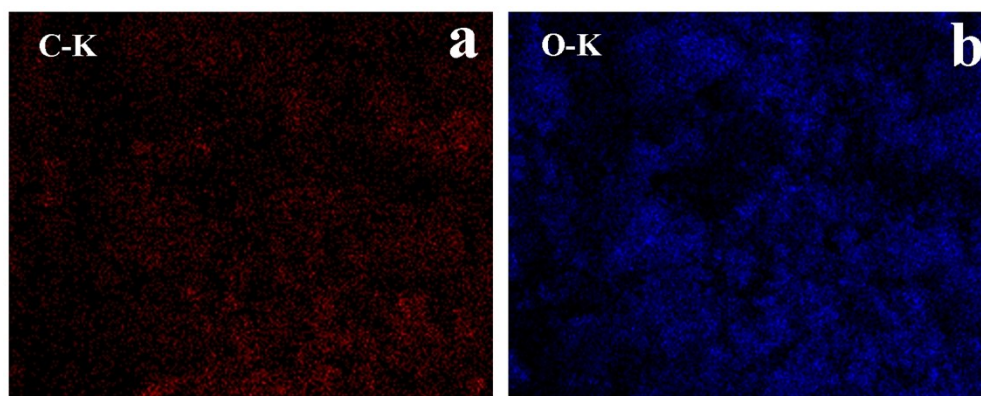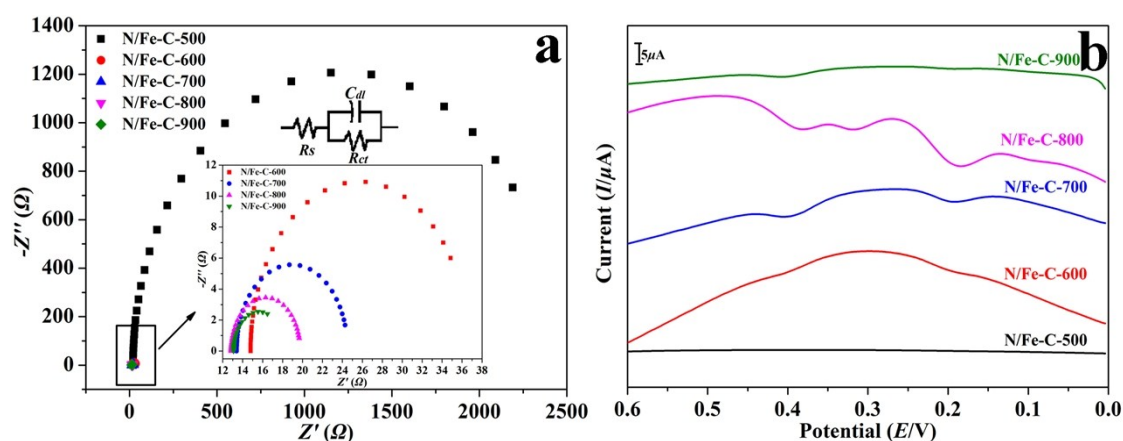
Fig. S1 SEM/EDX images of N/Fe-C

Fig. S2 (a) EIS of N/Fe-C calcinated at different temperatures in $Fe(CN)_6^{3-/4-}$ (1 mmol L^{-1}, with 0.1 mol L^{-1} KCl). (b) determination of DA, UA and PA (0.1 mmol L^{-1}, with 0.1 mol L^{-1} PBS, pH 7.0) by differential pulse voltammetry, using electrode modified with N/Fe-C calcinated at different temperatures

Table S1 Different scan rate regression equations of DA, UA, PA

Samples	Regression equation (mVs^{-1})	R
DA	$I_{pa}(\mu A)=-0.2364v-0.5182$	0.9982
	$I_{pc}(\mu A)=0.2126v+4.1581$	0.9963
UA	$I_{pa}(\mu A)=-0.2486v-0.5504$	0.9981
PA	$I_{pa}(\mu A)=-0.2613v-0.7083$	0.9973
	$I_{pc}(\mu A)=0.1816v+0.7021$	0.9928

Table S2 Different pH regression equations of DA, UA, PA

Samples	Regression equation	R
DA	E_{pa} (V)=-0.0857pH+0.9009	0.9966
UA	E_{pa} (V)=-0.0851pH+0.9853	0.9972
PA	E_{pa} (V)=-0.0972pH+1.1807	0.9992

Table S3 Linear equations, linear range and detection limit for UA, PA, and DA determination

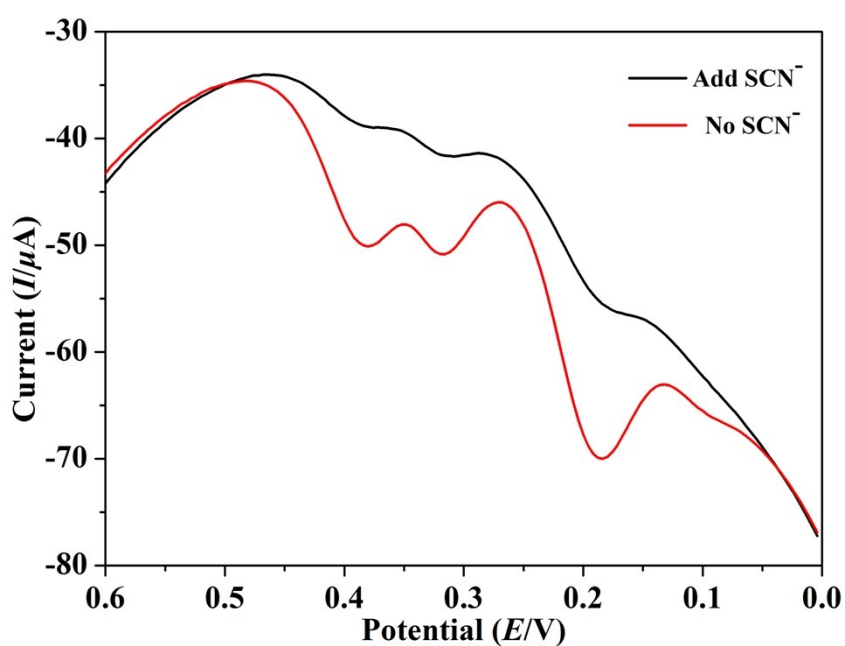| Samples	Linear regression equation $I(\mu A)$，$C(\mu mol\ L^{-1})$	R	Linear range（μmol L^{-1})	Limit of detection （nmol L^{-1}）
DA	I_{pa}=−0.7075C_{DA}−18.9367	0.9986	0.5-280	10.6
PA	I_{pa}=−0.1951C_{PA}−47.1567	0.9978	0.5-220	76.8
UA	I_{pa}=−0.0949C_{UA}−44.3772	0.9985	0.5-320	79.0

Fig. S3 Using SCN$^-$ (5 mmol L^{-1}) as metal masking agent, the effect of Fe doping on the performance of N/Fe-C/GCE as electrochemical selective sensor