Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supporting Information

Dispersed Transition Metal on Nitrogen Doped Carbon Nanoframework for Environmental Hydrogen Peroxide Detection

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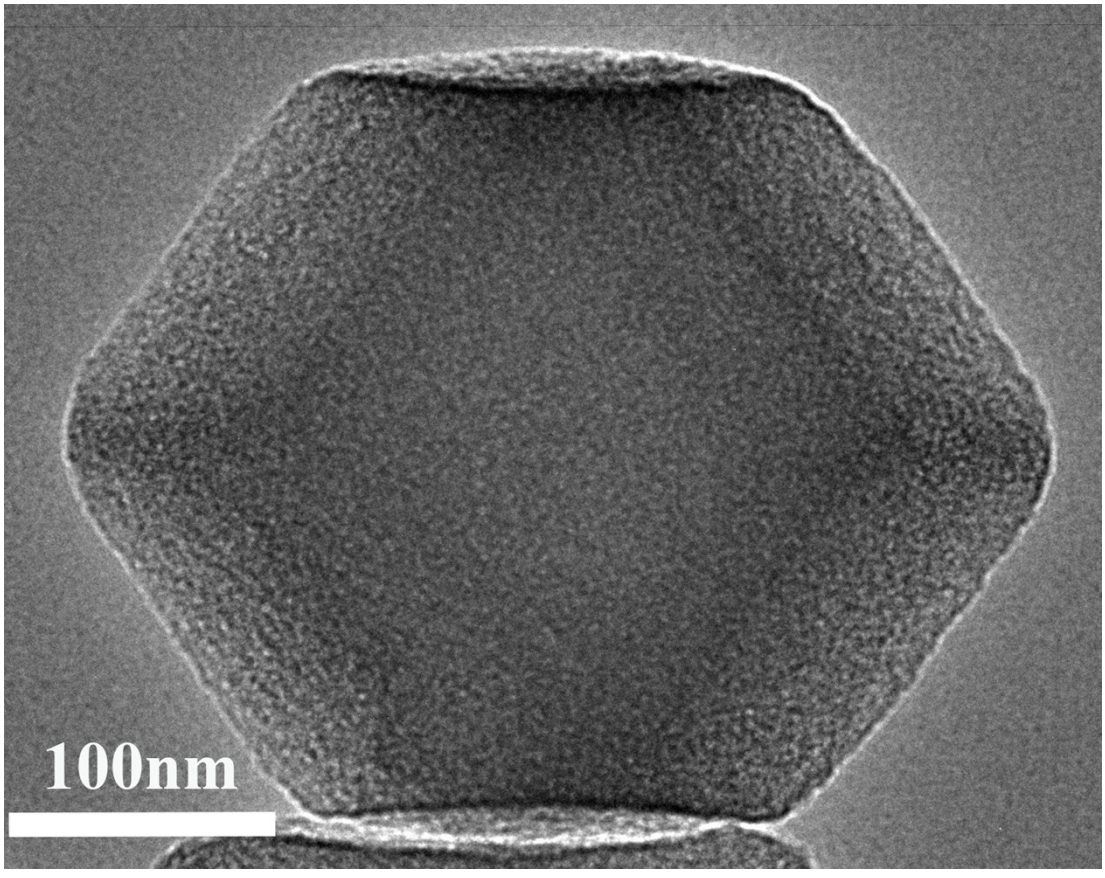

Figure S1. SEM images of N/C.

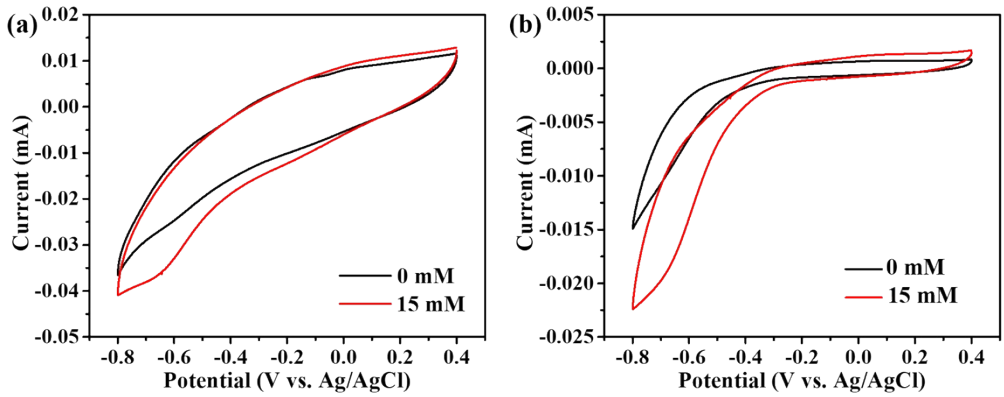

Figure S2. CVs of (a) 1% Cu-N/C and (b) 1% Mn-N/C in N_2-saturated 0.4 M PBS (PH=7.0) with 0 and 15 mM H_2O_2.

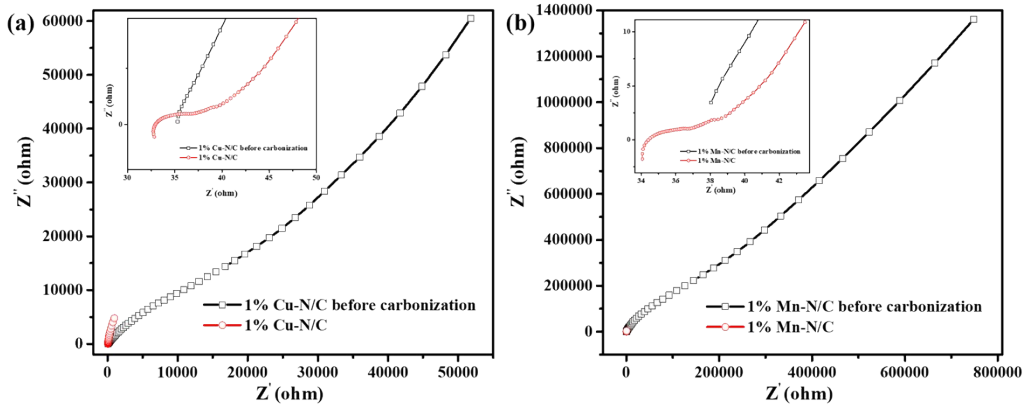

Figure S3. EIS of (a)1% Cu-N/C and (b) 1% Mn-N/C before and after carbonization in N_2-saturated 0.4 M PBS (PH=7.0).

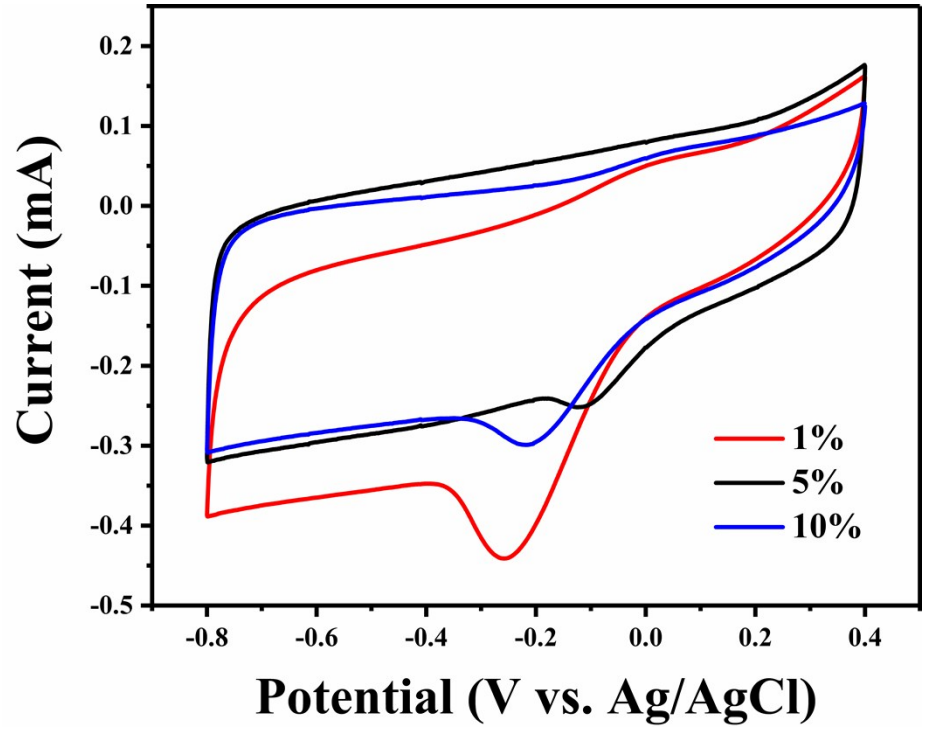

Figure S4. CVs of 1% Mn-N/C, 5% Mn-N/C, 10% Mn-N/C in N_2-saturated 0.4 M PBS (PH=7.0) with 15 mM H_2O_2.

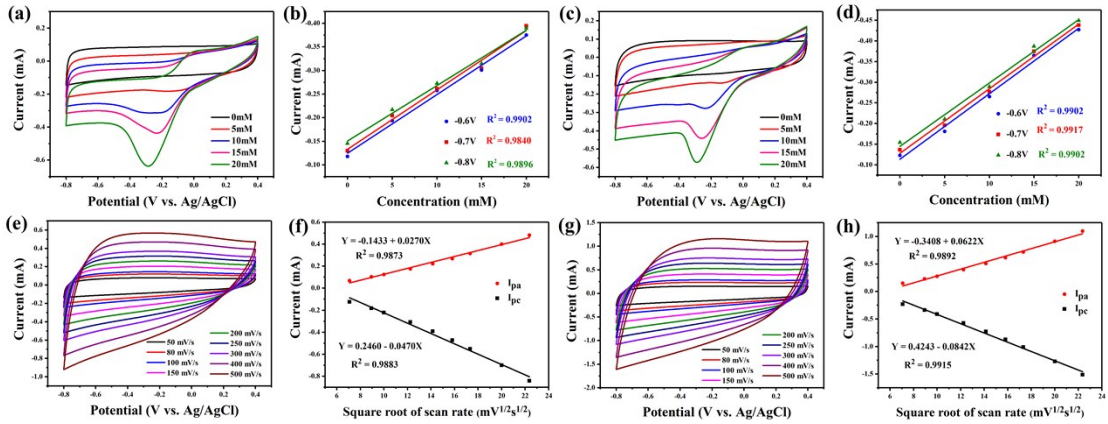

Figure S5. CVs of (a) 1% Cu-N/C and (c) 1% Mn-N/C electrodes in N_2-saturated 0.4 M PBS (PH=7.0) with different concentrations of H_2O_2 (0, 5, 10, 15 and 20 mM). Calibration curve of the amperometric response to the concentration of H_2O_2 from 0 mM to 20 mM at different negative potential (−0.6, −0.7 and −0.8 V) for (b) 1% Cu-N/C and (d) 1% Mn-N/C. CVs of (e) 1% Cu-N/C and (g) 1% Mn-N/C electrodes in 1 mM H_2O_2 solution with different scanning rate (50, 80, 100, 150, 200, 250, 300, 400 and 500 mV/s). Calibration curve of the amperometric response to the square root of scan rate for (f) 1% Cu-N/C and (h) 1% Mn-N/C.

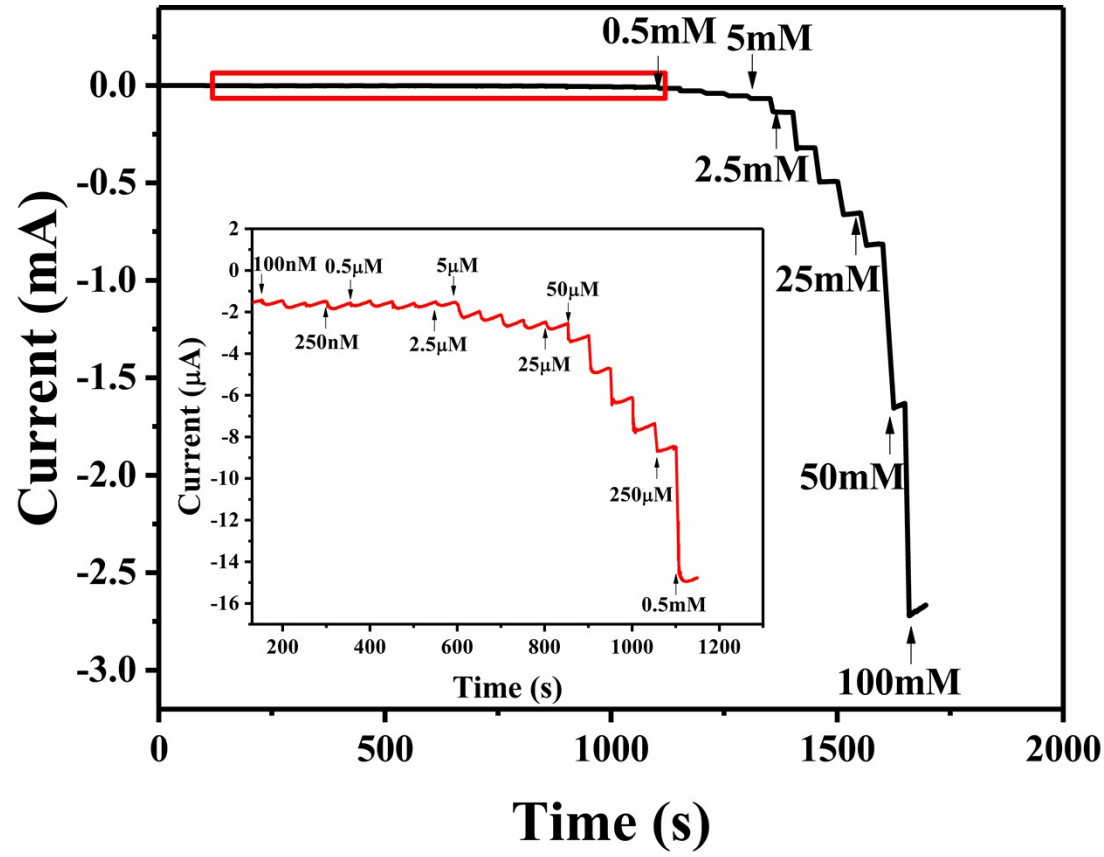

Figure S6. Chronoamperometric curves of 1% Mn-N/C with the successive addition of H_2O_2 in PBS at an applied potential of −0.7 V.

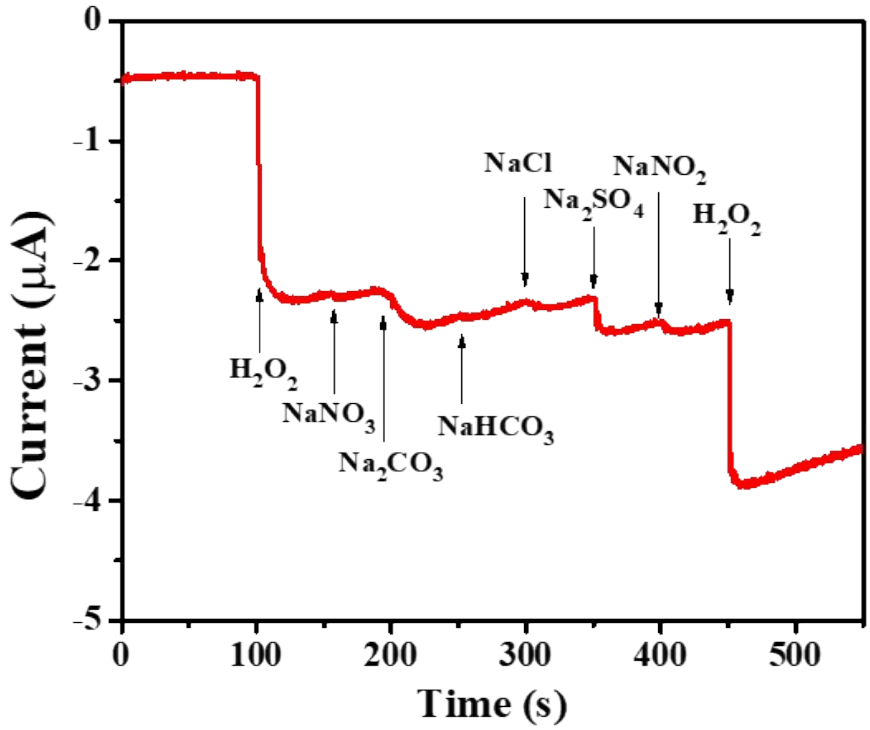

Figure S7. Chronoamperometric curves of 1% Mn-N/C electrode in a 0.1 M PBS buffer (pH=7) with the successive addition of 0.1 mM H_2O_2, $NaNO_3$, Na_2CO_3, $NaHCO_3$, NaCl, Na_2SO_4, $NaNO_2$ and H_2O_2 with a potential at −0.7 V.

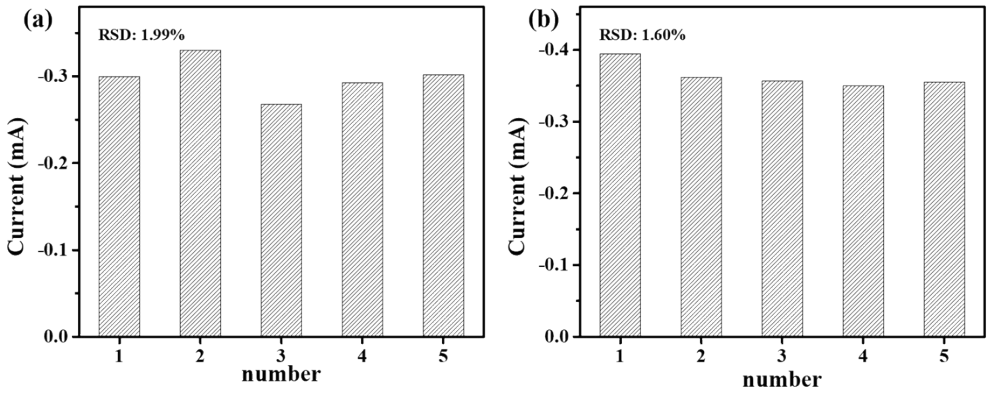

Figure S8. Current responses of five (a) 1% Cu-N/C and (b) 1% Mn-N/C modified GCEs to 10 mM H_2O_2 at -0.7 V.

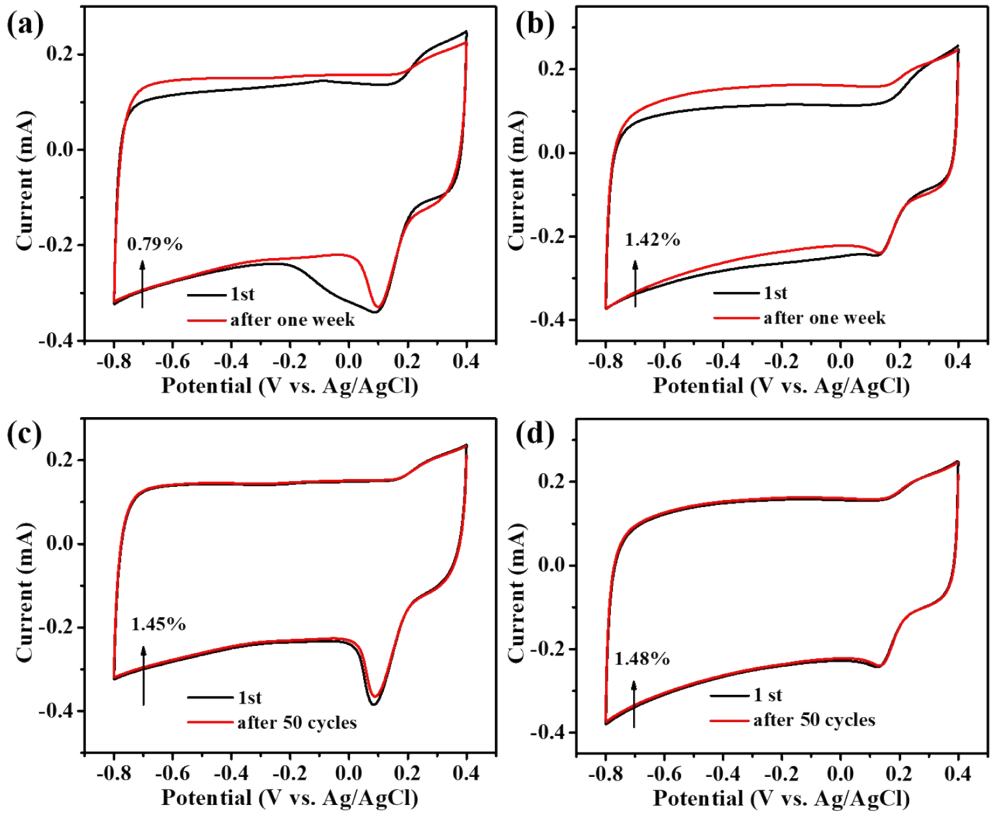

Figure S9. CV curves of (a) 1% Cu-N/C and (b) 1% Mn-N/C before and after one week in PBS solution with 15 mM H_2O_2. CV curves of (a) 1% Cu-N/C and (b) 1% Mn-N/C before and after 50 cycles of CV.

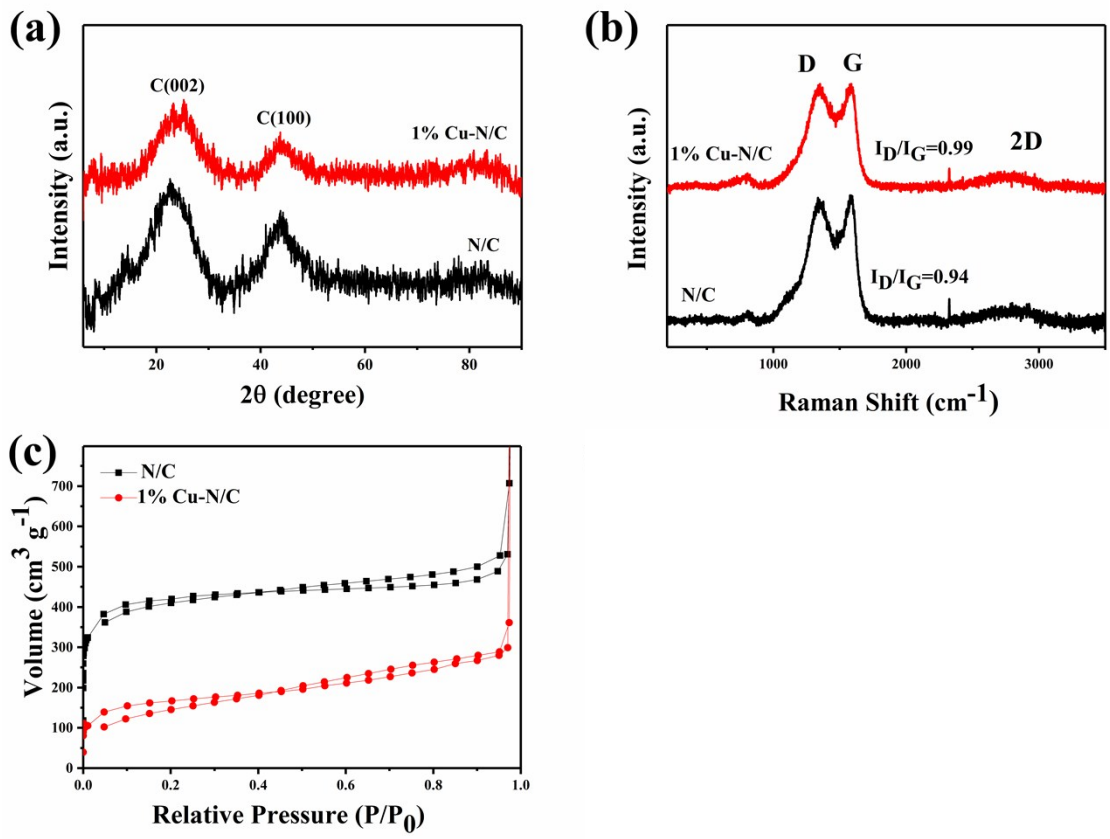

Figure S10. (a) XRD patterns (b) Raman spectra of N/C and 1% Cu-N/C and (c) N_2 adsorption–desorption isotherms.

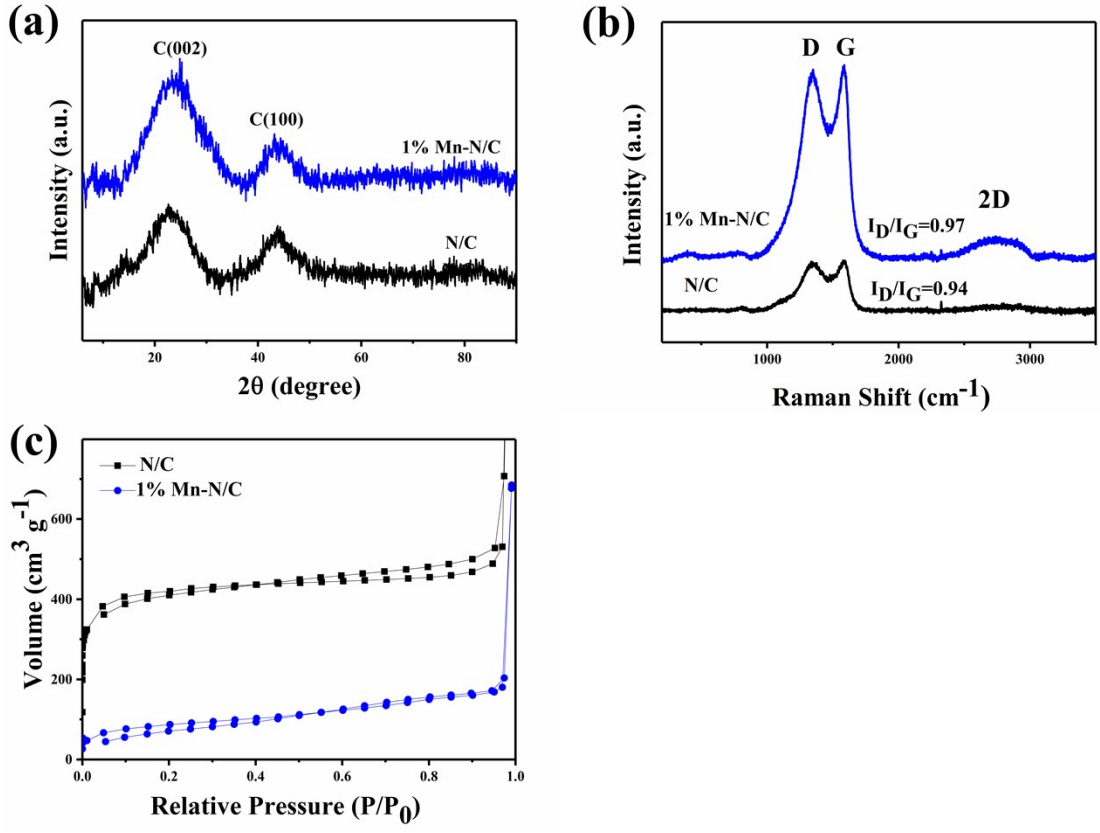

Figure S11. (a) XRD partterns (b) Raman spectra of N/C and 1% Mn-N/C and (c) N_2 adsorption-desorption isotherms.

Table S1. Pore structure parameters of N/C, 1% Cu-N/C and 1% Mn-N/C.

Materials	**Porosity parameter**			
	S_{BET} ($m^2\ g^{-1}$)	V_t ($cm^3\ g^{-1}$)	V_{mic} ($cm^3\ g^{-1}$)	V_{mic}/V_t (%)
N/C	1613.82	0.87	0.54	62.07
1% Cu-N/C	616.77	0.47	0.18	38.30
1% Mn-N/C	311.15	0.28	0.08	28.57

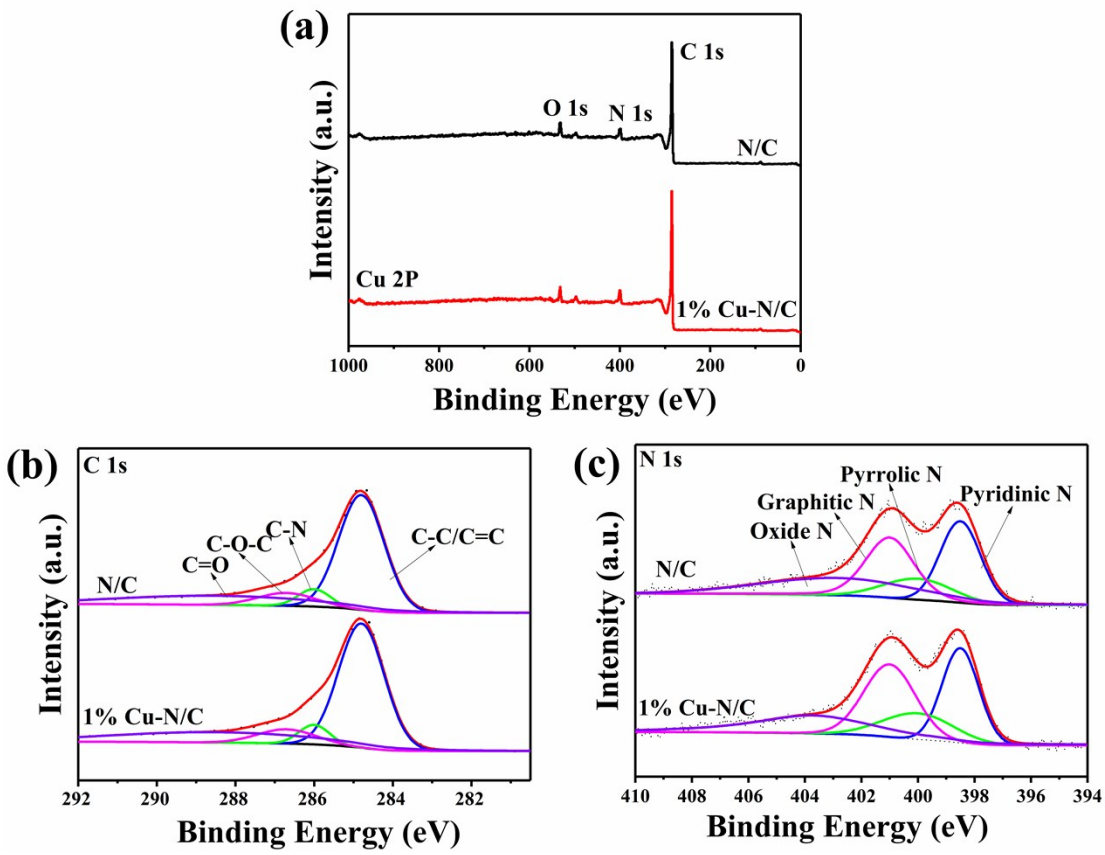

Figure S12. (a) XPS full spectra and high-resolution XPS spectra of (b) C 1s, (c) N 1s for NC and 1% Cu-N/C.

Table S2. Elemental content and percentage of C, N, Cu and Mn species of N/C, 1% Cu-N/C and 1% Mn-N/C from XPS.

Materials	Elemental composition (at %)					C (at %)				N (at %)				Cu (at %)		Mn (at %)	
	C 1s	N 1s	O 1s	Cu 2p	Mn 2p	C-C/C=C	C-N	C-O-C	C=O	pyridinic-N	pyrrolic-N	graphitic-N	Oxide-N	Cu^0	Cu^{II}	Mn	Mn^{II}
N/C	85.57	8.49	5.31	-	-	53.11	5.62	7.51	19.34	2.60	1.14	2.56	2.19	-	-	-	-
1% Cu-N/C	86.71	8.56	4.07	0.26	-	51.70	6.55	7.71	20.75	2.46	1.30	2.72	2.08	0.14	0.16	-	-
1% Mn-N/C	86.83	8.38	4.23	-	0.22	50.73	8.29	8.17	19.63	2.25	1.75	2.54	1.83	-	-	0.16	0.06

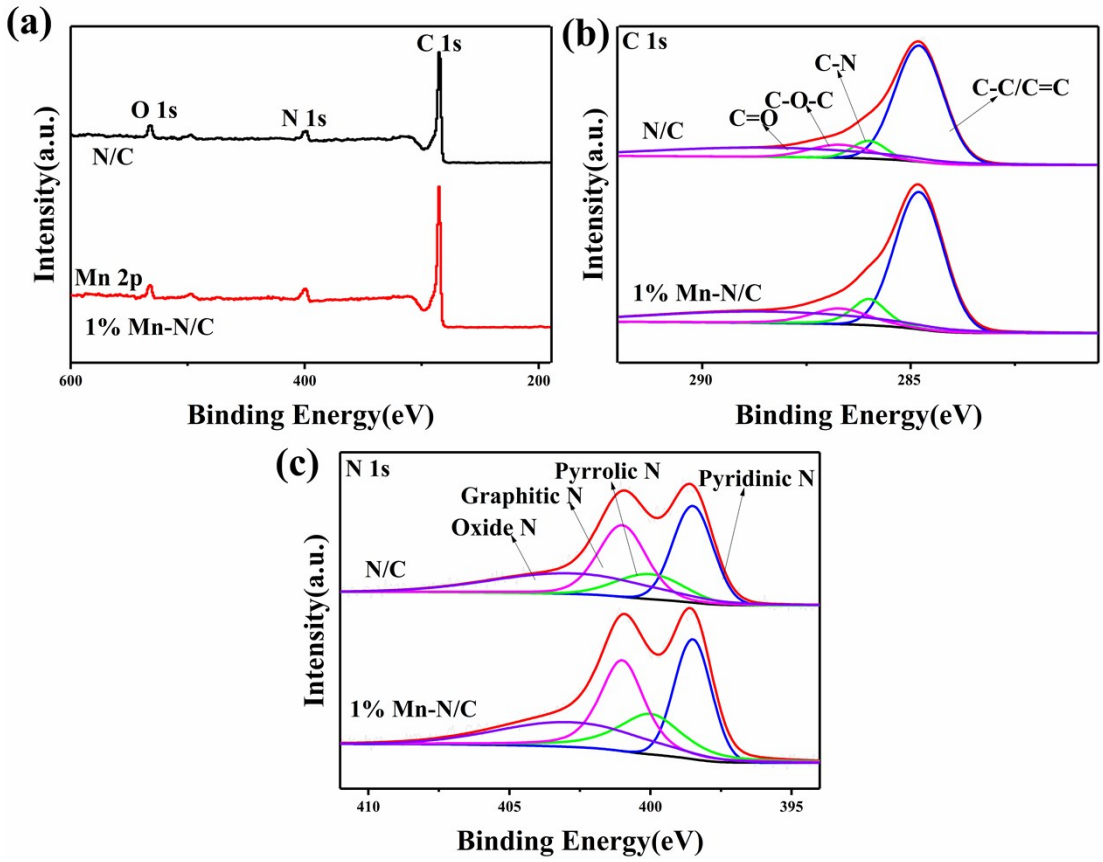

Figure S13. (a) XPS full spectra and high-resolution XPS spectra of (b) C 1s, (c) N 1s for 1% Mn-N/C.