Supporting Information

High Power Density Output and Durability of Microbial Fuel Cell Enabled by Dispersed Cobalt Nanoparticles on Nitrogen-Doped Carbon as Cathode Electrocatalyst

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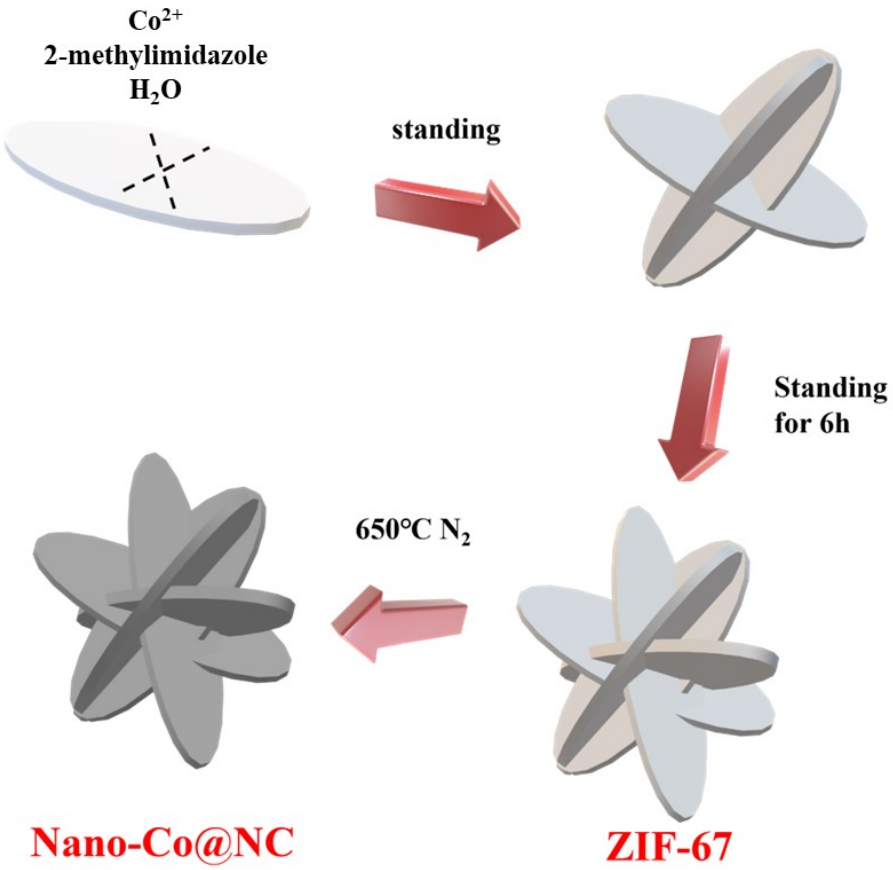

Fig. S1 Schematic synthesis of Nano-Co@NC from ZIF-67.

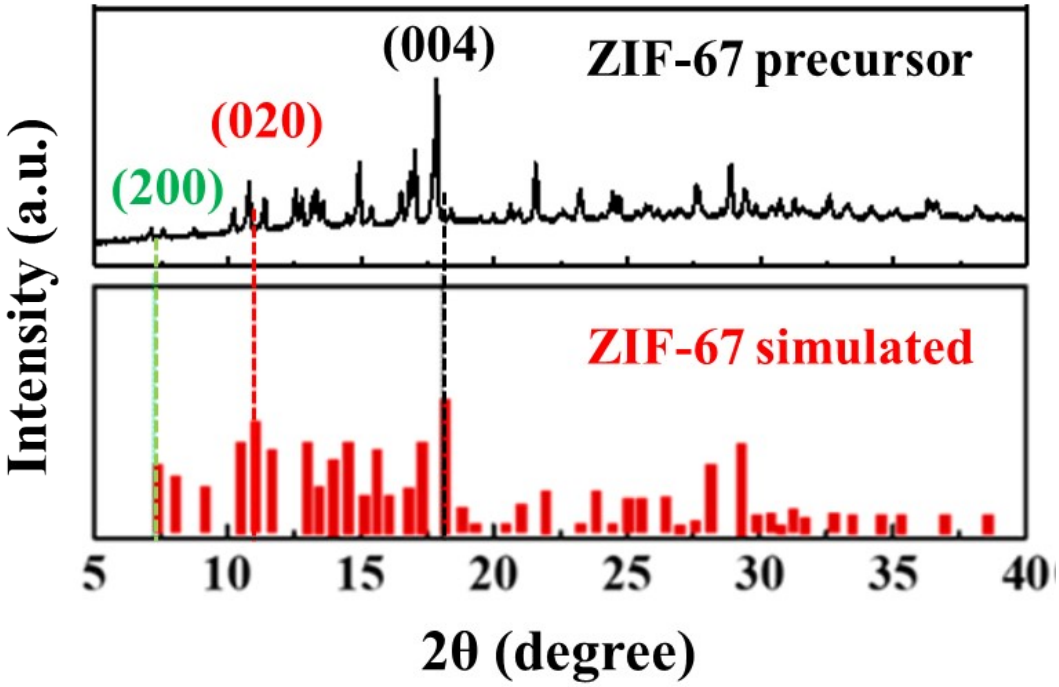

Fig. S2 XRD pattern of resultant ZIF-67 precursor.

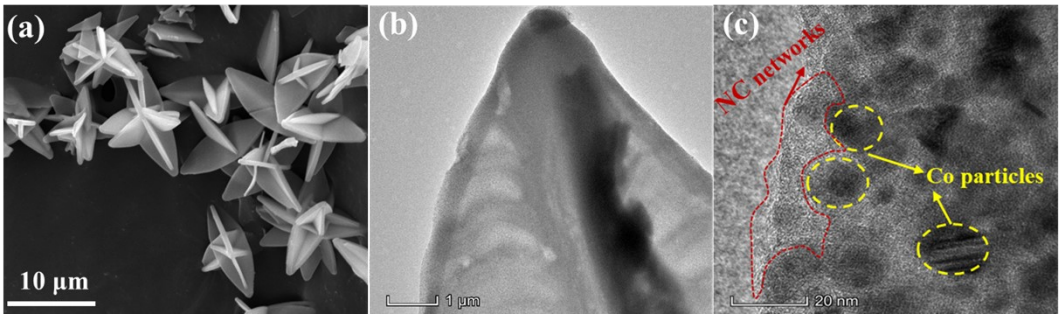

Fig. S3 SEM image of Nano-Co@NC (a), further microstructure of Nano-Co@NC: TEM image (b) and high-resolution TEM image (c).

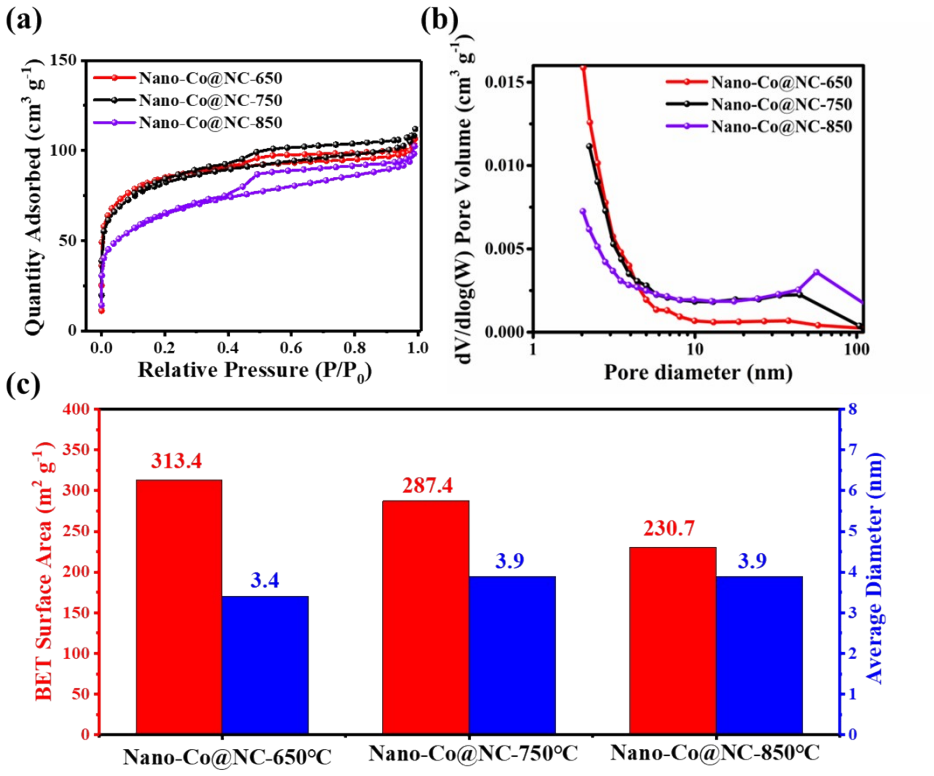

Fig. S4 Nitrogen adsorption-desorption isotherms (a), pore diameter distribution (b) and BET surface area and average pore diameter (c) of Nano-Co@NC samples obtained under different calcination temperatures.

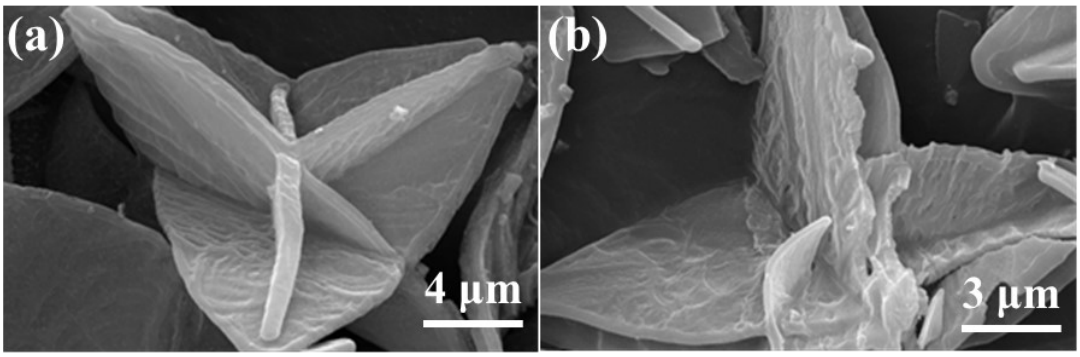

Fig. S5 SEM images of Nano-Co@NC-750 (a) and Nano-Co@NC-850 (b).

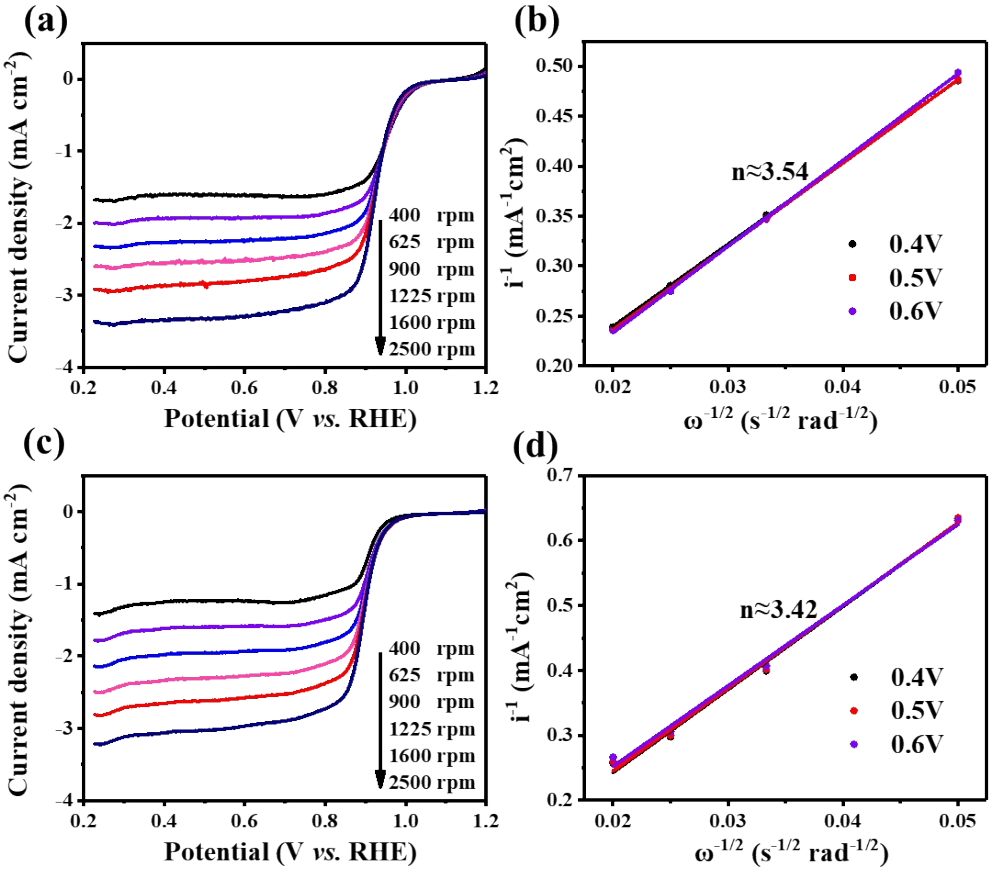

Fig. S6 ORR polarization curve (a,c) and corresponding K-L curves (b,d) of Nano-Co@NC-750 (a,b) and Nano-Co@NC-850 (c,d) in O_2-saturated 1 M KOH solution at various rotation speeds.

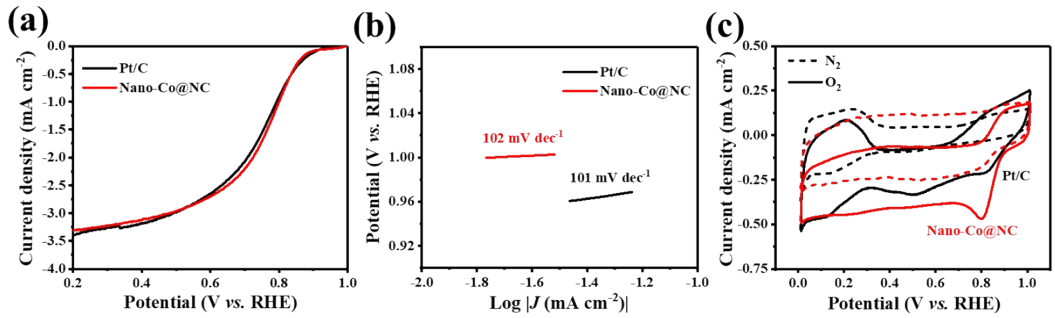

Fig. S7 Linear sweep voltammograms of different electrodes in O_2 saturated 50 mM PBS solution at 1600 rpm with a scan rate of 5 mV·s^{-1} (a), and corresponding Tafel plots (b); cyclic voltammograms of Nano-Co@NC and Pt/C electrodes in N_2- and O_2-saturated 50 mM PBS solution with a scan rate of 5 mV·s^{-1}.

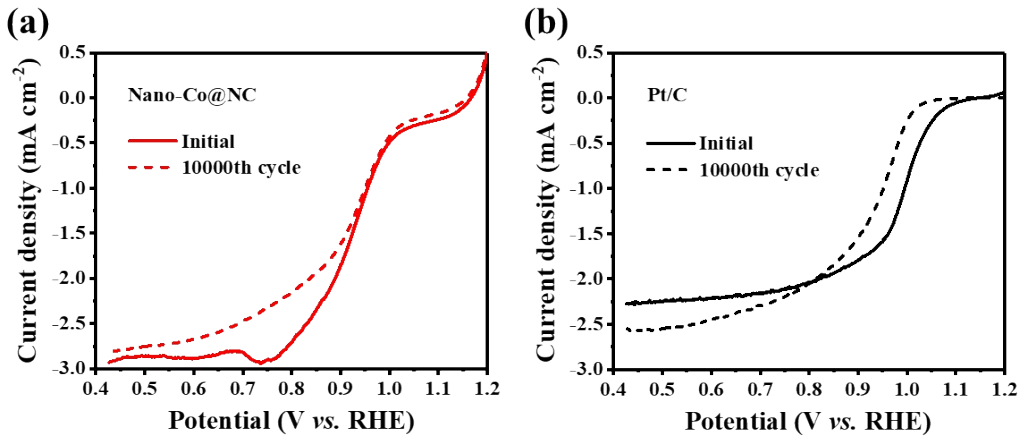

Fig. S8 Linear sweep voltammograms of Nano-Co@NC (a) and Pt/C (b) electrodes with a scan rate of 5 $mV \cdot s^{-1}$ before and after cyclic voltammetry between 0.8 V and 1.0 V at 50 $mV \cdot s^{-1}$ for 10 000 cycles.

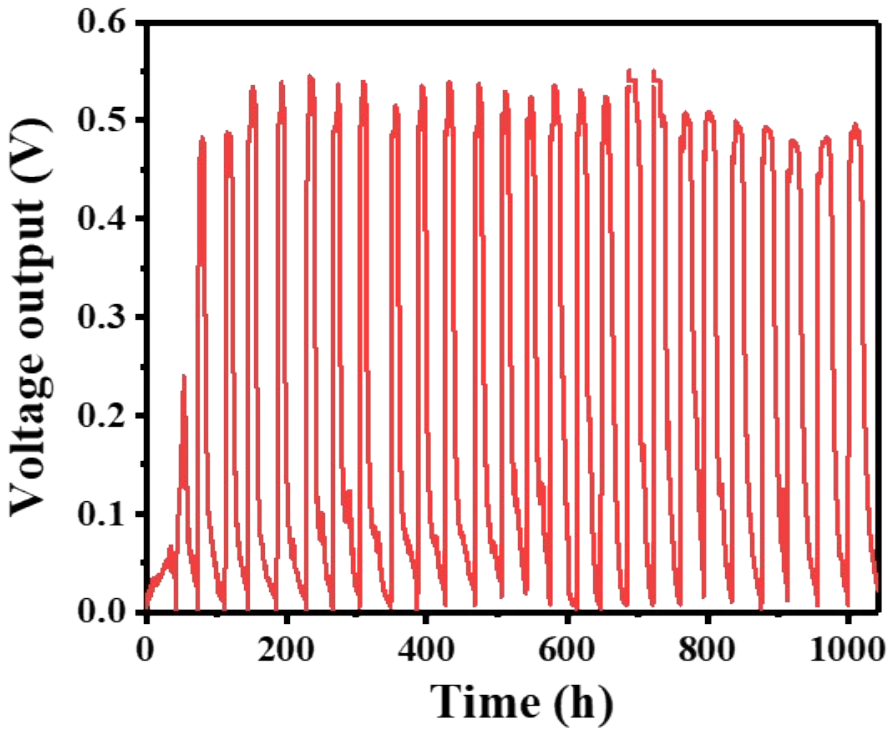

Fig. S9 Voltage output of the MFC equipped with Nano-Co@NC cathode electrocatalyst during 45 days' operations with 1000 Ω resistance loading.

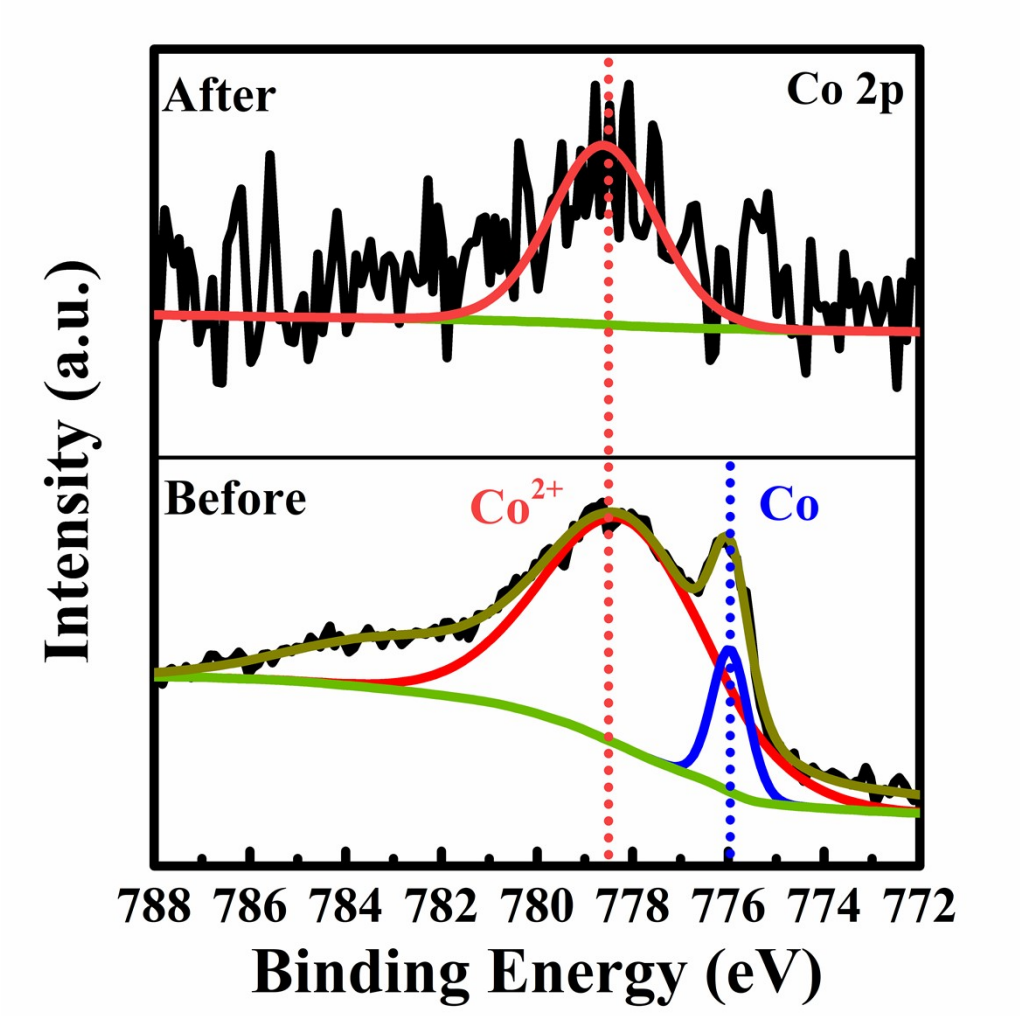

Fig. S10 XPS Co 2p spectra of Nano-Co@NC before and after 45 days' operations in the MFC with 1000 Ω resistance loading.

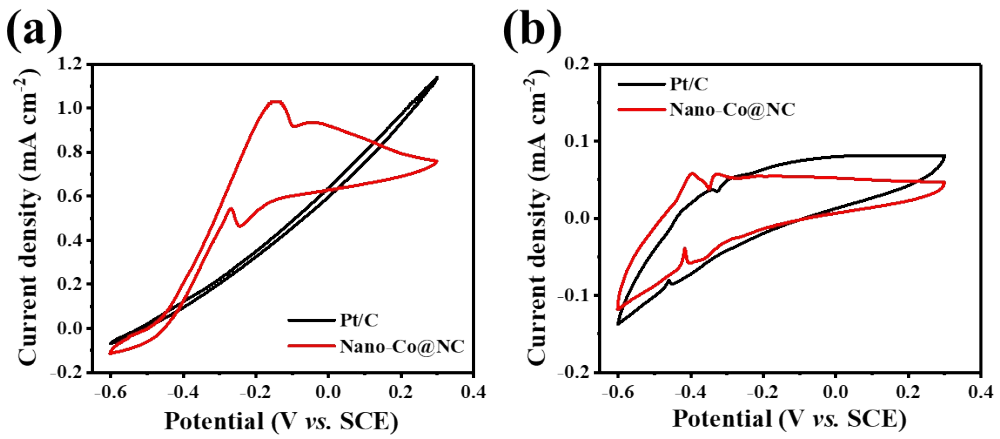

Fig. S11 Cyclic voltammograms of anodes from the MFCs after 1 month's batch mode operations, in the solutions with (a) and without (b) 1g·L^{-1} sodium acetate. Scan rate: 1mV·s^{-1}.

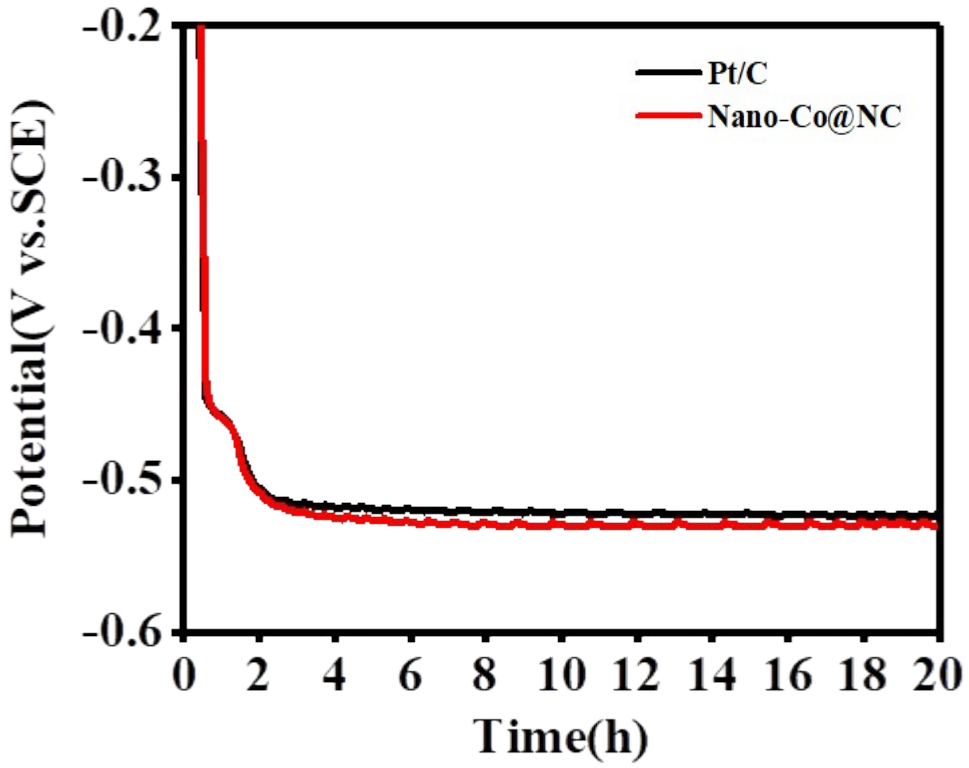

Fig. S12 Potential response of the anodes taken from the MFCs after 1 month's batch mode operations under a constant current of 0.1 μA.

Table S1. XPS element compositions of Nano-Co@NC samples.

Samples	Co at%	N at%	C at%
Nano-Co@NC-650	59.17	0.60	40.23
Nano-Co@NC-750	48.40	1.30	50.30
Nano-Co@NC-850	29.23	2.60	68.17

Table S2. A comparison of atomic percentages in Nano-Co@NC with Co_3O_4-NC/CF reported in reference.

Material	Co at%	N at%	C at%	Ref.
Nano-Co@NC	59.17	2.60	38.24	this work
Co_3O_4-NC/CF	19.00	0.56	19.87	Li et al., 2021

Table S3. Comparison in electrocatalytic activity of Nano-Co@NC toward ORR in alkaline electrolyte with those reported in literature.

Catalyst	E_{onset} (V vs. RHE)	$E_{1/2}$ (V vs. RHE)	Tafel slope (mV dec^{-1})	Ref.
Nano-Co@NC	0.98	0.9	31	this work
ZIF-L-D-Co_3O_4/CC	0.97	0.9	68	[1]
$Co_{0.8}$-N-OMC	0.79	0.59	—	[2]
Co_3O_4-NC/CF	0.92	0.78	98	[3]
3DHP Co-N-C	0.82	0.72	67.4	[4]
Cu/NC	0.76	0.3	134	[5]
Co@NC-Co_1Zn_3	0.84	0.68	—	[6]
Fe, N-AC	0.95	0.87	—	[7]

Table S4. Comparison in electrocatalytic activity of Nano-Co@NC toward ORR in weak alkaline or neutral electrolytes with those reported in literature.

Catalyst	Electrolyte	E_{onset} (V vs. RHE)	$E_{1/2}$ (V vs. RHE)	Ref.
Nano-Co@NC	0.05 M PBS	0.91	0.75	this work
Co-Nx/C-MnO	0.1 M KOH	0.93	0.87	[8]
$Fe_xCo_{9-x}S_8$-NHCS	0.1 M KOH	0.92	0.79	[9]
Hollow Fe–N/C-800	0.1 M PBS	0.99	0.81	[10]

Table S5. Comparison in power output of MFCs based on Nano-Co@C cathode electrocatalyst with those reported in literature.

Cathode catalysts	Inoculum	Substrate	P_{max} (mW m^{-2})	Ref.
Nano-Co@NC	Mixed	sodium acetate	1769	this work
NiFe-LDH@Co_3O_4	Mixed	glucose	467.35±8.27	[11]
Mn-Fe@g-C_3N_4	Mixed	sodium acetate	413±7	[12]
3DHP Co-N-C	Mixed	glucose	426.95±7.87	[4]
Co_3O_4-NC/CF	Mixed	sodium acetate	1560	[3]
Cu/NC	Mixed	sodium acetate	489.2	[5]
Co@NC-Co_1Zn_3	Mixed	sodium acetate	1039	[6]
CoNi-LDH@CNFs	Mixed	sodium acetate	1390.37	[13]

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