Supplementary materials

Fe/N codoped porous graphitic carbon derived from macadamia shell as an efficient cathode oxygen reduction catalyst in microbial fuel cells

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Captions

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Table S1 Nutrient solution formula used in MFCs

Table S2 Chemical composition of the samples and N1s components based on XPS measurements

Fig. S1 SEM image of (a) MSAC-N and (b) MSAC-Fe

Fig. S2 High resolution N1s peaks of (a) MSAC-600 ,(b) MSAC-700,(c) MSAC-800, (d)MSAC-900, and (e) MSAC-N

Fig. S3 High resolution Fe2p peaks of (a) MSAC-600 ,(b) MSAC-700,(c) MSAC-800, (d)MSAC-900, and (e) MSAC-Fe

Fig. S4 (a) and (b) CV curves in N_2- and O_2-saturated 50mM PBS solutions at 5mV/s of MSAC-N and MSAC-Fe, (c)Tafel plots, (d)LSV curves in O_2-saturated 50mM PBS with 1600rpm,(e)electron transfer number (*n*) and H_2O_2 yield of MSAC-N and MSAC-Fe.

Fig. S5 (a) Stability test of MSAC-750 in 0.1M KOH solution, (b) voltage output stability test of MFCs with MSAC-750 and Pt/C catalyst.

Text S1 Fabrication of the air cathodes

In this work, carbon cloth is used as the carbon-based layer of the air cathode, which also included a gas diffusion layer and catalyst layer (0.5 mg cm^{-2}). The gas diffusion layer was fabricated via coating PTFE solution (60 wt%) on the carbon-based layer and annealing at 370 °C for 15 min in a muffle furnace; this process was repeated threefold. The catalyst ink was prepared by sonicating a mixture comprising the catalyst (30 mg), nafion solution (150 μL), isopropanol (70 μL), and deionized water (20 μL) for 15 min. The uniform catalyst ink was brushed on the carbon cloth and dried for 24 h. This preparation process was adopted for the cathode of Pt/C and MSAC catalysts.

Table S1 Nutrient solution formula used in MFCs

PBS solution(g/L)		Trace elements(g/L)		Vitamin solution(mg/L)	
Component	concentration	Component	concentration	Component	concentration
$NaH_2PO_4·2H_2O$	2.45	Nitrilotriacetic acid	1.5	Biotin	2.0
$Na_2HPO_4·12H_2O$	4.57	$MgSO_4·7H_2O$	3.0	folic acid	2.0
KCl	0.13	$MnSO_4·2H_2O$	0.5	pyridoxine HCl	10.0
NH_4Cl	0.31	NaCl	1.0	riboflavin	5.0
		$FeSO_4·7H_2O$	0.1	thiamin	5.0
		$CaCl·2H_2O$	0.1	nicotinic acid	5.0
		$CoCl_2·6H_2O$	0.1	Pantothenic acid	5.0
		$ZnSO_4$	0.1	Vitamin B12	0.1
		$CuSO_4·5H_2O$	0.01	paminobenzoic acid	5.0
		$AlK(SO_4)_2·12H_2O$	0.01	thioctic acid	5.0
		H_3BO_3	0.01		
		$Na_2MoO_4·2H_2O$	0.01		
		$NiCl_2·6H_2O$	0.024		
		$NaWO_4·2H_2O$	0.025		

Table S2 Chemical composition of the samples and N1s components based on XPS measurements

materials	at.%(C)	at.%(N)	at.%(Fe)	Pyridinic-N(%)	Fe-Nx(%)	Pyrrolic-N(%)	Graphitic-N(%)
MSAC-600	80.49	7.49	0.27	4.45	-	2.39	0.62
MSAC-700	81.09	6.67	0.29	3.74	-	2.18	0.74
MSAC-750	82.96	6.36	0.54	2.29	1.69	1.67	0.71
MSAC-800	84.65	5.47	0.61	1.53	1.38	1.63	0.91
MSAC-900	86.12	4.97	0.73	0.95	1.36	1.81	0.82

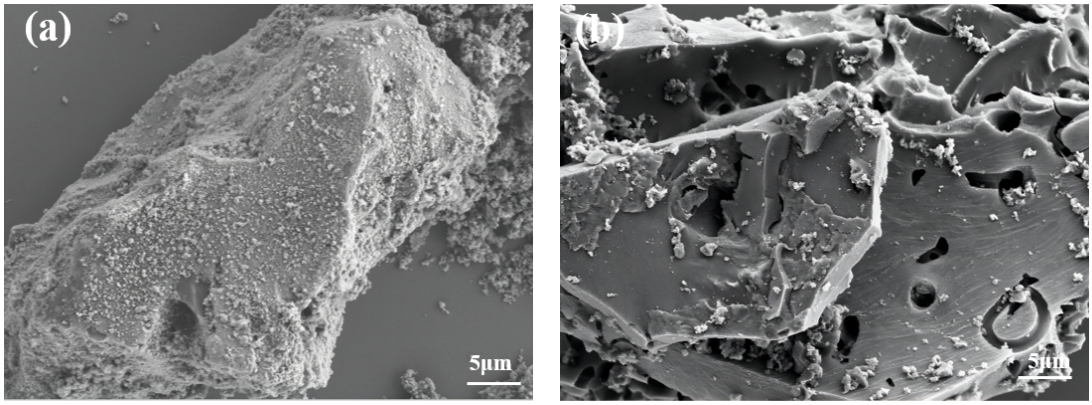
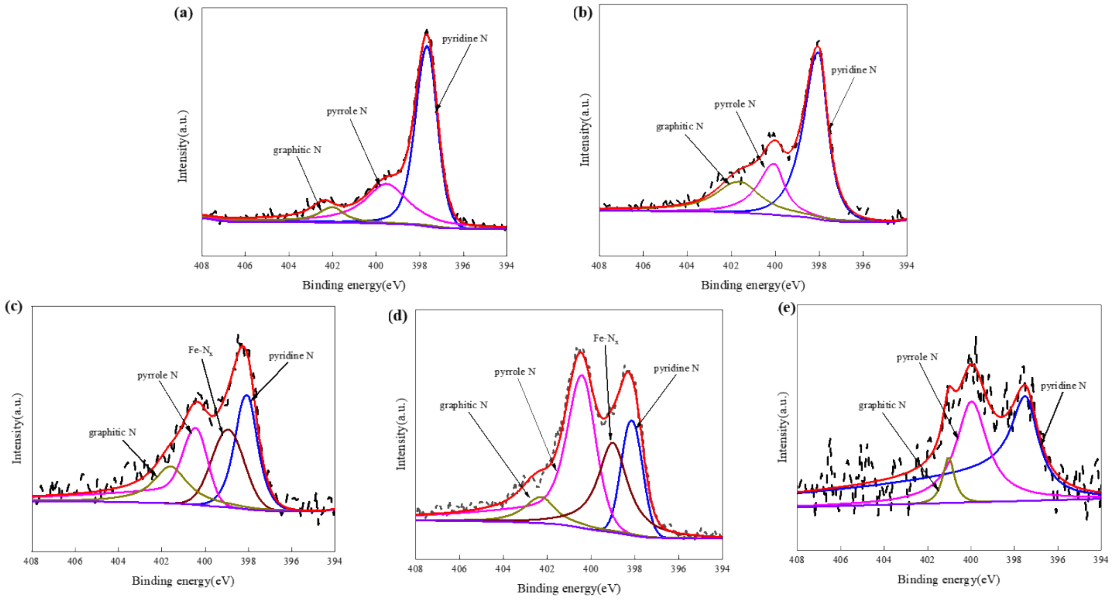


Fig. S1 SEM image of (a) MSAC-N and (b) MSAC-Fe



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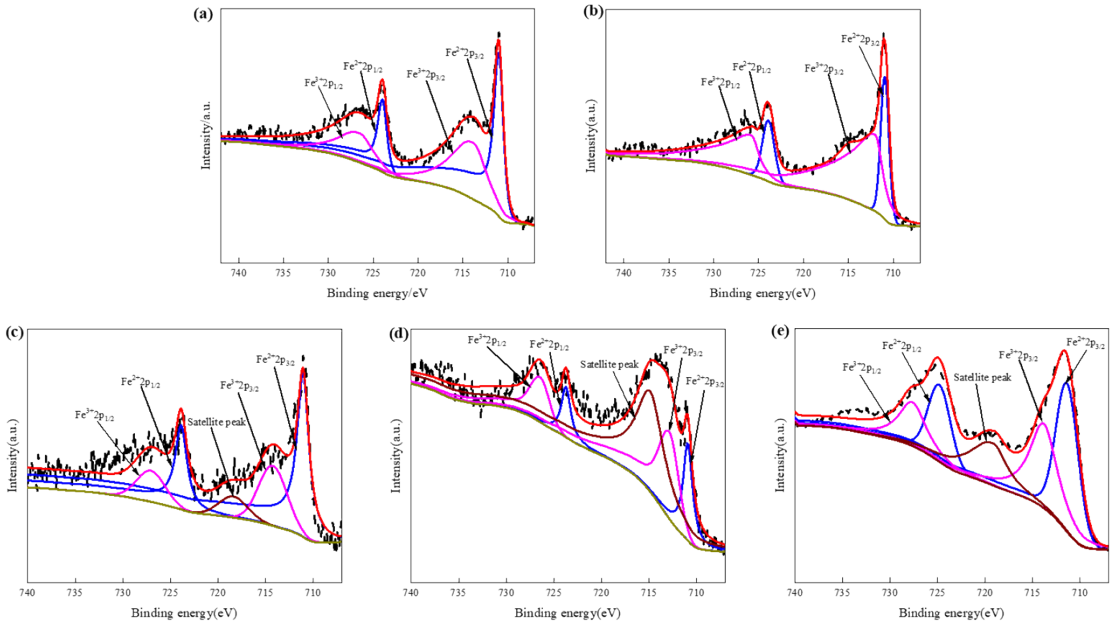

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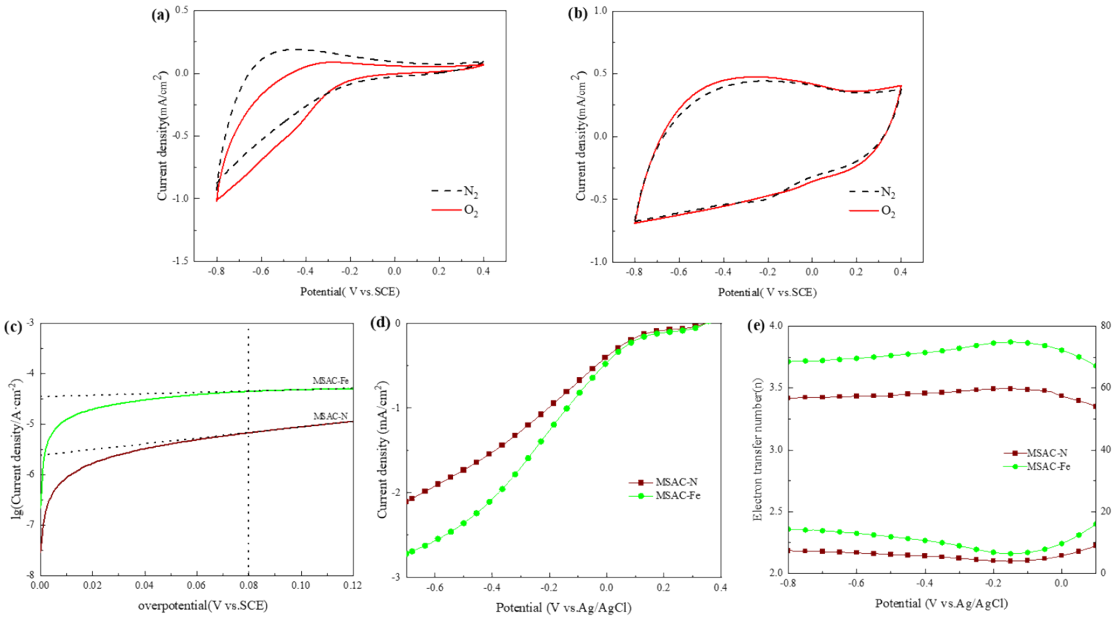

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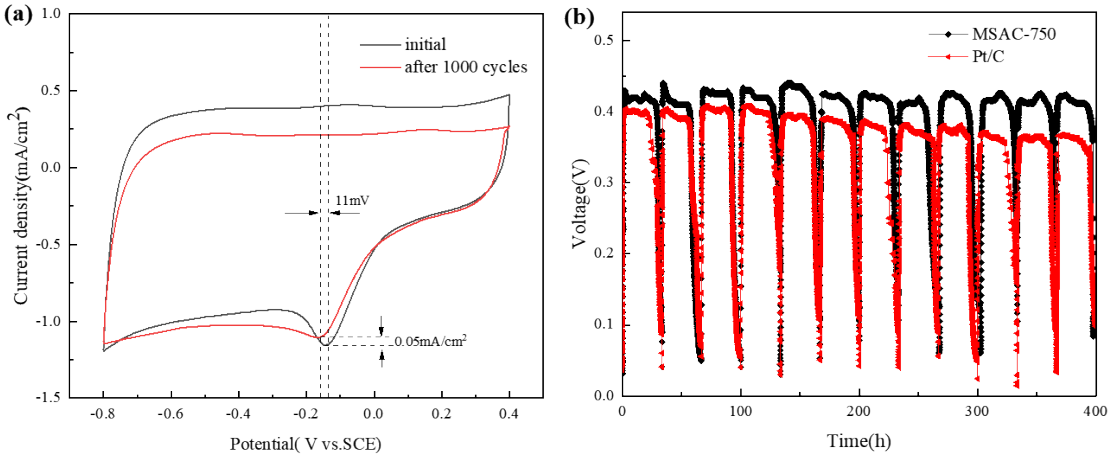

Fig. S5 (a) Stability test of MSAC-750 in 50 mM PBS solution, (b) voltage output stability test of MFCs with MSAC-750 and Pt/C catalyst.