SUPPORTING INFORMATION

Low-cost Fe-N-C catalyst derived from Fe (III)–chitosan hydrogel to enhance power production in microbial fuel cells

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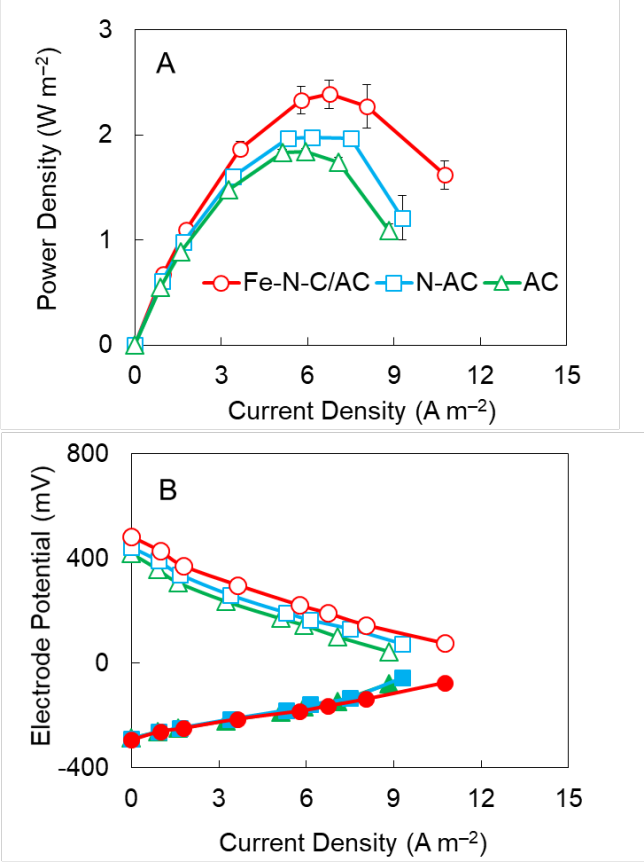

Figure S1. (A) Power density curves in 50 mM PBS for AC, N–AC and Fe–N–C/AC cathodes. (B) Electrode potentials in 50 mM PBS (solid symbols=anode potentials; open symbols=cathode potentials) without correcting solution resistance.

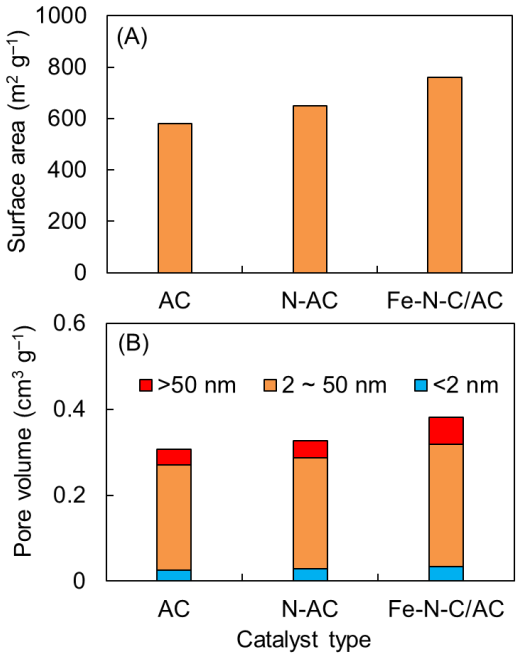

Figure S2. (A) BET surface area of AC, N–AC, and Fe–N–C/AC. (B) Pore volume of AC, N–AC, and Fe–N–C/AC at pore sizes of < 2 nm, 2–50 nm and > 50 nm.

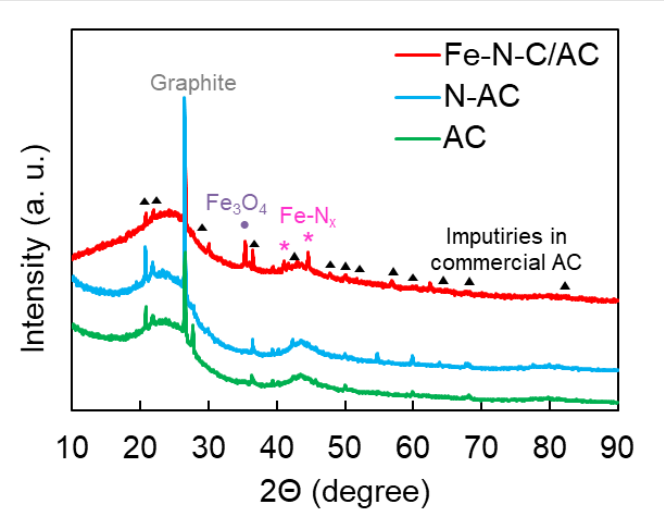

Figure S3. XRD patterns of AC, N–AC and Fe–N–C/AC catalysts.

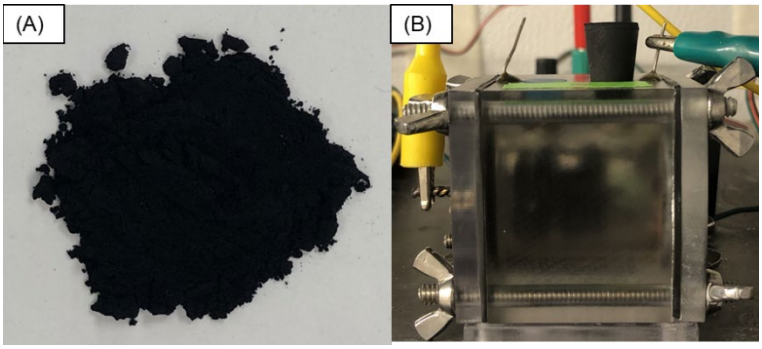

Figure S4. Images of (A) synthesized Fe–N–C/AC catalyst, and (B) single chamber microbial fuel cell.

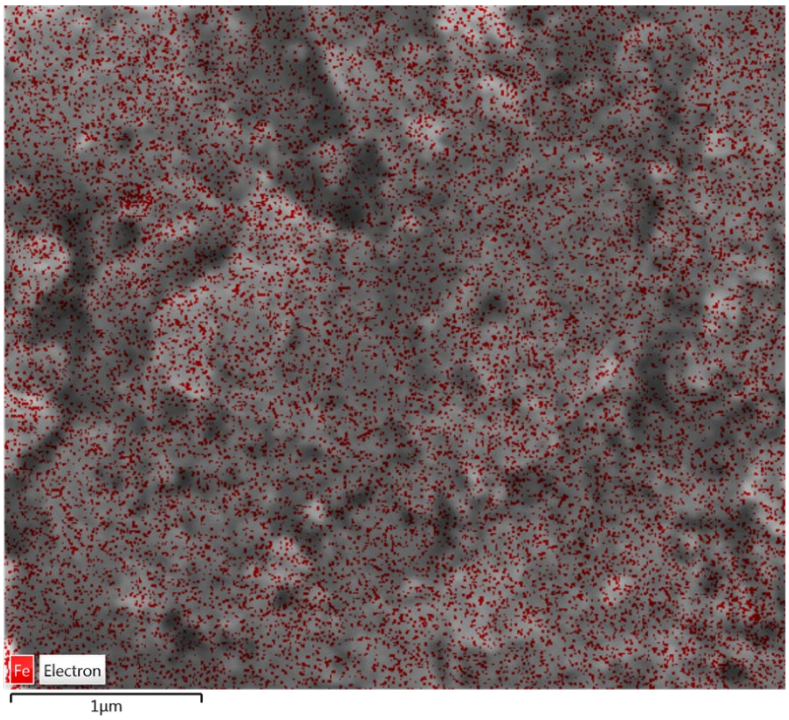

Figure S5. Original EDS mapping of Fe on Fe–N–C/AC.

Table S1. Concentrations of minerals and vitamins in solutions added to medium

Vitamins (mg L^{-1})		Minerals (g L^{-1})	
Biotin	2.0	NTA	1.5
Folic acid	2.0	$MgSO_4$	3.0
Pyridoxine HCl	10.0	$MnSO_4•H_2O$	0.5
Riboflavin	5.0	NaCl	1.0
Thiamin	5.0	$FeSO_4•7H_2O$	0.1
Nicotinic acid	5.0	$CaCl_2•2H_2O$	0.1
Pantothenic acid	5.0	$CoCl_2•6H_2O$	0.1
B–12	0.1	$ZnCl_2$	0.13
p-aminobenzoic acid	5.0	$CuSO_4•5H_2O$	0.01
Thioctiv acid	5.0	$AlK(SO_4)_2•12H_2O$	0.01
		H_3BO_3	0.01
		Na_2MoO_4	0.025
		$NiCl_2•6H_2O$	0.024
		$Na_2WO_4•2H_2O$	0.025

Table S2. Parameters for EPS analysis

σ (solution conductivity)	7.29 mS cm^{-1}
R_Ω/l (solution ohmic resistance per distance)	19.6 Ω cm^{-1}
$d_{An\text{-}Cat}$ (distance between anode and cathode)	1.0 cm
A (electrode projected area)	7.0 cm^2
$d_{An–RE}$ (distances from anode to the reference electrode)	0.2 cm
U (voltage drop)	Measured (mV)
$E_{An,m}$ (measured anode potential)	Measured (mV)

Table S3. Anode and cathode characteristic values based on EPS analysis.

Catalyst	Cathode			Anode		
	$E_{Cat,e0}$ (mV)	$R_{Cat,s}$ (mΩ m^2)	R^2	$E_{An,e0}$ (mV)	$R_{An,s}$ (mΩ m^2)	R^2
AC	350 ± 4	24 ± 1	0.998	–285 ± 6	17 ± 1	0.993
N–AC	366 ± 11	21 ± 2	0.983	–283 ± 5	17 ± 1	0.995
Fe–N–C/AC	424 ± 4	24 ± 1	0.999	–278 ± 7	15 ± 1	0.987

Table S4. Unit prices of different materials in cathode fabrication

Material	Supplier price	Calculating price	Sources
Stainless steel 50 × 50 mesh, type 304	\$6-17/m^2	\$12/m^2	http://www.alibaba.com/product-detail/50-micron-stainless-steel-wire-mesh_509492050.html
Activated carbon (AC)	\$0.9-1.8/kg	\$1.4/kg	http://www.alibaba.com/product-detail/Bamboo-wood-based-activated-carbon-manufacturer_1459751266.html
PTFE powder	\$10-40/kg	\$25/kg	http://www.alibaba.com/product-detail/Virgin-Molding-PTFE-Powder_797829147.html
PVDF membrane (hydrophobic)	\$18–28/m^2	\$23/m^2	https://www.alibaba.com/product-detail/Membrane-filters-0-22um-and-0_60738127213.html?spm=a2700.7724838.2017115.13.91ee3d58a0F01j
$FeCl_3$ (anhydrous) (96%)	\$0.1-0.5/kg	\$0.3/kg	https://www.alibaba.com/product-detail/96-Ferric-Chloride-Anhydrous-FeCl3-CAS_62151228640.html
Chitosan (99%)	\$20-30/kg	\$25/kg	https://www.alibaba.com/product-detail/Supply-Best-100-Water-Soluble-Chitosan_60503770758.html

(The prices were all reported based on specific suppliers and median price was adopted if a range was given in the supplier price)