Supporting Information

Co-existing anammox, ammonium-oxidizing, and nitrite-oxidizing bacteria in biocathode-biofilms enable energy-efficient nitrogen removal in bioelectrochemical desalination process

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Contents:

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Total number of Figures – 6

Total number of Tables – 1

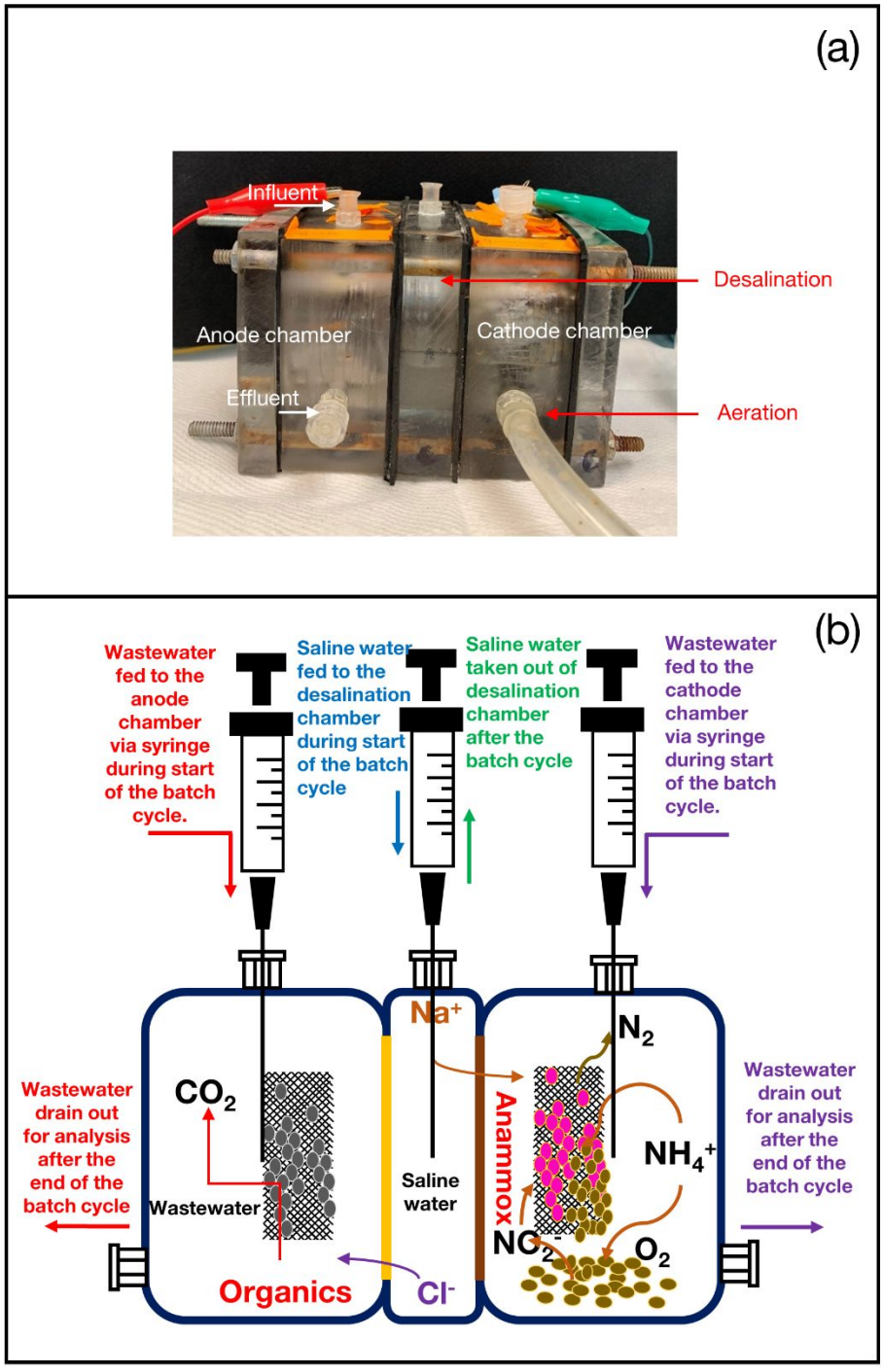
(a)
Influent
Desalination
Anode chamber
Cathode chamber
Effluent
Aeration
(b)
Wastewater fed to the anode chamber via syringe during start of the batch cycle.
Saline water fed to the desalination chamber during start of the batch cycle
Saline water taken out of desalination chamber after the batch cycle
Wastewater fed to the cathode chamber via syringe during start of the batch cycle.
Wastewater drain out for analysis after the end of the batch cycle
CO2
Wastewater
Organics
Na+
Saline water
Cl-
Anammox
N2
NH4+
NO2-
O2
Wastewater drain out for analysis after the end of the batch cycle

Figure S1. Experimental setup of nitritation anammox MDC ($NiA_{mox}MDC$).

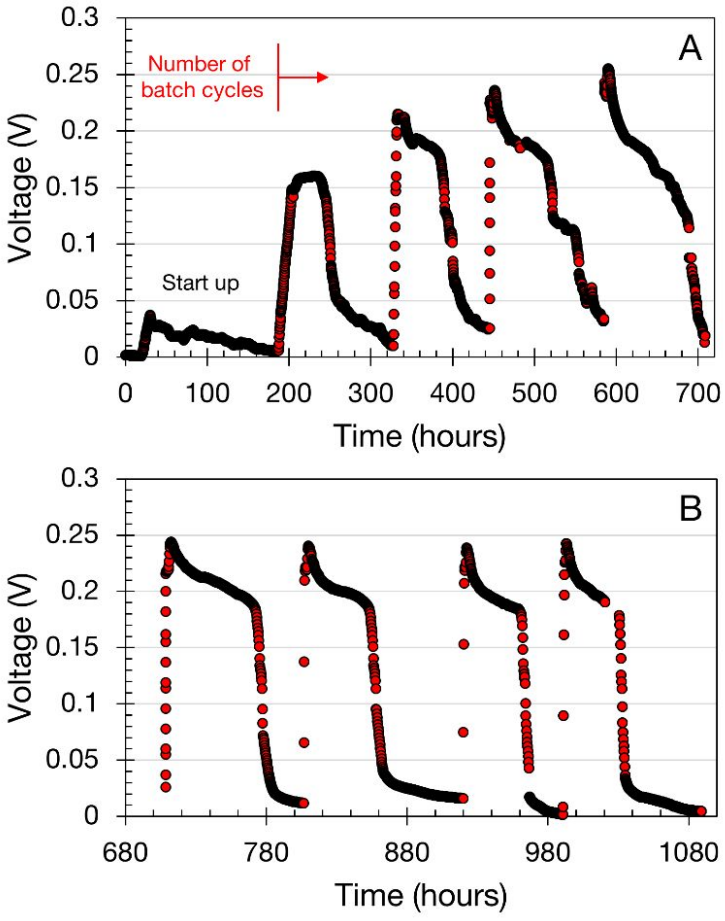

Figure S2. Voltage profile generated by $NiA_{mox}MDC$ at 1000 Ω resistor during start-up and different operational cycles at air flow rate of 10 ml/min (A), 3 ml/min (B).

Table S1. Maximum voltage and power density generated by NiA_{mox}MDC at different batch cycles at different air flow rate under 1 kΩ resistor.

A. Air flow rate of 10 ml/min

MDCs	Maximum voltage (mV)					Maximum power density (mW/m^3)					Hydraulic retention time (HRT) (hours)			
	Start up	1st cycle	2nd cycle	3rd cycle	4th cycle	Start up	1st cycle	2nd cycle	3rd cycle	4th cycle	1st cycle	2nd cycle	3rd cycle	4th cycle
NiA_{mox} MDC	26.5	160.32	212.1	236.3	255.2	11.70	749.77	930.6	930.6	1085.4	128	116	120	117

A. Air flow rate of 3 ml/min

MDCs	Maximum voltage (mV)				Maximum power density (mW/m^3)				Hydraulic retention time (HRT) (hours)			
	5th cycle	6th cycle	7th cycle	8th cycle	5th cycle	6th cycle	7th cycle	8th cycle	5th cycle	6th cycle	7th cycle	8th cycle
NiA_{mox} MDC	243.9	240.7	238.9	242.7	991.4	965.6	951.2	981.7	100	112	80	98

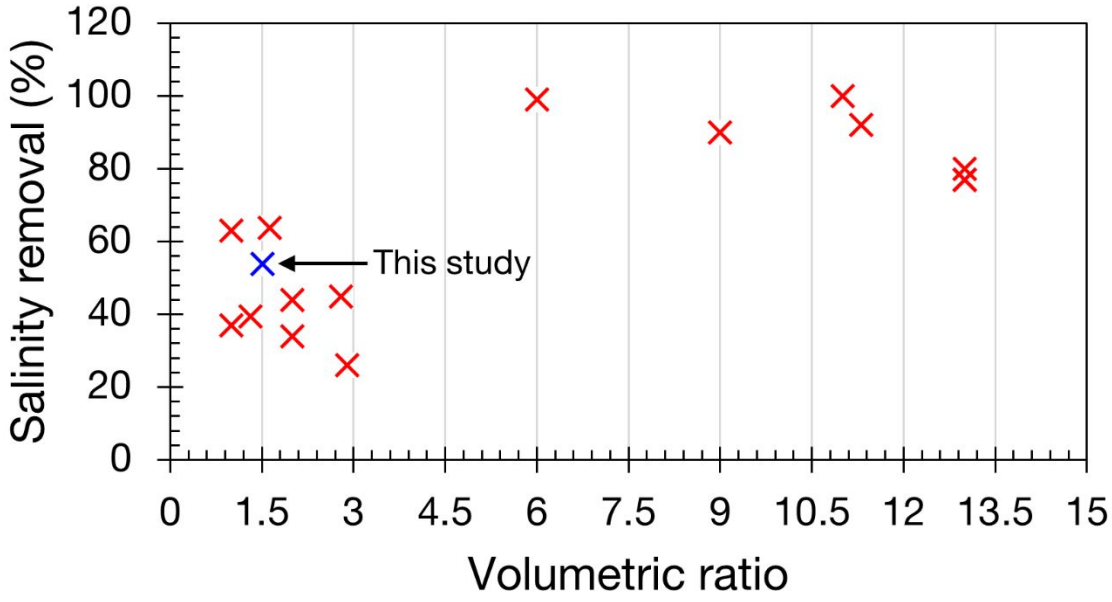

Figure S3. Effect of volumetric ratio (volume of anode to volume of desalination) in the salinity removal.[1–7]

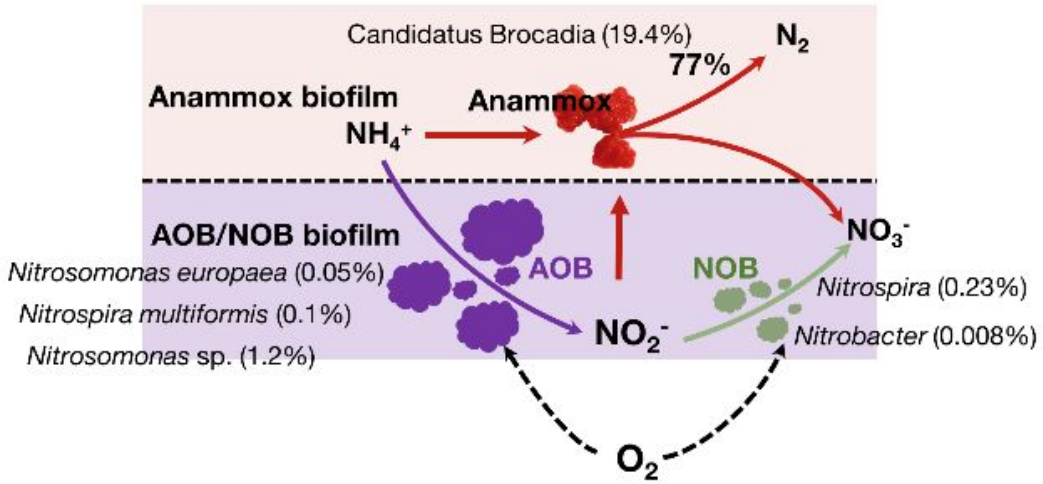

Figure S4. One stage nitritation anammox mechanism in bioelectrochemical biofilm with relative abundance of anammox, AOBs and NOBs.

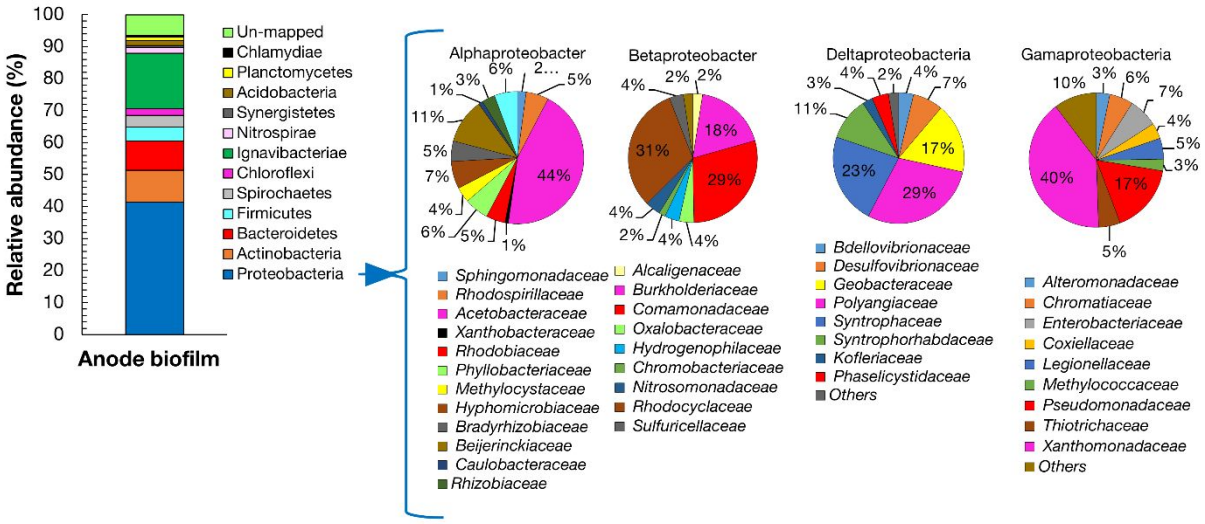

Figure S5. The relative abundance of the microbial community of anode biofilm at the phylum level and family level for proteobacteria phylum.

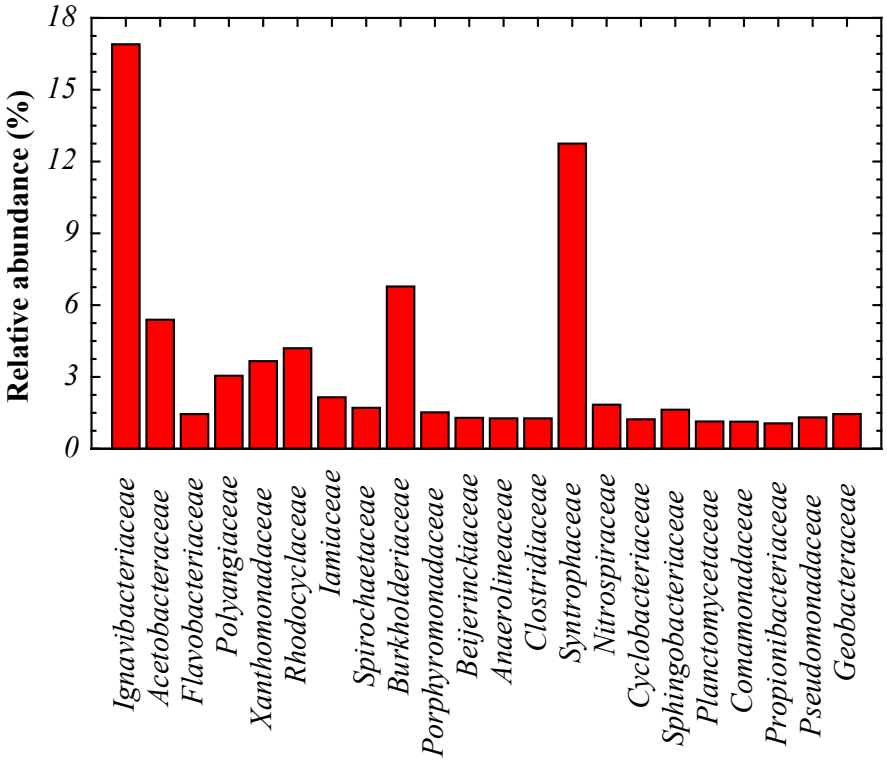

Figure S6. The relative abundance of the microbial community of anode biofilm at the family level.

Energy production calculation

The voltage (V) produced by the NiA_{mox}MDC was recorded by using Fluke (287 true RMS) multimeter. The voltage was dropped across 1000 Ω load resistor (R) in every 15 minutes of interval. This gives us the value of current flowing through the system in every 15 minutes. The energy produced by MDC was calculated using eq S1.

$$\text{Energy produced by MDC} = \int_0^t i(A)v(V)\,dt = 8.70 \text{ watt-sec} \quad \text{(S1)}$$

$$= 8.70 \backslash (3600*1000) \text{ kWh}$$

$$= 2.41 * 10^{-6} \text{ kWh}$$

$$= (2.41 * 10^{-6} \text{ kWh}) / (60 \text{ ml} * 10^{-6}) \text{ (anode volume 60 ml)}$$

$$= 0.040 \text{ kWh/m}^3$$

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