Supporting Information

Nanocomposite membrane composed of nano-alumina within sulfonated PVDF-co-HFP/Nafion blend as separating barrier in single chambered microbial fuel cell

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Fig S1. FT-IR of membranes

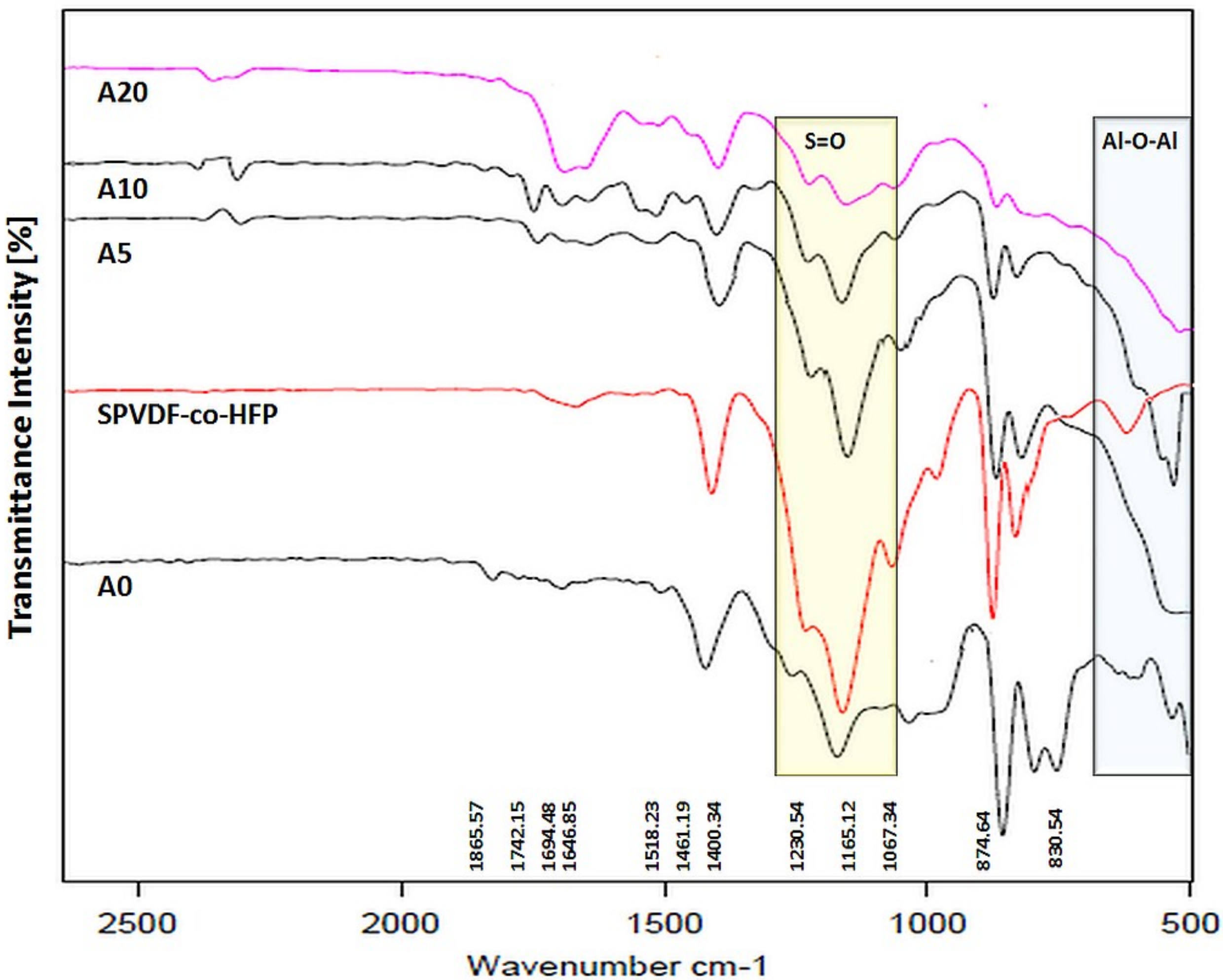


Fig S2. Nano-Al_2O_3 doped sulfonated PVDF-co-HFP/Nafion nanocomposite membranes

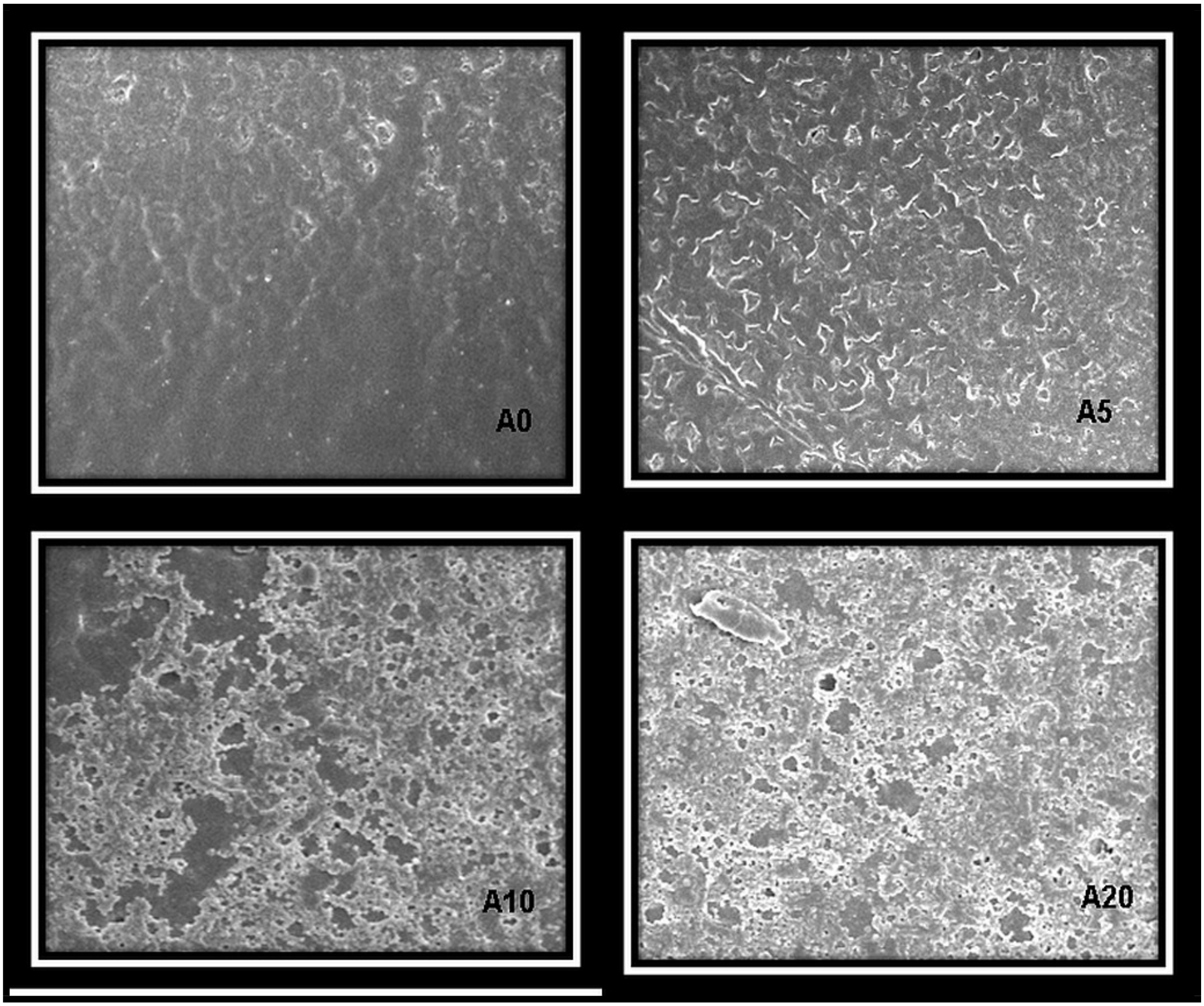
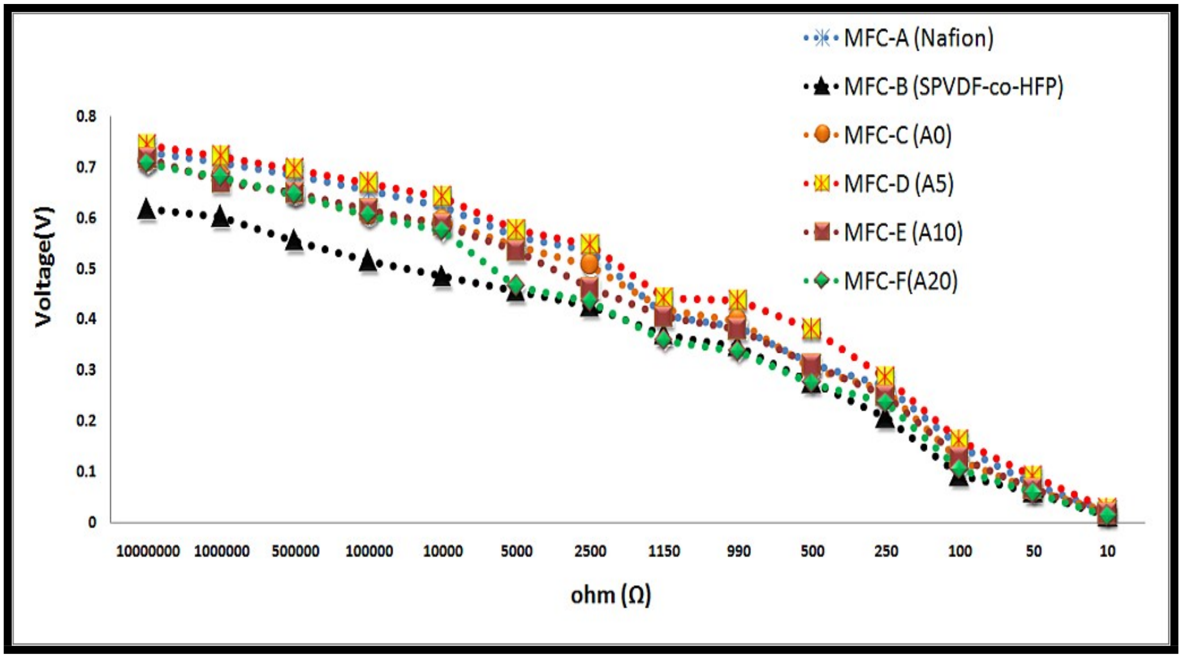


Fig S3. Cell performance at different resistances



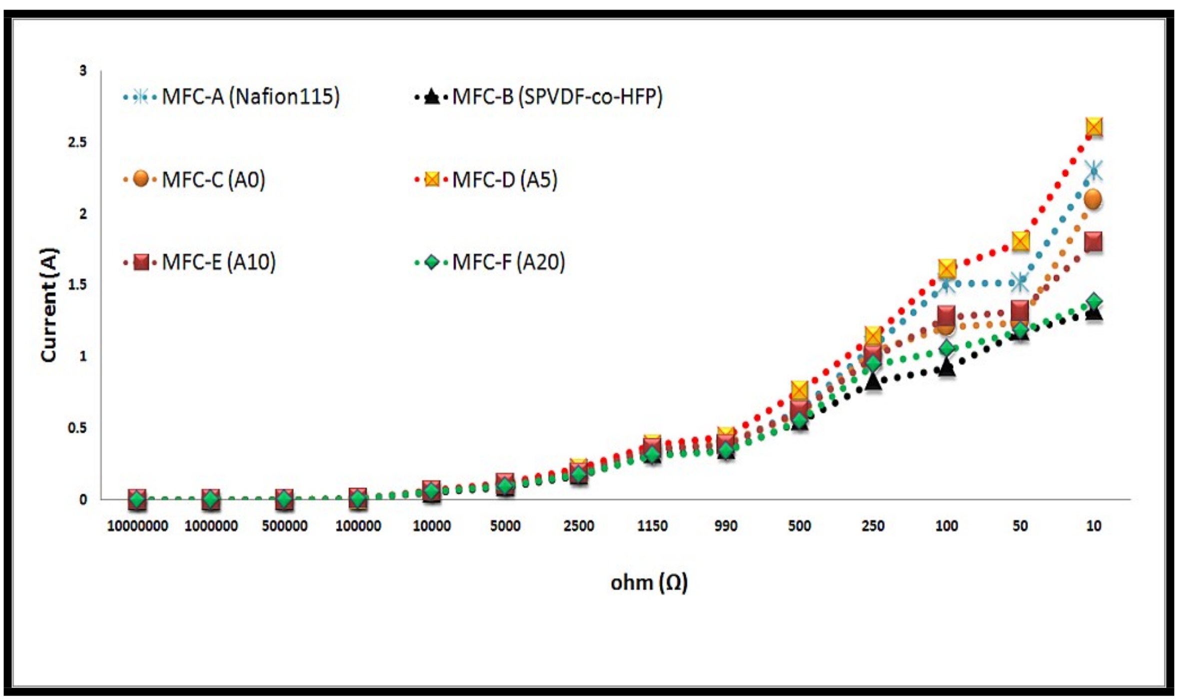


Table T1. A comparative study of MFCs in terms of power generation using different membranes

MFC Type	**Electrodes**	**Used Membranes**	**Maximum Power density**	**References**
Dual chamber with oxygen flow at cathode	Carbon papers	Nafion 117	600 mWm^{-2}	1
Air cathode MFC	Carbon Brush	Glass fibers	240±22 mWm^{-2}	**2**
	Carbon Mesh	Coated Glass fibers	230 ± 3.3 mWm^{-2}	
Air cathode MFC	Carbon papers	Nafion 117	239.4 mWm^{-2}	3
Air cathode MFC	Carbon papers	SPEEK/PES	170 mWm^{-2}	4
Dual chamber	Graphite Plates	Fe3O4/PES nanocomposite	20 mWm^{-2}	5
Single chamber (tubular) MFC	Carbon cloths	GO-PVA-STA composite	139 mWm^{-2}	6
Single chambered MFC	Carbon cloths	J-cloth	280 ± 6 mWm^{-2}	7
Air cathode MFC	Carbon cloths	Nano Al_2O_3 doped SPVDF-co-HFP/ Nafion nanocomposite	541.52 ± 27 mWm^{-2}	Present study

References:

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5. Rahimnejad, M.; Ghasemi, M.; Najafpour, G. D.; Ismail, M.; Mohammad, A. W.; Ghoreyshi, A. A.; Hassan, S. H. A. Synthesis, Characterization and Application Studies of Self-made Fe3O4/PES Nanocomposite Membranes in Microbial Fuel Cell. Electrochimica Acta 2012, *85*, 700–706.

6. Santimoy Khilari, Soumya Pandit, Makarand M. Ghangrekar, Debabrata Pradhan, Debabrata Das, Graphene oxide impregnated PVA-STA composite polymer electrolyte membrane separator for power generation in single chambered Microbial Fuel Cell. Industrial & Engineering Chemistry Research 2013, 52, 11597−11606.

7. Fang Zhang, Yongtae Ahn, Bruce E. Logan, Treating refinery wastewaters in microbial fuel cells using separator electrode assembly or spaced electrode configurations. Bioresource Technology 2014, 152, 46–52

Fig S4. 16S rDNA sequences of employed microbes.

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Uncultured Lysinibacillus sp. partial 16S rRNA gene, isolate VA5

Sequence ID: emb|HE648059.1| **Length:** 320 **Number of Matches:** 1

Range 1: 1 to 320 GenBank Graphics ▼ Next Match ▲ Previous Match

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Uncultured Lysinibacillus sp. partial 16S rRNA gene, isolate VA1

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Uncultured bacterium partial 16S rRNA gene, isolate VA3

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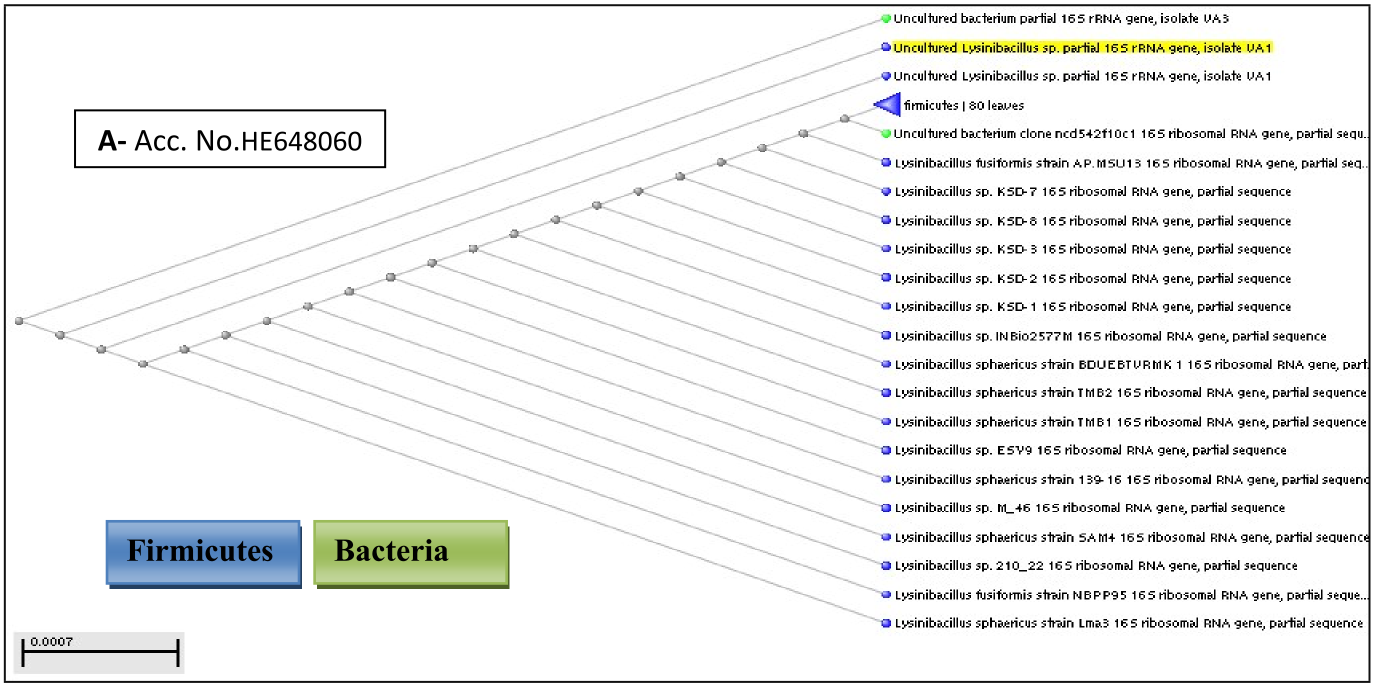
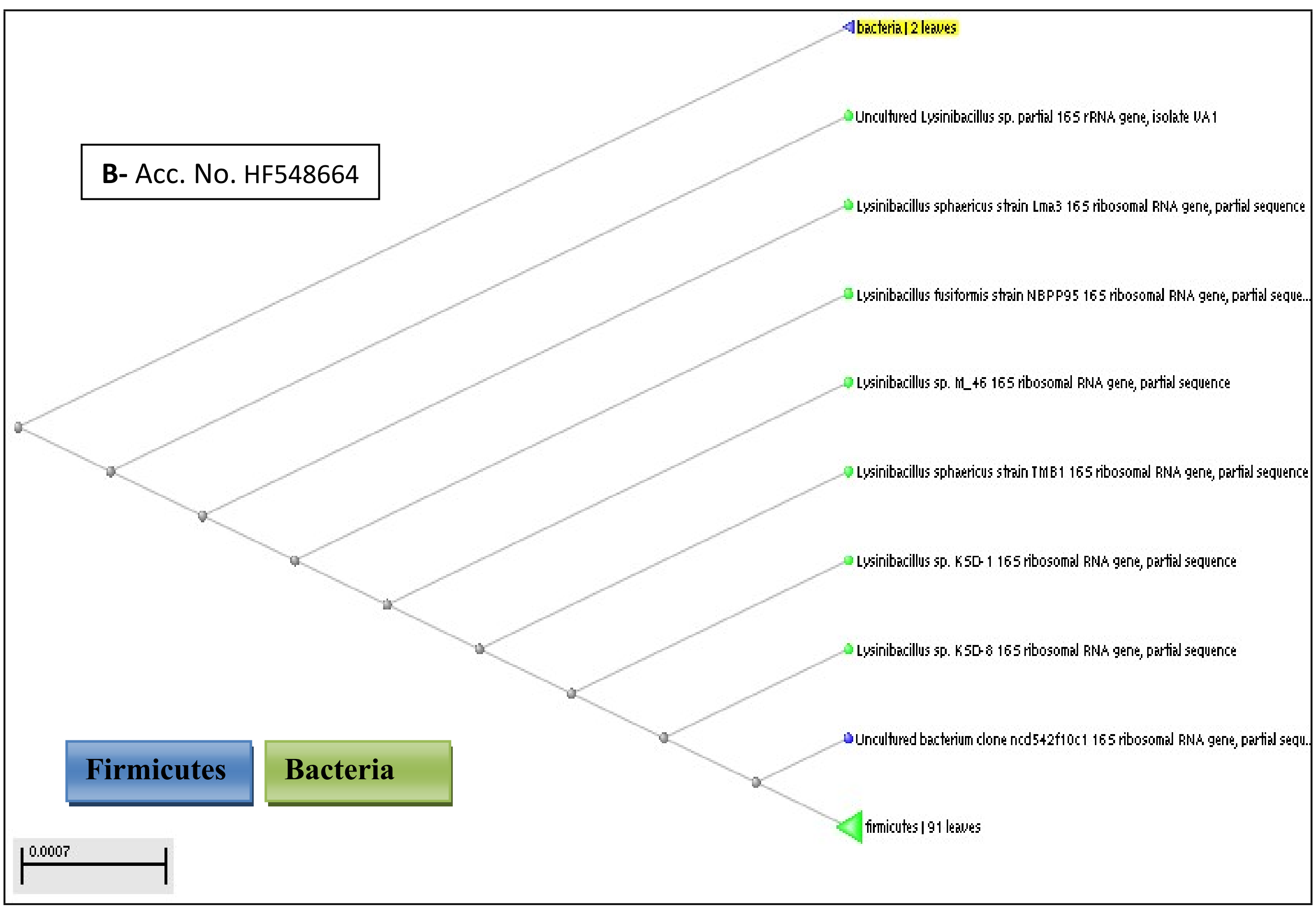
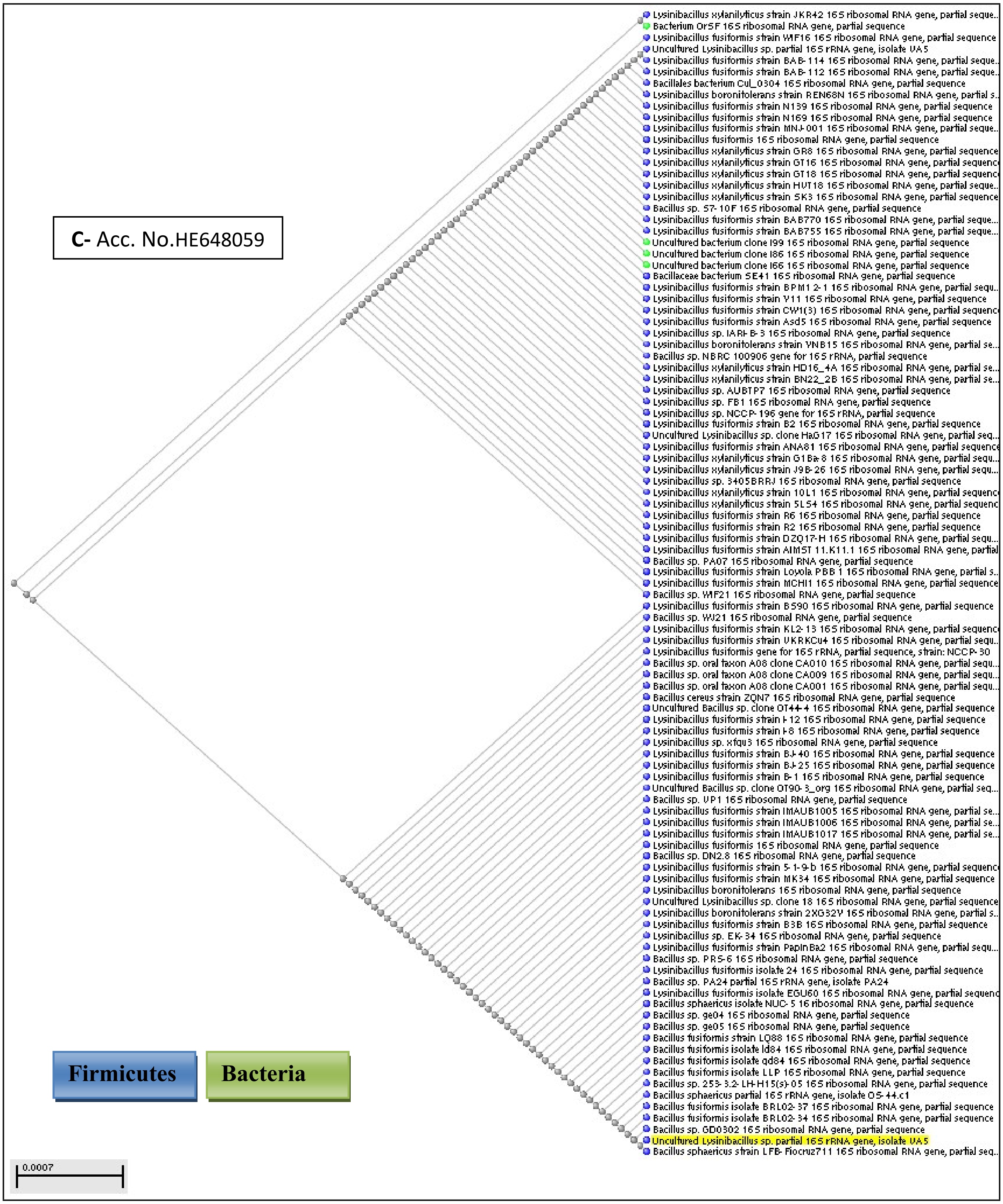
Phylogenetic tree based on 16S rDNA sequences of *Lysinibacillus species* (A,B and C) with closely related species using neighbor joining alignment



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Bacillus sp. PA24 partial 16S rRNA gene, isolate PA24
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Bacillus sphaericus isolate NUC-5 16 ribosomal RNA gene, partial sequence
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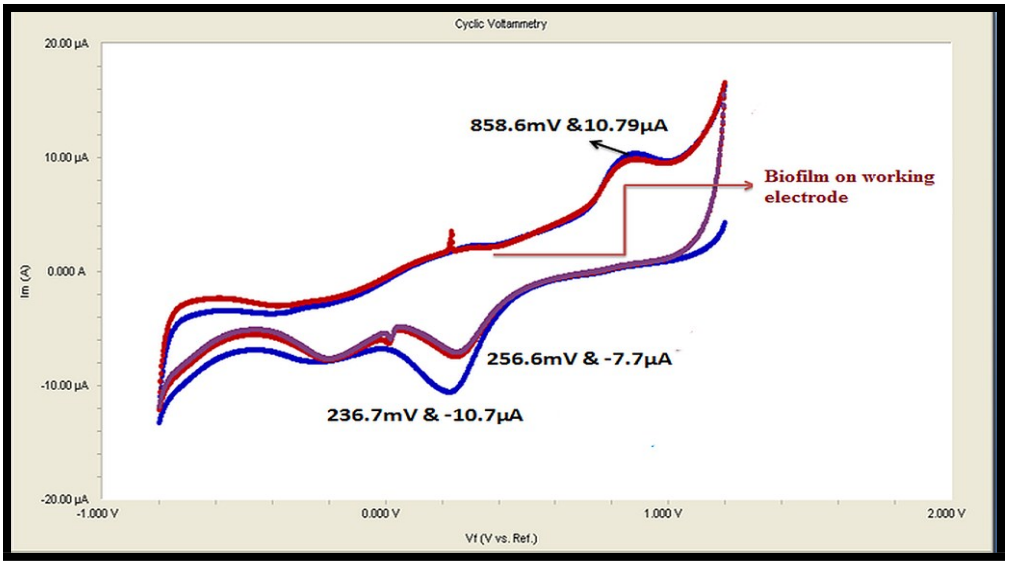
Firmicutes
Bacteria
0.0007

Fig S5. Cyclic voltammogramms of microbes



Electron transfer from biofilm to electrode indicated microbial oxidation, whereas reduction peaks corresponded towards microbial reduction (charge transfer from electrode to biofilm). This redox activity was attributed to the microbial cell surface proteins that evidently ensured its biocatalytic activity, resulting in subsequent substrate utilization from the employed *firmicutes* on repeated potential cycling.

Fig S6. SEM images of control (Left) and the formed biofilm colonies on the electrodes

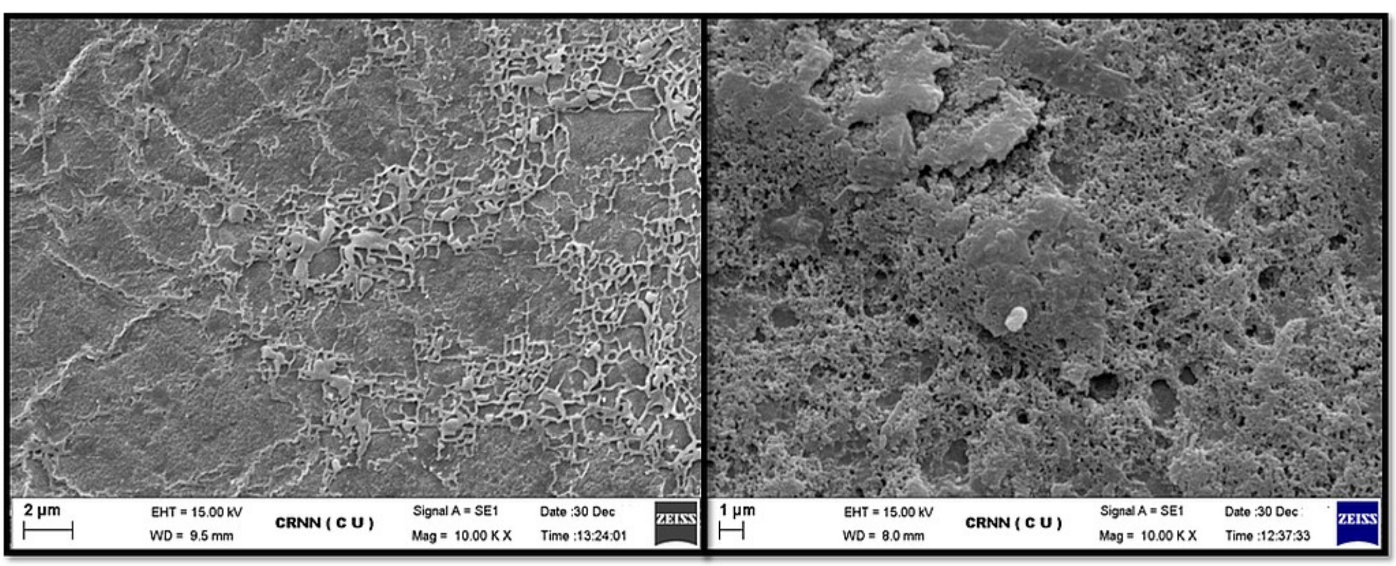
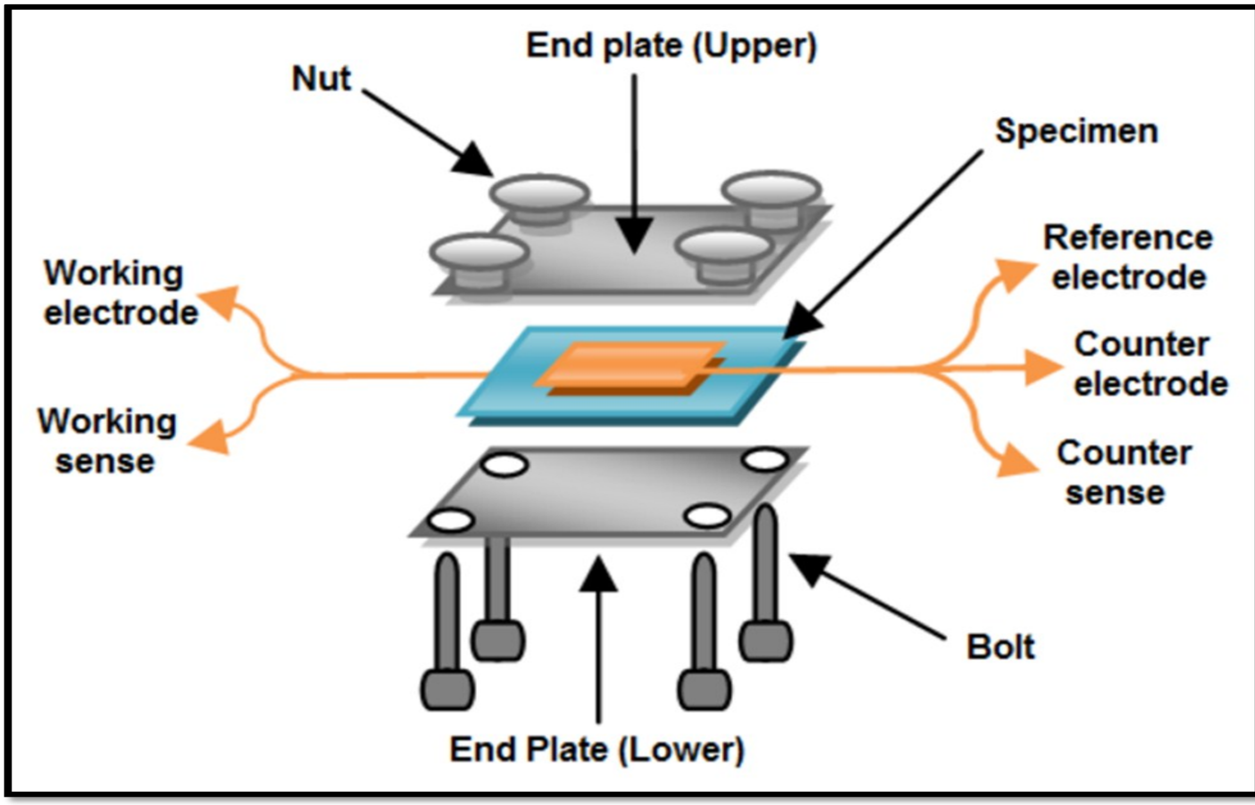


Fig S7. Schematic illustration for proton conductivity measurement.



Cost comparisons

Membranes	Costs (USD)
Nafion	~1.8-2.3$/cm^2
AEMs(e.g., AMI 7001)	~1.2-1.6$/cm^2
CEMs(e.g., CMI 7000)	~0.6-1.2$/cm^2
Glass fiber	~0.34$/100cm^2
Wiper J-cloth	~0.31$/100cm^2
Al_2O_3 incorporated nanocomposite membrane	**~0.8$/100cm^2**