Supporting information

Impact of flow recirculation and anode dimensions on performance of a large scale microbial fuel cell

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Impact on performance of anode coverage of the cathode

Reducing the number of anodes from 22 to 8 decreased the maximum power density to 0.068 ± 0.002 W m^{-2}, only 10% higher than that obtained with an electrode spacing of 3.5 cm (0.061 ± 0.003 W m^{-2}).[9] The calculated reduction of the internal resistance with smaller spacing was only 0.06 Ω (2.62 Ω with 3.5 cm electrode spacing and 2.56 Ω with 1.3 cm electrode spacing) despite the estimated internal resistance decrease was 0.3 Ω for a solution conductivity of 1.2 mS cm^{-1}, likely due to the large distance between the brush anodes, that result in a potential distribution in the electrolyte that was not parallel (Figure S1).

Anode and cathode performance was lower using 8 anode brushes in respect to 22. The anode potential at the maximum power density was – 0.174 ± 0.008 V at 0.218 ± 0.004 A m^{-2}. The cathodic overpotential was higher using 8 anodes, the cathode potential was 0.16 ± 0.01 V at 0.218 ± 0.004 A m^{-2} (8 anodes) in respect to 0.176 ± 0.006 V at a much higher current density of 0.277 ± 0.009 A m^{-2} (22 anodes). It has been previously showed that increasing the area per volume of reactor of one electrode can increase the performance of the opposite electrode and

the power density and volumetric power density.[13] Maximizing the electrode area is a fundamental parameter when scaling up MFCs.[9,18]

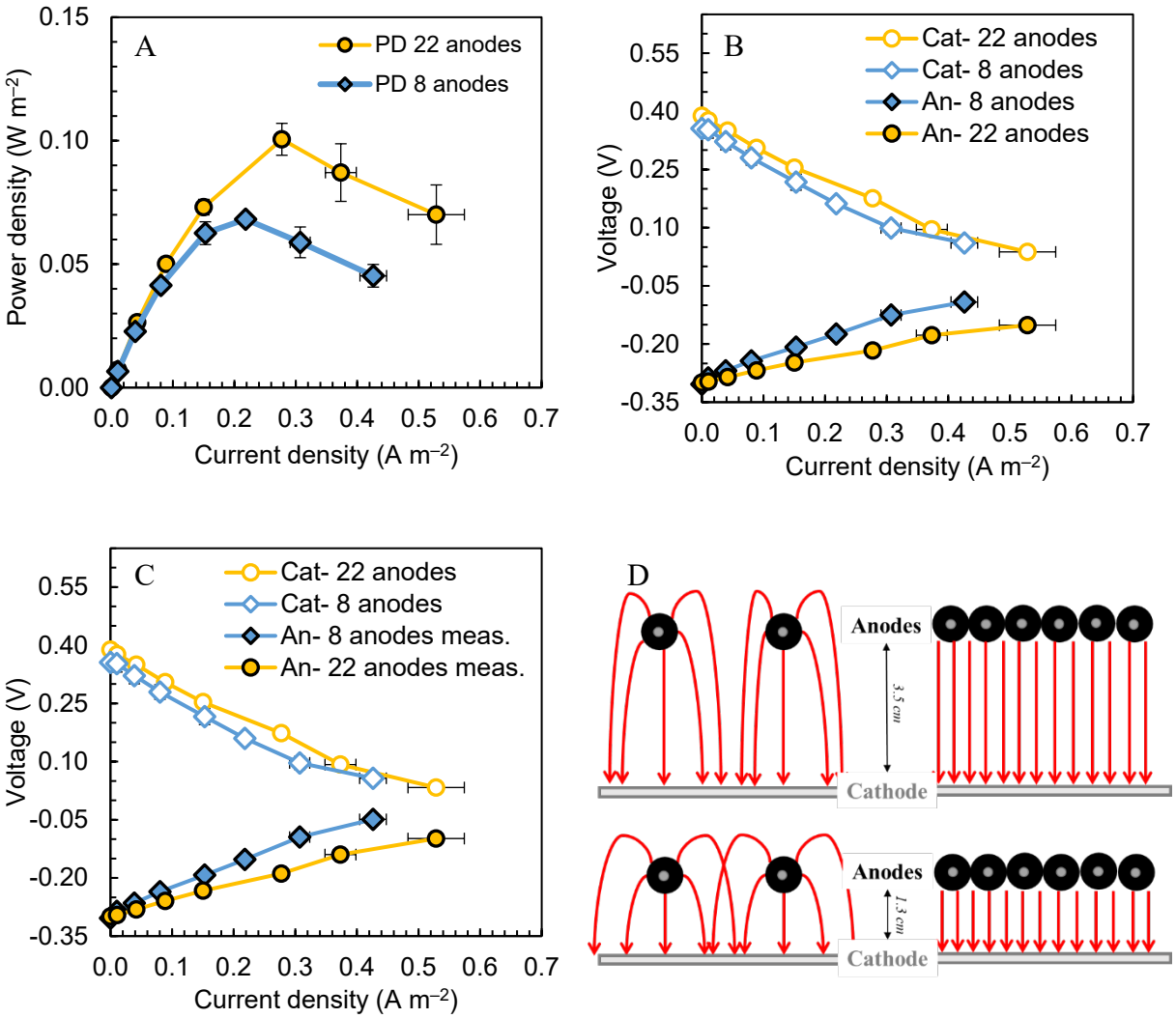

Figure S1. (A) Power density comparison using 8 (anodic projected area = 0.25 m^2) and 22 anode brushes (anodic projected area = 0.60 m^2) in the anode module with a 1.3 cm electrode spacing. (B) Corrected for electrode spacing and (C) measured electrode potential.

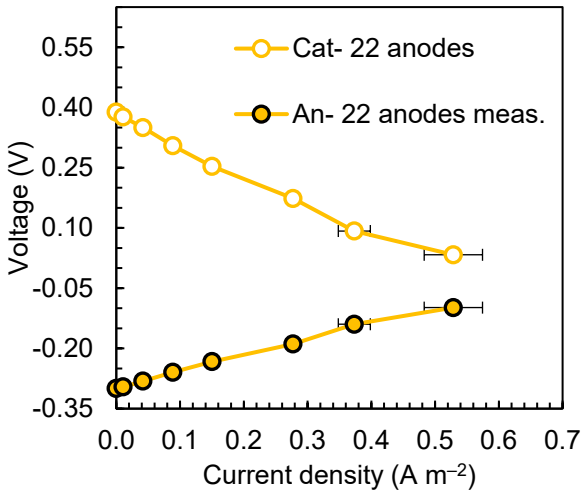

Figure S2. Measured cathode (Cat) and anode (An) potentials using 22 anode brushes (projected area = 0.60 m^2) in the anode module with a 1.3 cm electrode spacing.

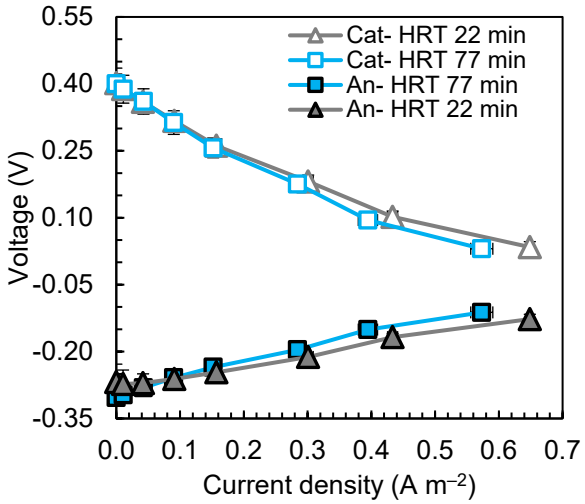

Figure S3. Measured cathode (Cat) and anode (An) potentials at an HRT of 22 min or 77 min in "diagonal" flow path.

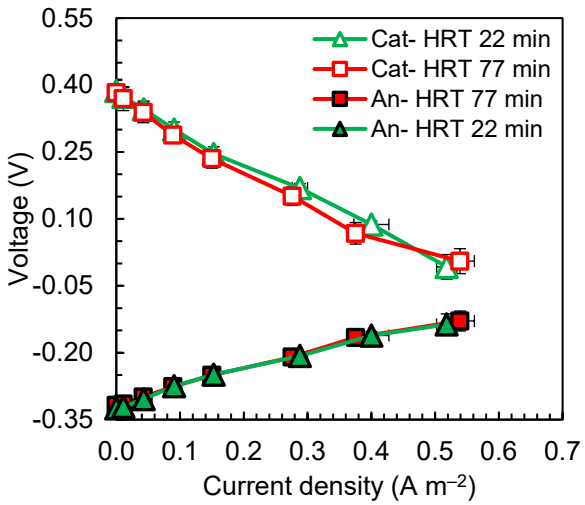

Figure S4. Measured cathode (Cat) and anode (An) potentials at an HRT of 22 min or 77 min in "parallel" flow path.

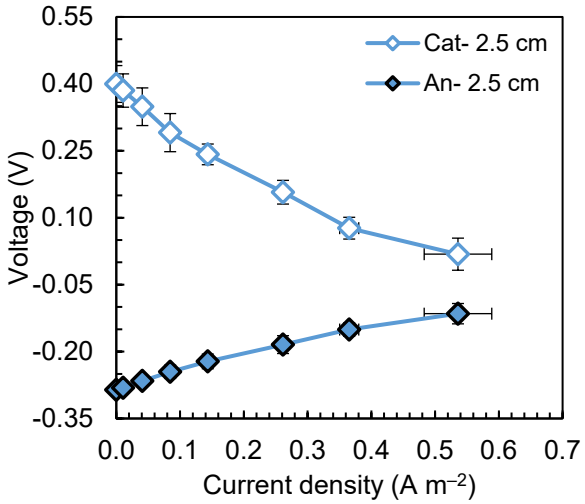

Figure S5. Measured cathode (Cat) and anode (An) potentials with 38 anode brushes of 2.5 cm diameter.

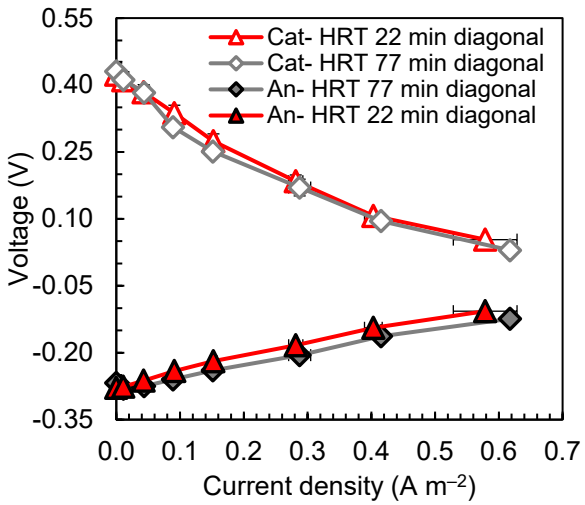

Figure S6. Measured cathode (Cat) and anode (An) potentials with 38 anode brushes at an HRT of 22 min or 77 min in "diagonal" flow path.

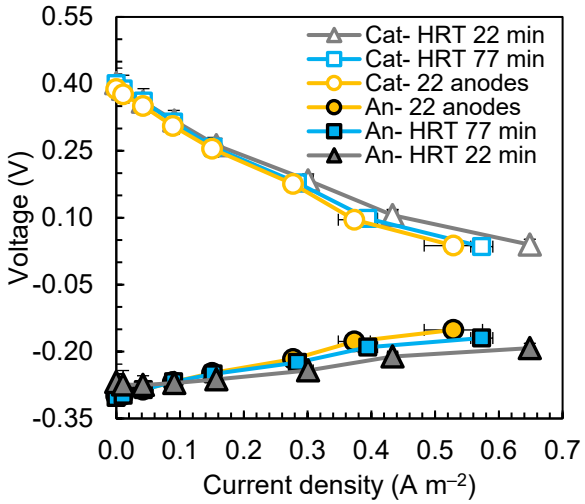

Figure S7. Comparison of the cathode (Cat) and anode (An) potentials with 22 anode brushes at an HRT of 22 min or 77 min in "diagonal" flow path and with no recirculation.