Supporting Information

Graphene oxide impregnated PVA-STA composite polymer electrolyte membrane separator for power generation in single chambered Microbial Fuel Cell

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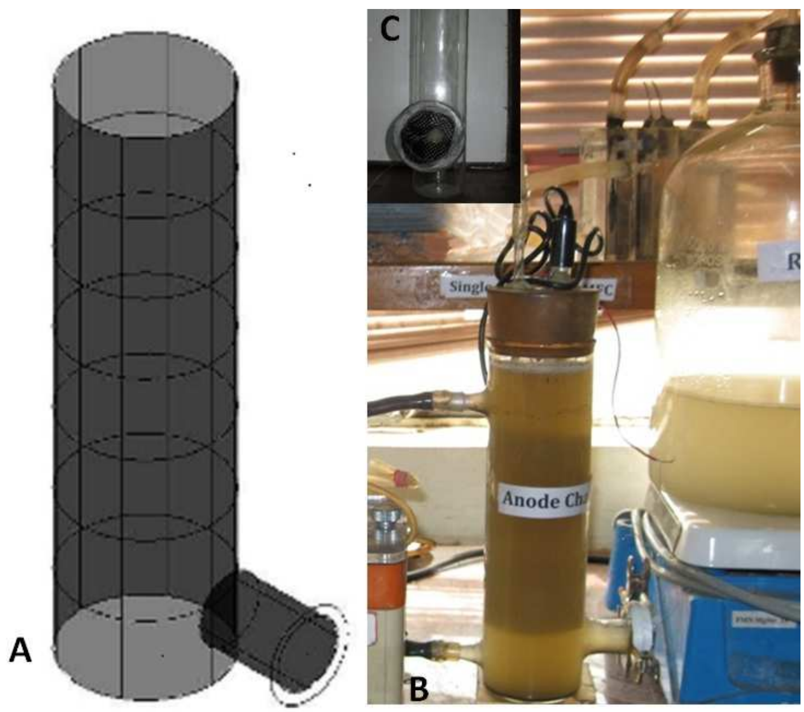

Figure S1. a) Schematic diagram of tubular single chambered MFC, b) Photograph of tubular single chambered MFC and c) Front view of cathode of tubular single chambered MFC (Inset).

Methods

Analytical measurements and calculations

The performance of MFC was examined in terms of power generation and coulombic efficiency. The operating voltage was measured using a digital multimeter with data acquisition system (USB-6009, National Instruments, Texas; USA). The anode and cathode potentials were measured using saturated Ag/AgCl reference electrode. Voltages were recorded every 15 min by a computer (NI LabVIEW–based customized software, Core Technologies, India) and converted to power according to

$$P = I \times V \tag{1}$$

where P = power, I = current, and V = voltage (V). The volumetric power density was expressed by dividing the power by working volume of the anode chamber. The volumetric current density was calculated by normalizing power with respect to anode surface area and anolyte volume of anode compartment respectively (equation 2)

$$i_d = \frac{V}{RV_{and}} \tag{2}$$

where R the external resistance (Ω) and V_{and} (cm^3) is the working volume of the anode chamber. The current density i_a (normalized to anode surface area) was calculated using

$$i_a = \frac{V}{RA} \tag{3}$$

where A (cm^2) the geometric surface area of the anode electrode. Power density was calculated as

$$p_a = \frac{V^2}{RA} \quad (4)$$

Polarization curves were obtained using variable resistance box (99 kΩ-0.1 Ω). The Coulombic efficiency (CE) is defined as the ratio of total Coulombs actually transferred to the anode from the substrate, to maximum possible Coulombs if all substrate removal produced current. The CE of the MFC operated under batch feed mode over a period of time *t*, was calculated according to Logan et al.[1]

$$\mathrm{CE} = \frac{\mathrm{M}\int_0^t \mathrm{I}dt}{\mathrm{Fbv}\Delta\mathrm{COD}} \quad (5)$$

where M = 32, molecular weight of oxygen; F, Faraday's constant = 96485 C/mol; b = 4, the number of electrons exchanged per mole of oxygen; v is the volume of the anode chamber of MFC; ΔCOD is the difference in the COD at t=0 and COD at the end of the batch test.

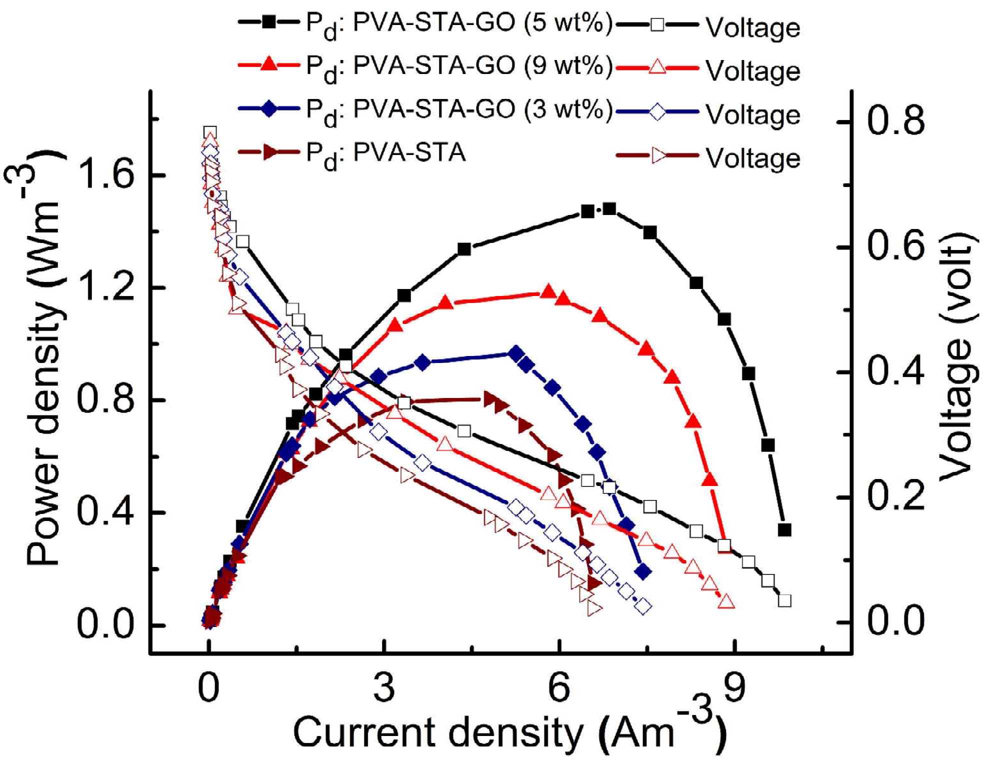

Figure S2. Comparison of polarization study of MFCs using with different GO containing PVA-STA-GO membranes and PVA-STA based MCA.

Table S1. A comparative study in terms of power generation using different membrane in MFC.

Anolyte volume	Anode	Cathode	Membrane type	Highest Power density	Reference
13 mL	Graphite electrode(17 cm^2)	Graphite electrode rod(17 cm^2)	Sulfonated polyethylene/poly(styrene-co-divinylbenzene) [PE/poly(St-co-DVB)]	44.1 mW/m^2	2
42.5 mL	carbon paper(15 cm^2)	Platinised carbon paper	Sulfonated poly(ether ether ketone)/poly(ether sulfone)	70.5 mW/m^2	3
28 mL	Carbon cloth	Platinised carbon Cloth(0.5 mg/cm^2)	Sulphonated polyetherether ketone (SPEEK)	5.7 W/m^3	4
760 mL	Graphite plate(20 cm^2)	Graphite plate(20 cm^2)	Fe_3O_4/PES nanocomposite	20 mW/m^2	5
350 mL	Carbon cloth(48 cm^2)	Platinised Carbon cloth(18.1 cm^2)		1.9 W/m^3 Or 139 mW/m^2	Present study

References

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