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Electronic Supplementary Information

Multi-walled carbon nanotube and carbide-derived carbon supported metal phthalocyanines as cathode catalysts for microbial fuel cell application

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A comparison of the RDE results

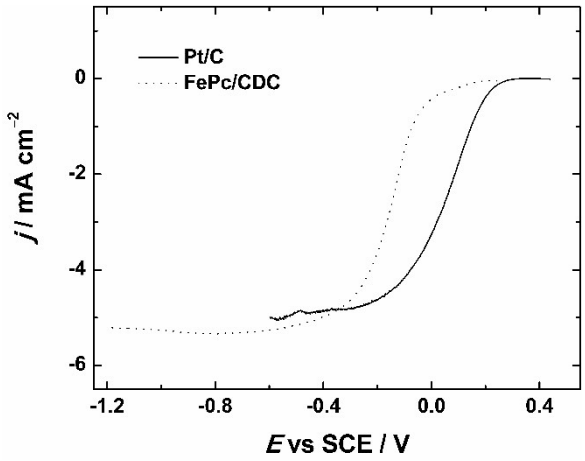

Fig. S1 Comparative RDE voltammetry curves for O_2 reduction on FePc/CDC (loading of 0.4 mg cm^{-2}) and Pt/C (Pt loading of 40 µg cm^{-2}) catalysts recorded in O_2–saturated 0.1 M PBS containing 0.1 M K_2SO_4 (pH 7) (ω = 1900 rpm, v = 10 mV s^{-1}).

Cost analysis (INR - ₹, USD - $ and 1 ₹ = 0.014 $)

Total cathode surface area = 120 cm^2

- **Cost calculation for M-1 (with FePc/MWCNT)**

Cost of FePc/MWCNT = 85.2 $ g^{-1}

Catalyst loading = 0.2 mg cm^{-2}

Total catalyst required = 24 mg

Total cost of FePc/MWCNT used = 85.2 $ g^{-1} × 24 mg = **2.05 $ (A1)**

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- *Component used for preparation of catalyst ink*

Cost of activated carbon, @0.5 mg cm^{-2} = 60 mg = 0.003 $
Nafion 117 dispersion (5% in alcohol) = 3.3 $
Acetone as solvent = 1.146 $
Total cost = **4.45 $ (B)**

- *Cost for reactor and electrode*

Cost of clayware reactor is ₹ 10/- and cost of required carbon felt is approx. ₹ 80 /-
Total = ₹ 90/- ≈ **1.35 $ (C)**
So, Total cost of construction of M-1 = **A1+B+C ≈ 7.85 $**

- **<u>Cost calculation for M-2 (with CoPc/MWCNT</u>**)

Cost of CoPc/MWCNT = 81.5 $ g^{-1}
Catalyst loading = 0.2 mg cm^{-2}
Total catalyst required = 24 mg
Total cost of CoPc-MWCNT used = 85.2 $ g^{-1} × 24 mg = **1.96 $ (A2)**
So, Total cost of construction of M-2 = **A2+B+C ≈ 7.76 $**

- **<u>Cost calculation for M-3 (with FePc/CDC)</u>**

Cost of FePc-CDC = 31.5 $ g^{-1}
Catalyst loading = 0.4 mg cm^{-2}
Total catalyst required = 48 mg
Total cost of FePc-MWCNT used = 31.5 $ g^{-1} × 48 mg = **1.51 $ (A3)**
So, Total cost of construction of M-3 = **A3+B+C ≈ 7.31 $**

- **<u>Cost calculation for M-Pt (10 wt.% Pt on Vulcan XC72)</u>**

Cost of catalyst = 105 $ g^{-1} (Sigma-Aldrich)
Catalyst loading = 0.5 mg cm^{-2}
Total catalyst required = 60 mg
Total cost of 10 wt.% Pt on Vulcan XC72 used = 105 $ g^{-1} × 60 mg = **6.30 $ (A4)**
Total cost of construction of M-Pt = **A4+B+C ≈ 12.10 $**

32.7 mW m^{-2} power is generated from M-1 having net power output = (32.7×0.120)/7.85 = **0.50 mW $**$^{-1}$
42.2 mW m^{-2} power is generated from M-2 having net power output = **0.65 mW $**$^{-1}$
58.5 mW m^{-2} power is generated from M-3 having net power output = **0.96 mW $**$^{-1}$
62.1 mW m^{-2} power is generated from M-Pt having net power output = **0.62 mW $**$^{-1}$

Ratio of the cost of Pt to catalyst FePc/MWCNT = (6.30/1.96) ≈ **3.2**
Ratio of the cost of Pt to catalyst CoPc/MWCNT = (6.30/2.05) ≈ **3.1**
Ratio of the cost of Pt to catalyst FePc/CDC = (6.30/1.51) ≈ **4.2**