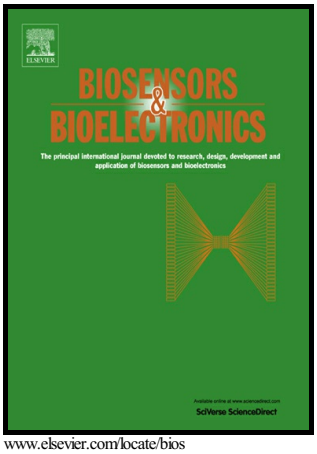

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Mrinal Kumar Sarma, Mohd Golam Abdul Quadir, Rupam Bhaduri, Sharbani Kaushik, Pranab Goswami

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Composite polymer coated magnetic nanoparticles based anode enhances dye degradation and power production in microbial fuel cells.

Mrinal Kumar Sarma[1], Mohd Golam Abdul Quadir[1], Rupam Bhaduri[1], Sharbani Kaushik[1], Pranab Goswami[2*]

[1]Center for Energy, [2]Department of Biosciences and Bioengineering, Indian Institute of Technology Guwahati, Guwahati-781039, Assam, India.

***Correspondence:** Fax: +91 361 2582249; Tel: +91 361 2582202; E-mail: pgoswami@iitg.ernet.in (P. Goswami)

Abstract

Combined power generation and waste degradation through microbial fuel cell (MFC) technology is emerging as an attractive solution for controlling pollution in water bodies. Cyanobacteria as fuel cell catalysts for such shared energy activities are not well studied even though these possess robust metabolic systems supporting exo-electrogenicity, biodegradation of toxic compounds, and their survival under wide environmental conditions. Herein, a dual chambered (50 ml each) MFC assembled with *Synechococcus* sp. based bioanode and abiotic cathode for simultaneous power generation and Mordant orange dye degradation is reported. The anode was prepared by encrusting chemically synthesised magnetic nanoparticle (MNP) of size 8.4 ± 0.2 nm with magnetization of 69 emu g^{-1}on Toray carbon paper (TCP). The MNPs were encapsulated with aniline and pyrrole composite polymers to facilitate biofilm formation and cellular electron flow to the anode as confirmed by advance microscopic and voltametric techniques, respectively. The MFC with the dye mixed acetate produced current of 14.04 ± 5.5 A m^{-3} with a maximum power density of 4.9 ± 0.5 W m^{-3} (at cell voltage of 0.494 ± 0.05 V), which was 18 % higher than the control (without dye). The MFC produced a high OCP of 0.949 ± 0.07V and offered to decolorize 68.5 % and degrade 89 % of the dye following 216 h of its operation as confirmed by photometry (λ_{385nm}) and LC-MS/MS analyses, respectively. The efficient dye degradation is attributed to the bioanode for secreting high level of reactive oxygen