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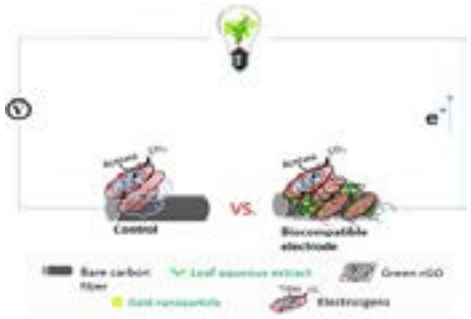
Green synthesized biocompatible anode in MFCs for sustainable wastewater treatments and energy recycling

Ying Cheng, Zuliang Chen, Megh Mallavarapu and **Ravi Naidu**
University of Newcastle, Australia

Statement of the Problem: The ever-increasing demand for energy and the growing water shortage are two major challenges all over the world. It is urgent to find environmentally sound methods for energy generation and waste disposal. Microbial fuel cells (MFCs) offer a clean and energy-conservative way for wastewater treatment and energy recycling. The performance of electrodes is the most important aspect in improving the power density and promoting the application of MFCs in large scales. Improving the anode configuration to enhance biocompatibility and accelerate electron shuttling is critical for efficient energy recovery in MFCs. Therefore, we aim to design an easy and eco-friendly synthesis process of nanomaterials for the modification of the electrode, eliminating the generation of hazardous substances while enhancing the productivity of MFC. Methodology: Graphene-based nanocomposite was coated using layer-by-layer assembly technique onto carbon brush anode then green reduced by Eucalyptus leaf extract. Findings: The green synthesized nanocomposite film affords larger surface roughness for microbial colonization. The modified anode achieved a 3.2-fold higher power density of 33.7 W/m^3 at a current density of 54.9 A/m^3 with a 75% shorter start period. Conclusion & Significance: The layer-by-layer structure of green reduced rGO/Au NPs film creates a high bacteria loading capacity, promotes intimate contact between the electricigens and anode surface and facilitates cell-anode interaction. Thereby the charge transfer efficiency in the process of electricity generation and power delivery is elevated. This green approach for designing biocompatible anode provides much potential for high-performance MFCs and efficient energy recovery. Finally, the increment in electrical conductivity and catalytic efficiency of anode guarantees its further applications in MFCs for sewage treatments.



Biography

Ying Cheng has her expertise in environmental remediation by nano-materials and by the biodegradation with microorganism. She developed novel functional nanomaterials by green synthesize with potential application in field remediation of contaminants. Besides, She has isolated several bacteria for the degradation of textile pollutions and organic contaminants. Functional biomaterials based on the immobilization of cells has been used in the removal of both textile pollutions and heavy metals. She aimed to integrate nano-material degradation with biodegradation for environmental remediation and the energy recycling and to understand the scientific issues for bio-nano interface.

ying.cheng@uon.edu.au

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