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Blue green algae: a hope for future in energy harvesting

Abstract:

A boom in energy dependency, with rapid industrialization, resulted in the search for alternative fuel resources. Although solar, wind and geothermal resources emerged as alternative sources, they suffer from reliability on the optimum environmental conditions for the peak energy output. Research geared toward fuel cells suffered from low conversion efficiency and low power density. Hence, a reliable, uninterrupted energy resource with zero environmental dependencies and cost-effectiveness remains the main challenge in alternative energy resources. A micro-photosynthetic power cell (μ -PSC) is a biofuel cell which contains suspended blue-green algae in the anode chamber separated by a strong electron acceptor in the cathode chamber in a microfluidic environment. The suspended blue-green algae in the anode chamber perform photosynthesis in the presence of light-releasing electrons. These electrons are collected by the charge-collecting electrode, realizing a potential. With the absence of light (dark), the blue-green algae perform respiration, releasing electrons. Again, these are collected by the charge-collecting electrode; the electricity is produced irrespective of the environmental condition. The microfluidic environment of this technology has resulted in nullifying any biofilm formation on the electrode terminals. This paper will discuss the modelling, design, fabrication, testing and validation of this μ -PSC technology. We are reporting a power density of 4.13 mw/m² with 2ml of suspended algae under an area of 484 cm² (22cm x 22cm). Electron transport and electron collection in this microfluidic-based energy harvesting technology will be covered briefly in this paper. Challenges and factors governing the scaling of this output will be addressed.

Biography

Dhillipan M. Panneerselvam is a Ph.D. student at the Optical Bio-Microsystems laboratory at Concordia University, Montreal, Canada. His expertise spans algae cultivation, engineering design and modeling and validation of physical processes. His research interests include identifying and developing green energy resources, modelling biofuel cells and designing and developing a carbon-neutral environment.