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Evaluation of selected tropical marine microalgal cultures for use in biophotovoltaic platforms

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Abstract

In this study, the bioelectrical power generation potential of four tropical marine microalgal strains native to Malaysia was investigated using BPV platforms. *Chlorella* UMACC 258 produced the highest power density (0.108 mW m^{-2}), followed by *Halamphora subtropica* UMACC 370 (0.090 mW m^{-2}), *Synechococcus* UMACC 371 (0.065 mW m^{-2}) and *Parachlorella* UMACC 245 (0.017 mW m^{-2}). The chlorophyll-a (chl-a) content was examined to have a linear positive relationship with the power density ($p < 0.05$). The photosynthetic performance of strains was studied using the pulse-amplitude modulation (PAM) fluorometer; parameters measured include the following: maximum quantum efficiency (F_v/F_m), alpha (α), maximum relative electron transport rate ($rETR_{max}$), photo-adaptive index (E_k) and non-photochemical quenching (NPQ). The F_v/F_m values of all strains, except *Synechococcus* UMACC 371, ranged between 0.37 and 0.50 during exponential and stationary growth phases, suggesting their general health during those periods. The low F_v/F_m value of *Synechococcus* UMACC 371 was possibly caused by the presence of background fluorescence from phycobilisomes or phycobiliproteins. Electrochemical studies via cyclic voltammetry (CV) suggest the presence of electrochemically active proteins on the cellular surface of strains on the carbon anode of the BPV platform, while morphological studies via field emission scanning electron microscope (FESEM) imaging verify the biocompatibility of the biofilms on the carbon anode.

Key points

- *Maximum power output of 0.108 mW m^{-2} is recorded by Chlorella UMACC 258*
- *There is a positive correlation between chl-a content and power output*
- *Proven biocompatibility between biofilms and carbon anode sans exogenous mediators*

Keywords Renewable energy · Bioelectricity · Algal biotechnology · Marine microalgae · Biophotovoltaic platform

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