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Mathematical Modeling of Light Energy Flux Balance in Flat Panel Photobioreactor for *Botryococcus braunii* Growth, CO_2 Biofixation and Lipid Production under Varying Light Regimes

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Highlights

- Propose mathematical model of light energy flux balance for flat panel PBR.
- Radiative transfer equation (RTE) accurately predicts the light transport in PBR.
- High cell conc. (> 0.83 g L^{-1}) reduced light penetration upto 3 cm of panel width.
- Maximum lipid yield on light energy was 0.146 g mol photons^{-1} at 450 μmol m^{-2} s^{-1}.
- Mathematical model for algal growth and dynamic lipid accumulation is established.

Abstract

Light is the most significant parameter for microalgal growth and light distribution inside the flat panel photobioreactor is critical to assess the photosynthetic productivity of *Botryococcus braunii*. In algal photobioreactors, self shading of the microalgal cells reduces the effective light penetration. The local light intensity inside the photobioreactor is essential for efficient designs.