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Abstract:

Double paddlewheels were proposed to generate cycle flow for increasing horizontal fluid velocity between dark and light zones in a flat plate photo-bioreactor, which strengthened the mass transfer and the mixing effect to improve microalgal growth with 15% CO_2. Numerical fluid dynamics were used to simulate the cycle flow field with double paddlewheels. The local flow field measured with particle image velocimetry fitted well with the numerical simulation results. The horizontal fluid velocity in the photo-bioreactor was markedly increased from 5.8×10^{-5} m/s to 0.45 m/s with the rotation of double paddlewheels, resulting in a decreased dark/light cycle period. Therefore, bubble formation time and diameter reduced by 24.4% and 27.4%, respectively. Meanwhile, solution mixing time reduced by 31.3% and mass transfer coefficient increased by 41.2%. The biomass yield of microalgae *Nannochloropsis Oceanic* increased by 127.1% with double paddlewheels under 15% CO_2 condition.

Keywords: microalgae, double paddlewheels, photo-bioreactor, cycle flow, biomass.

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