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Application of growth-phase based light-feeding strategies to simultaneously enhance *Chlorella vulgaris* growth and lipid accumulation

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Abstract

Considering the variations of optimal light intensity required by microalgae cells along with growth phases, growth-phase light-feeding strategies were proposed and verified in this paper, aiming at boosting microalgae lipid productivity from the perspective of light conditions optimization. Experimental results demonstrate that under an identical time-averaged light intensity, the light-feeding strategies characterized by stepwise incremental light intensities showed a positive effect on biomass and lipid accumulation. The lipid productivity ($235.49 \text{ mg L}^{-1} \text{ d}^{-1}$) attained under light-feeding strategy V (time-averaged light intensity: $225 \mu\text{mol m}^{-2} \text{ s}^{-1}$) was 52.38% higher over that obtained under a constant light intensity of $225 \mu\text{mol m}^{-2} \text{ s}^{-1}$. Subsequently, based on light-feeding strategy V, microalgae lipid productivity was further elevated to $312.92 \text{ mg L}^{-1} \text{ d}^{-1}$ employing a two-stage based light-feeding strategy V_{560} (time-averaged light intensity: $360 \mu\text{mol m}^{-2} \text{ s}^{-1}$), which was 79.63% higher relative to that achieved under a constant light intensity of $360 \mu\text{mol m}^{-2} \text{ s}^{-1}$.

Keywords: Microalgae; Growth-phase; Light-feeding strategy; Optimization; Lipid productivity

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