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Enhancement of CO_2 transfer and microalgae growth by perforated inverted arc trough internals in a flat-plate photobioreactor

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Abstract

Flat-plate photobioreactor (PBR) with perforated inverted arc trough (PIAT) internals was proposed to promote CO_2 bio-fixation by microalgae. The PIAT internals can enhance CO_2 transfer from gas to culture medium by prolonging CO_2 gas-liquid contact time and generate periodic aeration in the suspension upper side the PIAT providing suspension mixing. Experimental results showed gas-liquid contact time was prolonged from 0.448 s to 256 s and the CO_2 partial pressure inside the PIAT internals was about 15.5 kPa during microalgae cultivation. Consequently, the dissolved CO_2 concentration in the microalgae suspension of the proposed PBR was increased by 26.0% compared to that in the PBR without PIAT internals when 15% CO_2 (v/v) was aerated at a rate of 15 mL min^{-1}. The elevated CO_2 transfer contributed to a 20.9% increment in biomass concentration (3.35g L^{-1}) and a 26.2% increment in

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