Quantitative Analysis on Photon Numbers Received per Cell for Triggering β-Carotene Accumulation in Dunaliella salina

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Abstract

Accumulation of β-carotene in Dunaliella salina is highly dependent on light exposure intensity and duration, but quantitative analysis on photon numbers per cell for triggering β-carotene accumulation is not available so far. In this study, experiment results showed that significant β-carotene accumulation occurred with at least 8 hours illumination at 400 μmol photons·m-2·s-1. To quantifying the average number of photons received per cell (APRPC), correlation between light attenuation with light path, biomass concentration, and β-carotene content was built with both Lambert-Beer and Cornet models, and the latter provided a better simulation. With Cornet model, APRPC was calculated and proposed as a parameter for β-carotene accumulation. It was found that once APRPC reached 0.7 μmol photons cell-1, β-carotene accumulation was triggered, and it was saturated at 9.9 μmol photons cell-1. This study showed that APRPC can be used as an important parameter in D. salina cultivation process, to accurately simulate and control β-carotene production.

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