Induction of proteins, polyunsaturated fatty acids and pigments in three microalgae using flashing light

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May 5, 2020

Abstract

Microalgae use light to produce biomass and high value bio-compounds that are used as supplements in foods and feeds. They are commonly cultivated outdoors where organisms capture energy from sunlight. However, production at high latitudes require artificial light sources such as light emitting diodes (LEDs), to complement or entirely replace sunlight. LEDs can be tailored to emit repeatedly pulses of photons (so-called flashing light), which can stimulate growth or induce the biosynthesis of high value biomolecules. Here, we assessed the effects of flashing light (f = 5, 50 and 500 Hz; duty cycle = 0.05) on growth and biochemical composition of Nannochloropsis gaditana, Koliella antarctica and Tetraselmis chui strains. At low flashing light frequencies (e.g., f= 5 and 50 Hz), a strain-dependent growth inhibition and an accumulation of protein, polyunsaturated fatty acids (PUFA), chlorophyll and carotenoids (lutein, -carotene, violaxanthin and neoxanthin) were observed. In addition, a short-term 4-day application of flashing light to concentrated cultures increased productivities of eicosapentaenoic acid (EPA) and specific carotenoids up to two to three times compared to continuous light. In conclusion, protein, PUFA or pigment productivities of microalgae can be maximised by applying low-frequency flashing light at exponential or late growth stages.

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