High intensity of light: a potential stimulus for maximizing biomass by inducing photosynthetic activity in marine microalga, Tetraselmis tetrathele

ABSTRACT

The current research aimed to increase biomass production by manipulating the light intensity between 300 and 2500 μmol m−2 s−1 into a semi-continuous culture system. The growth productivity, photosynthetic performance, pigments, lipids, and fatty acids compositions of Tetraselmis tetrathele were closely investigated. This microalga could tolerate high light intensity (1500 μmol m−2 s−1), where the light intensity per cell ranged 13 μmol m−2 s−1 g-dw−1 cell−1 produced 2.92–3.34 g-dw L−1 of dry-cell weight during steady-state growth condition, approximately 1.8 times higher than the condition at 300 μmol m−2 s−1. Interestingly, maximal electron transport rate of photosystem II (ETRmax) was induced to reflect the photoacclimation activity and accompanied with variations in pigments, lipids, and fatty acids profile to protect cells from photo-oxidative damage. The scavenging role of β-carotene as a vital photoprotective pigment was achieved upon exposure to excessive light, about 1.9-fold higher than 300 μmol m−2 s−1 light intensity.

Keyword: Microalga biomass; High light intensity; High cell density culture; Tetraselmis tetrathele; Semi-continuous culture