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STRATEGIES FOR OIL AND EPA PRODUCTION FROM *PHAEODACTYLUM TRICORNUTUM*

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Phaeodactylum tricornutum is a widely studied diatom, which has been proposed as a source of oil and PUFA. This microalga contains a high proportion of eicosapentaenoic acid (EPA) that belongs to the omega-3 fatty acid class, essential fatty acids that our body is unable to synthesize. Recent studies on *P. tricornutum* indicate that lipid and fatty acid accumulation occurs in conditions of stress (e.g., under nitrogen depletion). The aim of this study was to determine how changes in nitrogen availability affect growth rate, oil yield and fatty acid composition in *P. tricornutum* UTEX 640.

Two trials, one in summer and one in spring, were carried out outdoors in 0.8-m^2 GWP®-III reactors, with different nitrogen regimes in batch conditions. In summer three nutrient supply regimes were tested: nitrogen sufficiency, nitrogen limitation and nitrogen starvation. In the spring, besides nitrogen sufficiency and starvation, three different nitrogen limitation regimes were applied: nitrogen was added once, twice or three times per day, up to 7.5 mg L^{-1}.

Nitrogen sufficient cultures showed the highest biomass productivities with an average value of 0.38 g L^{-1} d^{-1} (corresponding to a panel productivity of 16.7 g m^{-2} d^{-1}) in the summer and of 0.27 g L^{-1} d^{-1} (corresponding to a panel productivity of 12.3 g m^{-2} d^{-1}) in the spring trial. Total fatty acid content (% dry weight) increased according to the level of nitrogen limitation applied, reaching the highest values in the starved culture (24.5% lipid and 15.5% fatty acid in the summer trial; 35.4% lipid and 21.7% fatty acid in the spring trial). Starved cultures showed the highest values of fatty acid productivity (2.5 g m^{-2} d^{-1} and 2.1 g m^{-2} d^{-1} in summer and spring, respectively). In terms of EPA, the nitrogen sufficient culture achieved the highest productivity (0.43 g m^{-2} d^{-1}) in the summer trial. In the spring trial, both the nitrogen sufficient culture and the culture in which nitrogen was added once per day reached the highest productivity (0.35 g m^{-2} d^{-1}).

The cultivation of *P. tricornutum* can be manipulated according to the objectives of the process: if the goal is oil, a reduction in available nitrogen should be applied. If high biomass or EPA productivities are the objective, a nutrient sufficient regime is preferable.

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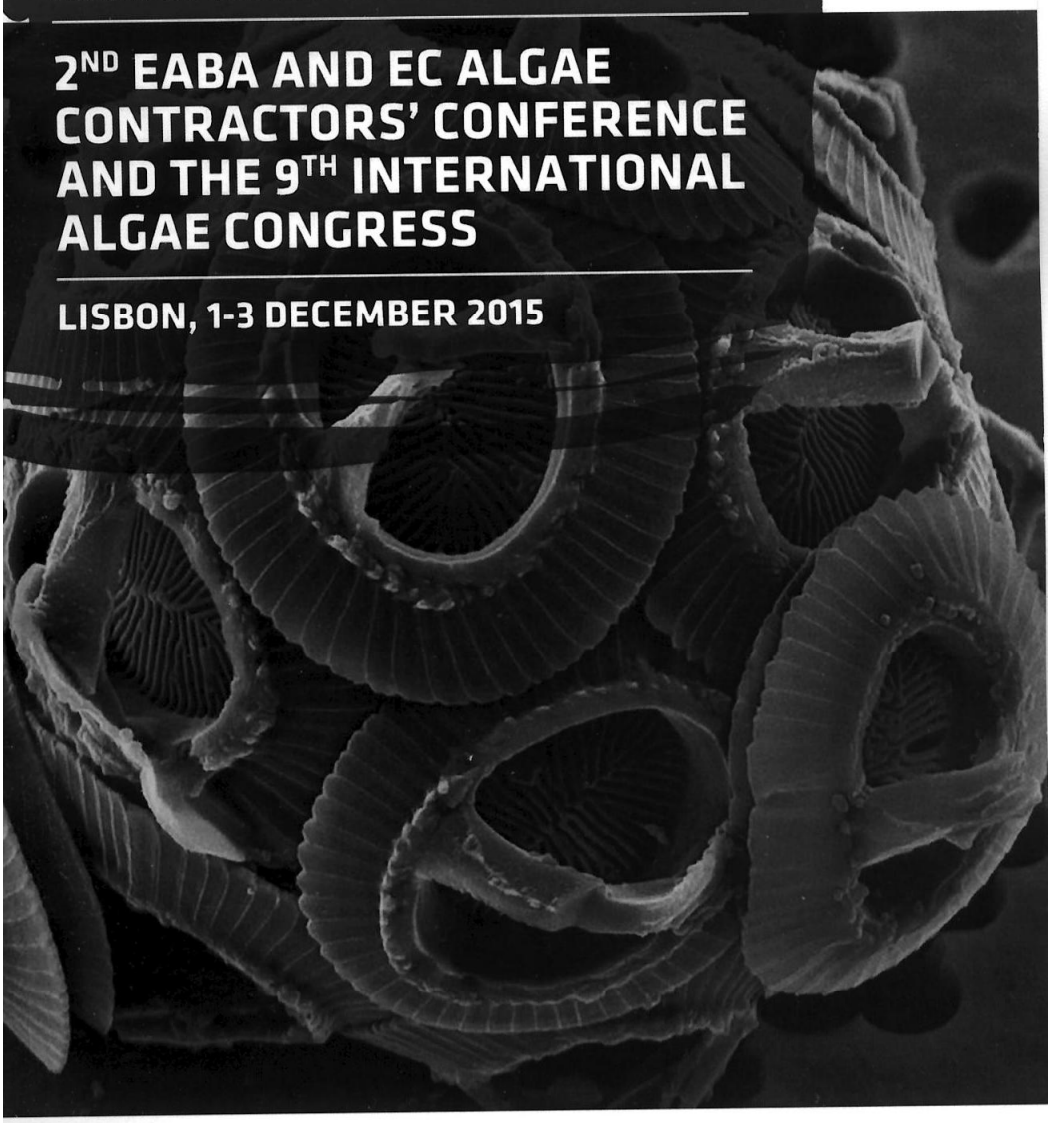

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