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# *Neochloris oleoabundans* grown in enriched natural seawater for biodiesel feedstock: Evaluation of its growth and biochemical composition

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ABSTRACT

The freshwater microalga *Neochloris oleoabundans* was used to study algal lipid production in enriched natural seawater, in order to assess its suitability as biodiesel feedstock. Optimal and nitrogen-stress (N-stress) conditions were analyzed. Under optimal conditions, the strain's growth rate was 0.73 div $day^{-1}$ and the biomass concentration was 1.5 g $L^{-1}$, while it had a maximum lipid yield under N-stress conditions (lipid content: 26% of dry weigh and lipid productivity: 56 mg $L^{-1}$ $day^{-1}$). Lipid accumulation was mainly due to a significant increase of triacylglycerol content. Neutral lipids were characterized by a dominance of monounsaturated fatty acids and displayed a fatty acid profile that is suitable for biodiesel. This work offers an interesting alternative for sustainable microalgal oil synthesis for biodiesel production without using freshwater resources. However, further studies are necessary in order to optimize the lipid productivities required for commercial biodiesel production.



## 1. Introduction

Under the contemporary scenario of fossil-fuel depletion and global climatic change, the production of biodiesel from microalgae has been recognized as a promising source of renewable energy (Mata et al., 2010; Leonardi et al., 2011). Biodiesel production from microalgae is technically feasible (Patil et al., 2011), but for an effective use of this renewable resource as biofuel, it is necessary to be able to modify microalgal growth conditions in order to achieve the productivities required for biodiesel production under a profitable cost. A critical step is the selection of the most adequate oleaginous species, and high lipid productivity is a key desirable characteristic of a species for biodiesel production (Griffiths and Harrison, 2009). However, optimizing the trade-off between lipid content and high biomass is not always possible.

The unicellular green microalga *Neochloris oleoabundans* has shown to be an adequate potential candidate for biodiesel production due to its high lipid content-17.5–54% of dry weight (% of dw) (Tornabene et al. 1983; Li et al., 2008; Gouveia and Oliveira, 2009; Gouveia et al., 2009; Pruvost et al., 2009) and to its lipid quality (Tornabene et al. 1983; Gouveia and Oliveira, 2009). Its neutral lipids, mainly triacylglicerols (TAGs), can reach up to 80% of total lipids (Tornabene et al., 1983). On the other hand, its lipid productivity in freshwater-synthetic media has been well reported allowing a proper comparison among the related studies (Li et al., 2008; Gouveia and Oliveira, 2009; Gouveia et al., 2009; Pruvost et al., 2009). According to these results, it is clear that the highest yield of lipids was not always accompanied by the highest lipid content. So far, there is no single strategy to maximize total lipid productivities in *N. oleoabundans*.

The microalgal cultivation unit is another key step that ultimately determines the economic viability of the process (Mata et al., 2010). The water supply and demand, its salinity and chemistry comprise a criterion to be considered in the implementation of the microalgal cultivation unit (Maxwell et al., 1985). Under the increased scarcity of freshwater for human consumption, the culture of halotolerant species, especially using marine and brackish water, is presented as an interesting alternative for biodiesel production. *N. oleoabundans* is a freshwater species that has also been isolated from edaphic environments (Chantanachat and Bold, 1962). Experimental studies have reported its capability to grow in the same salt concentration as the seawater one (Vazquez-Duhalt and Arredondo-Vega, 1990). Moreover, Band-Schmidt et al.

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