Genomic analysis and culture optimization of *Neochloris oleoabundans*, a promising microalga for biofuels production.

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Coal, petroleum and natural gas are cheap and may not run out soon. However, considering political and environmental implications associated with them, there appears to be no net economic benefit in its use. Therefore, sustainable alternatives are really necessary due to the global growing demand of energy. Among the alternatives, cultivation of microalgae has been reported as a promising technology. Algae use sunlight to produce biochemical energy via photosynthesis and its oil productivity and growth rates greatly exceeds that of vascular plants. Unlike the existing crop-derived biofuels, algae fuels can be produced without encroaching on food cropland. The technology is being intensively investigated by nearly every major and startups oil companies nowadays. However, there are no species developed for industrial use and there are several technological barriers to overcome. In this study we investigated the microalga *Neochloris oleoabundans*, selected for its naturally higher ability to accumulate lipids. Initially *N. oleoabundans* growth rates were very low. We decreased by seven times the cell doubling time by changing parameters such as light intensity, nutrients, and agitation. Variations in nitrogen and phosphorus concentrations led to increases in cellular lipid content by nearly 30 times. Real Time PCR experiments show that some key enzymes of fatty acid biosynthesis are differentially expressed in nitrogen starved cultures. The genome of *N. oleoabundans* was sequenced using Solexa Technology and preliminary analysis show the presence of a bacterium associated with the microalga. We believe that there is a symbiotic relationship between them, since that the alga needs vitamin B12 despite being not capable of producing it. Our analysis show that *N. oleoabundans* is a very promising strain. The excellent response to nutrient starvation and knowledge acquired with genomic approach led us to a better understanding of *Neochloris* metabolism, indicating that this specie may be suitable for industrial application.

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