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Potential biomass production from microalgae *Chlorella vulgaris*: Identifying the limitations in terms of energy and environmental performance

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The use of microalgae for the production of energy sources offers several advantages given the benefits associated with its growing process namely the fixation of CO₂, the rapid growth rate, the capability of mobilizing marginal land unsuitable for agricultural purposes and the potential of degraded water regeneration. The production of biodiesel from *Chlorella vulgaris* which can be used in the transportation sector as a replacement for conventional energy sources has been investigated.

Chlorella vulgaris was grown by resorting to the local resources available at the Aveiro region, in Portugal. The growth rate were determined by collecting and experimenting 80 ml of grown samples daily for 10 days and restoring the same amount by adding water and nutrients to the culture. The wet extraction procedure as a modification of method by Bligh and Dyer was used to determine the lipid content. A comparison between the dry and wet extraction techniques were carried out. The analysis of the obtained biodiesel has shown that *Chlorella vulgaris*, developed under local conditions, seems capable of being used as a source of biodiesel which complies with existing standards.

A technical, economical and Life Cycle Assessment of biodiesel production from *Chlorella vulgaris* was performed with the GREET model (developed by Argonne National Laboratory). This identifies the obstacles and limitations to the feasibility of the process evaluating the energetical and environmental performance. Preliminary results confirm that *Chlorella vulgaris* has a strong potential to be used as a source of biodiesel in a sustainable manner.

Keywords: *Chlorella vulgaris*, Growth rate and lipid content, Biodiesel, Life Cycle Assessment