OIL ACCUMULATION STRATEGIES IN MICROALGAE GROWN IN WASTEWATERS.

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The current scenario of exhaustion of fossil energy resources, increasing oil prices and global warming as a result of the accumulation of greenhouse gases, is strongly motivating research on fuel production from renewable biomass. The conventional biodiesel is a biofuel mainly produced from plant oils, which despite their lower CO_2 footprint (compared to fossil fuels) it can also induce negative environmental impacts. On the one hand, pesticides and fertilizers over-exploit the land, and on the other hand, the competition for cropland might mediate a global food crisis if they are expected to satisfy the actual world's fuel demand.

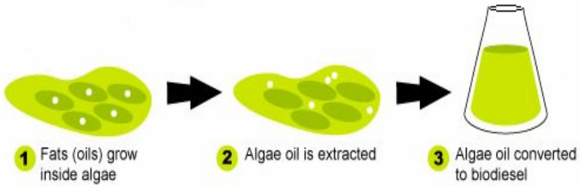

Figure 1. Algae oil extracted to produce biodiesel.

Microalgae have emerged as a satisfactory feedstock for biodiesel production based on their high photosynthetic yields, elevated oil productivity due to their ability to accumulate lipids, sustained high growth rates and capability to grow in marine, salt, fresh and wastewaters (Figure 1).

Besides the above mentioned advantages, microalgae have the ability to capture the CO_2 released in industrial processes via photosynthesis. In addition, this CO_2 can supplement the required carbon needed for the treatment of effluents from the anaerobic digestion of livestock wastes, which can not be discarded into aquatic environments due to their high content of nitrogen and phosphorus. Finally, the potential valorisation of the residual algal-bacterial biomass after oil extraction as a biofertilizer, as a source for CH_4 production or as a supplement in animal nutrition can offset a significant fraction of the process operational costs (Figure 2).

Consequently, the environmental advantages of microalgae-based processes can be summarized in:

- CO_2 capture by reducing its emissions to the environment.
- Production of biodiesel as a substitute for fossil fuels.
- Valorisation of the residual algae biomass.
- Wastewater treatment.

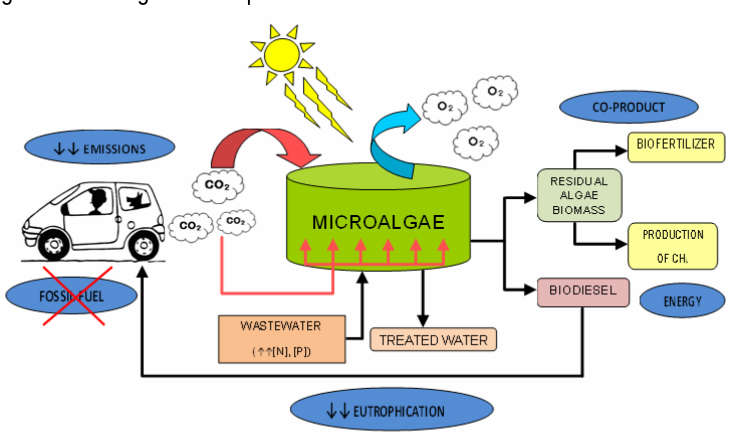

Figure 2. Environmental advantages of microalgae-based processes.

However, there are significant limitations associated with microalgae culture systems, such as the lack of information for scale up, difficulty for maintaining axenic cultures, the limited CO_2 supply rates as a result of its poor solubility and the high costs associated to algal biomass production and harvesting. Consequently, an optimization of the microalgal culture systems is necessary. The challenges addressed in this research project in order to assess the potential of the microalgal-bacterial biomass as a biodiesel source are as follows:

- Isolation and characterization of different species of microalgae and the study of their optimal culture conditions to maximize oil production.
- Optimization of the design and operation of photobioreactors.
- Development of a residual algae biomass pre-treatment of oil-extracted biomass to improve the production yields of methane and their properties as a biofertilizer.
- Evaluation of the technical and economic feasibility of the integration of microalgae cultivation with wastewater treatment.