Reuse of Anaerobic Digestion Effluent for Microalgae Biorefinery (RAMBIO)

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The challenge of RAMBIO Project is to integrate microalgae production and anaerobic digestion of vegetable feedstocks, agricultural and livestocks wastes applying a "BIOREFINERY" approach. The Anaerobic Digester Effluent (ADE), is the wastewater rich in nutrients produced by anaerobic digestion of organic matter. The use of digestate as non conventional nutrient source for microalgae growth is particularly interesting for the reduction of the process inputs, coupling microalgae culture and anaerobic digestion. Indeed, the outlet of the anaerobic digesters contains about 50% of the initial nitrogen that can be reused as a source of nutrients and water for microalgae growth, contributing in reducing the production costs. One of the critical aspect for microalgae cultivation is that it requires nutrients in large quantities, which can significantly affect the cost and environmental impact of its production. Applying a life cycle analysis (LCA), it was found that the use of chemical fertilizers for media preparation accounts for 50% of the energy and GHG emissions associated with algae cultivation.

Several reported experiments pointed out the existence of inhibitory effects on microalgal growth, especially with manure wastewater or digestate as substrate. Among the observed effects, high ammonia concentrations and turbidity were often responsible for microalgae growth inhibition. Moreover, contamination of other microorganism can support competition for nutrients reducing biomass productivity of selected microalgal strains, other than precluding the use of cultivated biomass for food and feed application.

In this work, preliminary results of RAMBIO project will be showed. Ozonization of liquid digestate has been used in order to obtain High Quality Digestate (without particulate, turbidity, and microbiological contaminants), to be used as culture medium for microalgae. *Chlorella sorokiniana* and *Scenedesmus bijugatus* have been tested in batch and semi continuous photobioreactors. The produced algal biomass has been tested for a set of biotechnological applications including, fine chemicals and platform compounds extraction (by means of "green technologies"), biodiesel, biooil and biochar production (by thermochemical process).

The innovation of this project is to investigate this integration (so called BIOREFINERY") not at laboratory scale, where some studies have already been done, but to work at pilot scale. To the best of our knowledge, no real scale up processes have been carried out. Furthermore, such an integrated approach in academia and industry is still at its infancy and interests in algae-based biorefinery continue to increase because of the necessity to resolve environmental and economic drawbacks of terrestrial biomass-based biorefinery.

The expected results will be the transformation of waste (ADE) produced by agroenergy plants in a high added value biomass (microalgae) that has promising applications in key sectors including energy, biotech, food, pharmaceutic.

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