



## Algae Biodiesel: a Promise or the Future?

The increasing demand for “green” fuels to replace the fossil fuels has led to the launching of biofuel programs all over the world. By launching first the ethanol program and then the biodiesel one, the Brazilian government came out first in this rush. Nowadays, in Brazil, it is mandatory the addition of ethanol to the gasoline (a 20-to-25% content, depending on the supply of anhydrous ethanol in the market) and the addition of biodiesel to the diesel (a fixed 5% content).<sup>1</sup> In order to meet the annual demand for over 40 billions liters of the diesel-biodiesel mix, the biofuel production in Brazil has already surpassed two billions liters a year, with a strong growing tendency, since the use of the diesel-biodiesel mix is increasing at a rate of almost 1% a month.

The advantage of the biofuel over the fossil fuel is the reduction of the CO<sub>2</sub>, SO<sub>x</sub>, soot and hydrocarbon emission. However, if biofuels are less polluting, on the other hand their production requires large areas of farmland. As the demand for transportation fuel increases annually, the production of biofuel will require more and more farmland, which is starting to threaten food security, not only because producing more ethanol means less sugar, but also because, in Brazil, the greatest part of biodiesel comes from the soybean oil. To turn the problem less threatening, it is necessary to develop new technologies and, mainly, to start using urban, industrial and agricultural waste as well as other sources of biomass as raw-material for the production of biofuels.<sup>2</sup>

Among the many alternatives for the production of biofuels, the intensive cultivation of algae and fungi has been receiving special attention due to the possibility it brings of producing 200 times more oil or sugar per hectare with no need for the use of fertile land.

Both algae and fungi can be harvested in a few days, with no need for storage infrastructure.

This has led many small and large companies as well as many researchers, all over the world, to invest resources and a lot of time in researches on algae as a source of oil and sugar.

The outcome results, in a lab-scale, have been encouraging. On the other hand, all large-scale

experiences with algae for oil production focusing on biofuels have failed.

The main reasons for such failure have been:

- 1 - the attack of not-oil-producing wild strains;
- 2 - the high price of nutrients;
- 3 - the fact that the resulting oil generally presents high content of free fatty acids and also high iodine index;
- 4 - difficulties to dehydrate the algae for the oil extraction;
- 5 - difficulty to control the acidity, temperature and nutrient parameters in order to prevent severe drops in production or even the extinction of cultivated varieties of algae.

As the biodiesel production technology has been developed based on basic catalysts,<sup>3</sup> the high content of fatty acid in the oil obtained from algae turns its production process expensive, since onerous previous purification steps are required. Moreover, the high degree of unsaturation of the oil worsens the problem, because it makes the oil too vulnerable to oxidation, demanding either its modification before the processing or the use of antioxidant additives. Consequently, the production cost of the oil from algae is still 20 times higher than, for example, that of the soybean oil.

Algae have great potential for becoming a future source of raw material for the production of biodiesel. However, to make this future come real, it is necessary to find out adequate conditions for their large-scale growth, so that the oil production turns to be economically feasible. Until then, the algae-based biodiesel production should be seen as a long-term solution. This is why large companies have recently announced their research in this field will be discontinued.

Nowadays, the algae-based biodiesel production strongly depends on the fundamental research and on the technological development. In case the funding agencies have grant programs for studies on algae for oil production, Brazil may also lead this biofuel rush and possibly start what might be called a second “green revolution”. Besides the economic dividends

brought to Brazil, the ethanol and biodiesel programs have proved that, whenever there is funding, Brazilian researchers stand out in the international arena. The best example lies in the Brazilian leadership in the world ranking of the scientific publications involving studies on biodiesel.

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## References

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