

# **ADVANTAGES OF BIOFUEL FROM ALGAE OIL**

Producing biofuel from algae is considered as one of the most efficient ways of generating biofuels. The main advantages of deriving biodiesel from algae oil include:

- Rapid growth rates,
- A high per-acre yield (7 to 31 times greater than the next best crop – palm oil),
- Certain species of algae can be harvested daily,
- Algae biofuel contains no sulphur,
- Algae biofuel is non-toxic,
- Algae biofuel is highly bio-degradable,
- Algae consume carbon dioxide as they grow, so they could be used to capture CO<sub>2</sub> from power stations and other industrial plant that would otherwise go into the atmosphere.

## **Patents in the Algae oil sector**

At present, the photo-bioreactor and algae pond layouts to cultivate algae as well as optimization processes have been patented, but the procedure of production biodiesel from Algae oil is fairly simple.

Most companies in the sector are early stage start-ups and involved in R&D rather than commercialisation. To date, none has launched full commercialisation/industrialization of biodiesel from Algae oil on a large scale.

## **Main obstacles to realize biofuel production from algae**

The obstacles to the realization of Algae oil projects lies as follows:

1. The oil-rich algae are difficult to protect from consumption or displacement by invading organisms as they were grown in ponds open to the environment.
2. Algae best produce oil within a narrow temperature band, thus night sky radiation and low temperature and high temperature days and excessive solar IR radiation interfere with pond experiments by wildly varying the cultivation temperature.

## **Economics of biodiesel production**

The cost of biomass production is an important part of the cost of biofuel produced by algae. Based on the two kinds of reactors to produce biofuel, the cost of microalgae biomass was estimated as follows:

**Table 1 The cost estimation of biofuel production**

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	photobioreactors		Raceways ponds	
Annual biomass production (t)	100	10,000	100	10,000
The cost to produce 1 kg algae biomass 1 (\$)	2.95	0.47	3.8	0.6
Cost of 1 liter oil 2 (\$)	1.40		1.8	

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- assume that carbon dioxide is available at no cost
- assuming that the biomass contains 30% oil by weight

The estimated cost of producing a kilogram of algae biomass is \$2.95 and \$3.80 for photobioreactors and raceways, respectively. The cost of production per kilogram reduces to roughly \$0.47 and \$0.60 for photobioreactors and raceways respectively, if the annual biomass production capacity is increased to 10,000 t.

The cost of biomass for providing a liter of oil would be about \$1.40 and \$1.81 for photobioreactors and raceways, respectively. Assuming that the biomass contains 30% oil by weight, the cost of biomass for providing a liter of oil would be about \$1.40 and \$1.81 for photobioreactors and raceways, respectively. Oil recovered from the lower-cost biomass produced in photobioreactors is estimated to cost \$2.80/L.

This assumes that the recovery process contributes 50% to the cost of the final recovered oil.

In comparison with this, during 2006, crude palm oil, that is probably the cheapest vegetable oil, sold for an average price of \$465/t, or about \$0.52/L. In the United States during 2006, the on-highway petrodiesel price ranged between \$0.66 and \$0.79/L. This price included taxes (20%), cost of crude oil (52%), refining expenses (19%), distribution and marketing (9%). If taxes and distribution are excluded, the average price of petrodiesel in 2006 was \$0.49/L with a 73% contribution from crude oil and 27% contribution from refining. Thus, a reasonable target price for algae oil is \$0.48/L for algal diesel to be cost competitive with petrodiesel. Elimination of dependence on petroleum diesel and environmental sustainability require reducing the cost of production of algal oil from about \$2.80/L to \$0.48/L. This is a strategic objective.

In conclusion, the biofuel production from algae is feasible based on the technology. However, it will take some time to realize commercialization as an alternative energy

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