

## Algaeoleum-a third generation biofuel

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The world is undergoing a challenge of meeting severe crisis due to diminishing stock of finite fossil fuel in near future. The world-demand of diesel is about 49.56 MMT according to a survey carried out by International Energy Agency. In coming five years the demand will increase by another 20 MMT. The finite resources are shrinking fast and will not be able to meet such a high demand. The point of concern is not only exhaustion of nonrenewable energy resource but also the unfathomable disaster to the environment caused due to its excessive use. Hence, research for alternative fuel with characteristic such as, capacity to replace the present fuel, protect the environment from obnoxious pollutants and renewable, biodegradable, cost evasive for common man, started.

Development of usage of solar energy is still under progress and several hitches are to be removed. Although an indirect way to use solar energy was proposed by Rudolf Diesel in 1895 and Melvin Calvin in 1974. The idea of using plant biomass as a source of renewable energy was well taken by scientists.

Plant latex, resin and oil are identified as possible hydrocarbons, which can be converted to fossil fuel like products. So far, about 400 plant species belonging to more than 20 families have been identified as petrocrops.

High oil prices, competing demands between foods and other biofuel sources and the world food crisis have ignited interest in algaculture (farming algae) for making vegetable oil, biodiesel, bioethanol, biogasoline, biomethanol, biobutanol and other biofuels. Biofuels obtained from algae are referred as algal fuel, oilgae, algaeoleum, third generation biofuel, etc.

Biodiesel is

- Fatty Acid Alkyl Ester
- Non-toxic and biodegradable substitute for conventional nonrenewable diesel fuel
- Can be synthesized from vegetable oil (edible/non-edible), animal fats, algal oil, waste vegetable oil, etc.
- Obtained by a process called transesterification

### *Why to use algal as oil source instead of oil yielding crops:*

Algae can produce 15-300 fold more oil per acre than any of the conventional crops, such as soybeans, rapeseed, oil palms, jatropha. This is because almost entire algal organism can use sunlight to produce lipids or oils. As per the current diesel fuel requirement if the algal fuel replaced all the petroleum fuel in the United States, it would require 15000 sq. miles (40000 sq. kms). Algae have harvesting cycle of 1-10 days which permits several harvests in a very short time frame increasing the total yield. Whereas other oil yielding crops has harvesting cycles running in months. Algae can also be grown on land that is not suitable for other established crops. This minimizes the issue of taking away the pieces of land from the cultivation of food crops. Algal fuels do not affect the fresh water resources. These can be produced by using sea water (saline water) as well as wastewater.

### *Making biodiesel from algae:*

- Collection- Amount of algae is collected
- Oil extraction- Algae are ground (with the help of mortar and pestle when production is on small scale) as much as possible. The ground alga is then dried at 80 C for sufficient time period for releasing water. Hexane and ether solution is then mixed with the dried ground algae to extract oil. Then this mixture is kept for 24 hrs for settling.
- Separation- the crude oil and algal biomass are then separated by filtration.
- Heating- The crude oil after filtration is heated to vapor release hexane and ether solution.
- Mixing of catalyst and alcohol- Sodium hydroxide (acts as a catalyst) is mixed with alcohol (generally methanol due to its low cost) and then mixed properly by stirring.
- Processing- The mixture of catalyst and methanol is then poured into algal oil.
- Transesterification- then the whole mixture is