

# “JETRA-ALGAE” A NEW FANGLED RESOURCE TO MITIGATE GLOBAL WARMING AND SUBSTANTIATE POWER PRODUCTION

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## **Abstract**

*In this present world, the change attributed by the emissions involving various outcomes is on its escalating state. Though there are several new methods to lessen these effluents, still we are in need of a new way out that could manage it effectively. Global warming and green house effect have started to play a great part in this trend. This article focuses on the sources, manufacturing process, the wide range of uses of jatropha and bio algae and how to integrate the same for large scale enrichment.*



## **JATROPHA OIL SOURCES**

The energy crop that is generally cultivated for the purpose of extracting jatropha oil is *Jatropha curcas*. The seeds are the primary source from which the oil is extracted and are toxic. Analysis of *Jatropha curcas* seed shows the following chemical compositions.

- Moisture: 6.20%
- Protein: 18.00%
- Fat: 38.00%
- Carbohydrates: 17.00%
- Fiber: 15.50%
- Ash: 5.30%

The oil content is 25-30% in the seed and contains 21% of saturated and 79% of unsaturated fatty acids. Curcin being poisonous renders the oil not suitable for human consumption.

## **METHODS AND DEVICES FOR JATROPHA OIL EXTRACTION OIL PRESSES**

Oil presses have been used for the purpose of oil extraction as simple mechanical devices - either

powered or manually driven. Among the different oil presses that are used for jatropha oil extraction, the most commonly used presses include the Bielenberg ram press. This press involves the traditional method of extracting oil and prepares oil cakes as well as soaps. It is a simple device that yields around 3 liters of oil per 12 kg of seed input. Since the recognition of jatropha as an alternative energy source, the extraction methods have also gained due importance in the market.

### **OIL EXPELLERS**

Different kinds of oil expellers are used for the purpose of jatropha oil extraction. The most commonly used ones are the Sayari oil expeller (also called the Sundhara oil expeller) and the Komet Expeller. The Sayari expeller is a diesel-operated oil extraction device that was originally developed in Nepal. It is now being developed for use in Tanzania and Zimbabwe for the purpose of jatropha oil extraction and oil cake preparation. The prototype included heavy parts made of cast iron. The lighter version has the cast iron replaced with iron sheets. A model driven by electricity is also available. The Komet expeller is a single-screw oil expeller that is often used for extracting jatropha oil from the seeds .

Methods like ultrasonification have been discovered to be effective in increasing the percentage of jatropha oil that can be extracted using chemical methods like aqueous enzymatic treatment. The optimum yield for such methods has been discovered to be around 74%. Jatropha oil

extraction methods are still being researched. The goal of such researches is to discover methods to extract a greater percentage of jatropha oil from the seeds than the current procedures allow.

### **EXPERIMENTAL PROCEDURE**

#### **TRANSESTERIFICATION**

It is the process of chemically reacting a fat or oil with an alcohol in a presence of a catalyst usually sodium hydroxide or potassium hydroxide. The main product of transesterification is biodiesel and the co-product is glycerin. The biodiesel phase is separated from the glycerin phase by purification

#### **NEUTRALIZATION**

The presence of about 14% of free fatty acid makes Jatropha oil inappropriate for industrial biodiesel production. The dehydrated oil is agitated with 4% HCl solution for 25 minutes and 0.82 gram of NaOH was added per 100 ml of oil to neutralize the free fatty acids and to coagulate by the following reaction.



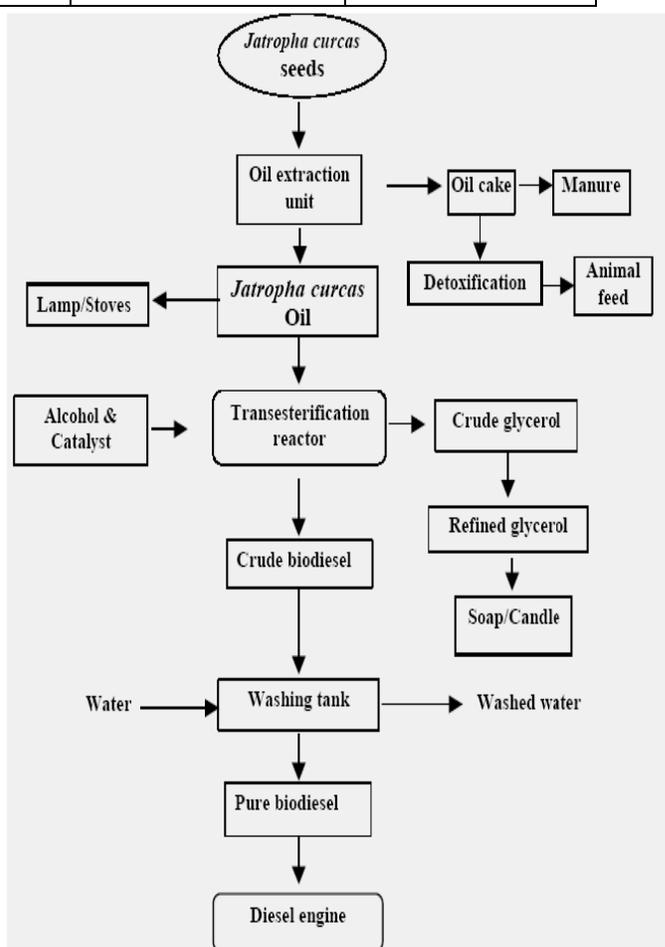
The coagulated free fatty acid (soap) is removed by filtration. This process brings the free fatty acid content to below 2 % and is perfect source for biodiesel production.

Transesterification-ion reaction is carried out in a batch reactor. For this process 500 ml of Jatropha oil is heated in a round bottom flask to drive off moisture and stirred vigorously. Methanol of 99.5% purity having density 0.791 g/cm<sup>3</sup> is used. 2.5 gram of catalyst NaOH is dissolved in Methanol in bi-molar ratio, in a separate vessel and is poured

into round bottom flask while stirring the mixture continuously at 60°C for 60 minutes. After

Property	Diesel	Jatropha oil	Biodiesel
Flash point °C	65	214	128
Fire point °C	78	256	136
Pour point °C	-6	6	-2
Cloud point °C	5	11	8
Viscosity at 40°C	2.86	36.92	4.82
Viscosity index	98	181	154
Specific gravity (29°C)	0.792	0.944	0.84
Refractive index at 40°C	1.32	1.61	1.46
Calorific value (MJ/kg)	44.34	39.76	42.80

completion of transesterification process, the products formed are Jatropha oil methyl ester and Glycerin. The bottom layer consists of Glycerin, excess alcohol, catalyst, impurities and traces of idle oil. The upper layer consists of biodiesel, alcohol and some soap. Jatropha methyl ester (biodiesel) is mixed, washed with hot distilled water to remove the idle alcohol, oil and catalyst and allowed to settle under gravity for 25 hours. The separated biodiesel is taken for characterization.



**PROCESS FLOW CHART**

## **FEASIBILITY OF JETROPHA OIL**

Biodiesel produced from jatropha oil is assessed to be feasible economically when the seeds are cultivated on large scale. As reported by other studies, producing jetropha oil on commercial basis is less costly. Therefore, if 1tonne of biodiesel can be produced from jatropha at quite a minimal cost, then on commercial basis, when this quantity is normalized to a desired capacity, marginal profit will be reported after payback time of not more than three years. It allows social and economic development in rural areas.

## **IT'S A POISONOUS PLANT**

To put in other way, the plant can protect itself against predators. Besides, many ornamental plants in Europe are more poisonous than jatropha. But jatropha is a useful crop and it is becoming a useful crop precisely because it can protect itself against grazing animals, it can be grown on poor lands. The crop doesn't need to be fenced off or protected; it is its own fence.

## **DETOXIFICATION OF JATROPHA MEAL**

The poisonous property of the plant is mainly due to presence of toxalbumins called curcin, ricin and cyanic acid, related to ricinoleic acid and the primary toxic factors present in Jatropha seed meal are the phorbol esters. Ricin has been shown to exhibit many cardio toxic and hemolytic effects.

- When the toxins in the Jatropha meal are removed, the detoxified Jatropha meal can be used as animal feed.
- The components associated with toxicity can be denatured or inactivated by heat. Heat treatment or the combination of heat and chemical treatments can inactivate the toxic components. Extraction with 80-90% ethanol or methanol also holds promise in detoxification.
- Certain fermentation processes also have the potential to eliminate the toxins. Jatropha oil cake compares well with any other oil cake and poultry and farm yard manure in terms of N, P and K content of 4.4, 2.09 and 1.68 per cent respectively.

## **HANDLING SEEDS AND FEEDS**

The empty and leftover seeds will form compressed cakes that also have alternative uses. The first use for the leftover cakes is as a fertilizer, since the seed shells do contain nutrients that strengthen the soil, and the leftover oil also has an insecticide quality which can help keep unwanted pests away from plants. While castor oil is not meant to be consumed by animals, if the oil has been drained from the seeds and the cakes are properly processed (cleaned and drained so little oil remains) they can be used as supplemental feed stock as well.

### KEY FEATURES OF JETROPHA PLANT

<b>PARTS OF JETROPHA</b>	<b>USES</b>
<b>SEEDS</b>	To produce insecticides and as a medicine for constipation.
<b>SHRUB</b>	Shrubs of jatropa act as a host for the insects. It is also used for controlling the erosion.
<b>LATEX</b>	Strongly suppresses the mosaic viruses.
<b>BARK</b>	Bark of jatropa is used as a fish poison
<b>NUTS</b>	Used as a contraceptive
<b>ROOTS</b>	Root ashes are used as substitute for slat since they contain HCN and Rotenone.
<b>FLOWERS</b>	Because of HCN the flowers of the jatropa is listed as honey plant
<b>LEAVES AND TWIGS</b>	Used as a massage material for strained muscles and as a brewed tea to combat malaria. Jatropa plant twigs are used to clean the teeth

	and the young leaves can be safely eaten by steaming them or cooking it. Powdered jatropa leaves are applied to horses eyes to get rid of the flies since hydrogen cyanide is present in the leaves
<b>PLANT</b>	Used to fight against the skin diseases, rheumatism and as a curative for sores on domestic livestock. Dark blue dye from the bark is used for coloring cloths and fish nets.

### CONSTRAINTS IN JETROPHA

- Jatropa contains numerous toxic compounds including lectin, saponin and a trypsin inhibitor. The bark contains hydrogen cyanide and is used as a fish poison. The leaves are most commonly used as a purgative and a diuretic. The sap is a skin irritant.
- The majority of the plant, including the seeds, is toxic. When the toxin is ingested it can cause gastroenteritis and death. The plant can tolerate extremely poor growing

conditions and the seeds have been rumored to last up to 15 years.

- Aside from the toxicity levels, jatropha has a negative effect on surrounding plant life. Because grazing animals find the plant to be inedible, it has a tendency to spread untouched. It is extremely resilient and can grow in desert climates, with little water.
- While the plant can survive in low-water locations, it prefers wetter conditions. Each Jatropha plant needs at least 23 inches of rain each year. Without this amount of rain, the plant will not produce the nut that makes the oil.
- Some of the regions where the Jatropha plant has been planted do not receive enough water to result in maximum production. It costs about Rs.4000 to maintain 1,000 Jatropha plants.
- This comes out to be about Rs.4 per plant inhabiting 1 acre of ground. A field of Jatropha plants produces between 400 and 600 kg of oil each year, which is equal to about 1,000 lbs. of oil. This is equal to about 125 gallons of oil, which is not very much considering the plant cost.
- Each Jatropha plant requires 6 feet of space per plant. This area is very large, and a field of Jatropha plants will not contain many

plants. The amount of space necessary to make Jatropha a viable option for a biofuel .

- Growing the plants is not the only process that must be done to extract the Jatropha oil. Processing plants must be built once the nuts are harvested. From there, the oil must be refined into fuel. Most of the rural locations that grow Jatropha are unequipped to process the plants.

## USES

- It has very high saponification value and being extensively used for making soap in some countries.
- As an illuminant in lamps as it burns without emitting smoke.
- Jatropha curcus oil cake is rich in Nitrogen, Phosphorous and Potassium and can be used as organic manure.
- Cars could be run with jatropha curcus without requiring much change in design. Jatropha oil expelled from seeds and filtered through filter press can replace kerosene or oil lamp.
- Jatropha oil can be used as a fuel for cooking. It can also be used in big Diesel engine based electricity generating sets, pump sets, heavy farm machinery, where the viscosity of oil is not an issue.
- The seeds of jatropha contain (50% by weight) viscous oil which can be used for manufacture of candles and soap, in the

cosmetic industry and as a Diesel /paraffin substitute or extender.

- The latter use has important implications for meeting the demand for rural energy services and also exploring practical substitute

for fossil fuels to counter green house gas

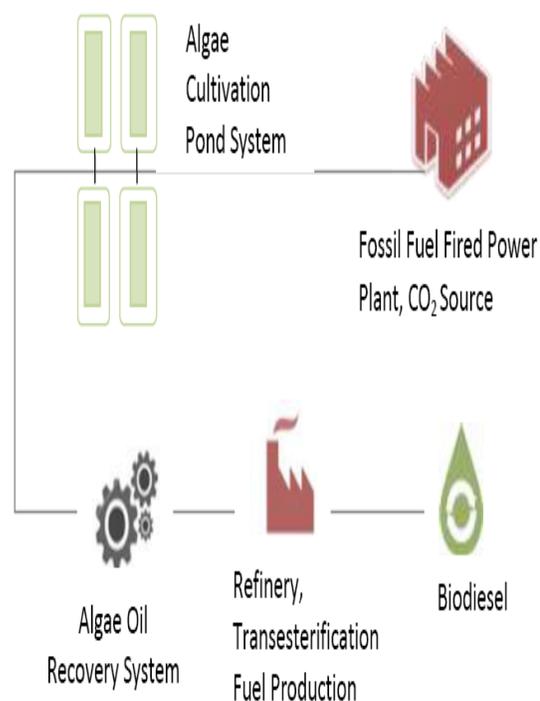


accumulation in the atmosphere.

### BIO ALGAE

Global warming due to increased carbon dioxide concentration in atmosphere is an evolving hazard that has to be dealt sporadically with greater attention. The emission levels of these effluent and used fuels should be held to a particular range for tackling this decisive factor. Though there are several methods to lower this effect still we need a radical approach to effectively down trod this aspect of warming the atmosphere. Algae based carbon capture is one of the latest methods of biological sequestration vastly employed in CO<sub>2</sub> emitting industries. These are the third generation feedstock that is apt to capture CO<sub>2</sub> from large scale emitters such as Power plants and industries. Algae are also a sensible choice in regards to their fast proliferation rates, extensive tolerance to adverse climatic conditions and their potential for comprehensive culture.

Biodiesel is a promising substitute as an alternative fuel and has gained significant attention due to the predicted shortness of conventional fuels and environmental concern. The utilization of liquid fuels produced from Jatropha oil by transesterification process represents one of the most promising options for the use of conventional fossil fuels. On comparing the physical properties such as density, flash point, Kinematic viscosity, Cloud point and Pour point for Jatropha oil with the conventional diesel, the jetropha based bio diesel forms a best alternative and can be used in the existing diesel engine without any modification.

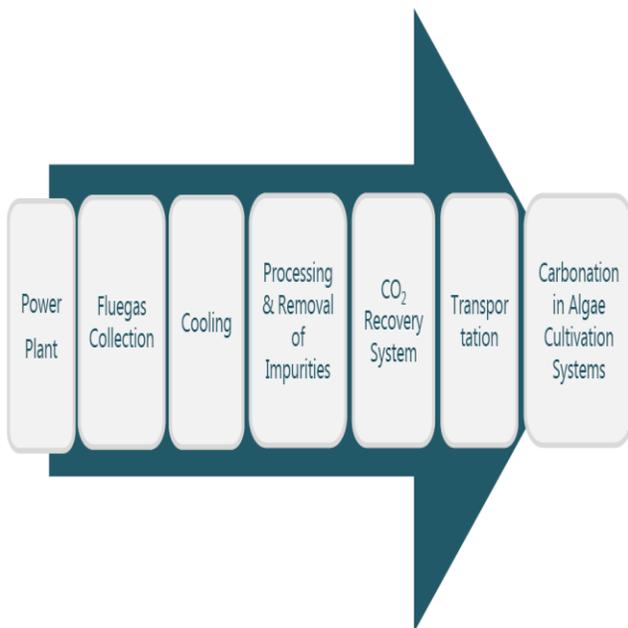


Flow diagram for Microalgae production with introduction of CO<sub>2</sub> from fossil fuel fired power plants

## CARBON CAPTURE

Algae are relatively simple organisms that capture light energy through photosynthesis and use it to convert inorganic substances into organic matter. Photosynthesis is the process of producing sugar from sunlight, carbon dioxide and water, with oxygen as a waste product. Nearly all life depends on this complex biochemical process, which occurs most famously in plants, but also in phytoplankton, algae, and some bacteria, among other organisms. They are usually found in damp places or bodies of water. They vary from single-celled forms to complex forms made of many cells, such as giant kelps, which can grow as much as 65 meters in length. It is estimated that algae produces 73% to 87% of the net global production of oxygen.

The algae based carbon capture involves



## SOURCES OF CO<sub>2</sub> IN INDUSTRIES

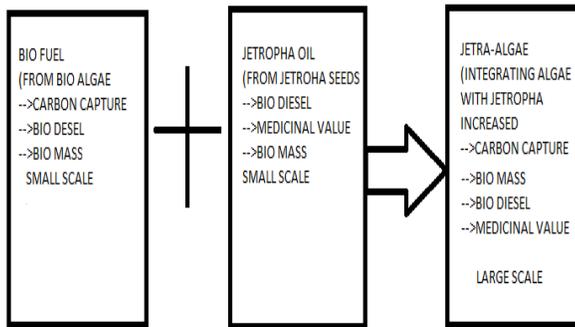
- Coal burning and natural gas power plants
- Cement industry, Petrochemicals, Sugar
- Breweries, Iron & Steel, Inorganic Chemicals
- Fertilizers, Aluminium, Mining
- Carbon Black & TYRE

## FINDINGS AND SUGGESTIONS

It has been found under study that there is development in the field of jetropha and bio algae. But the cost of production remains high. This could be retaliated in an effective way if these are integrated. On combining jetropha oil with bio algae fuel we can obtain

- Optimal results with cent percent utilization
- To drive diesel power plants and substantiate power production
- On culture of brown algae in arid and semi arid regions that are prone to adverse climatic conditions can yield good quality oil
- The left out and other unused by products in the form of bio mass can be enabled for varied power driven alternatives

can never be a waste instead “**ENERGY FROM WASTE**”



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## CONCLUSION

Jatropha is a promising source of biodiesel and many countries have started developing programs to produce it on a large scale. India being the sixth largest net importer of oil in the world, invests more than 300 million dollars each year in biodiesel research. Green energy is the cleanest form of energy and can be harnessed with negligible pollution. Energy as a result of burning bio mass (from jetropha and bio algae) can be utilized and harnessed for the betterment and very well could necessitate the basic needs. Thus it forms an important consideration for minimizing global warming and other abnormalities pertaining to the industries that releases CO<sub>2</sub> in large quantity. This new form of energy crops opens a new way for the rear future and sheds its path for an enriched energy that can substantiate the economy of our nation. The benefits outlay the problems encountered as in the case of jetropha and bio algae. Integrating this will evolve a new trend in market and the waste lands