EPH - International Journal of Science And Engineering
ISSN (Online): 2454 2016
Volume 07 Issue 02 June 2021

DOI: https://doi.org/10.53555/eijse.v3i1.50

A REVIEW ON JATROPHA PLANT-A GREEN FUEL

Mr. Amol Ashok Inamdar[1]*
**[1]Bachelor of Civil Engineering, Master of Environmental Engineering Lecturer in Civil Engineering Department University of Buraimi, Oman*

Corresponding Author:-

Abstract:-

Bio fuel refers to many different types of alternative energy sources that could supplement or even replace fossil fuels. Although they only account for a few percent of the world's transport fuel to date, they are increasingly popular due to higher oil prices and an increasing concern with global warming and investments into them are therefore growing each year. Biofuels are normally divided into three categories: solid biomass, liquid fuel and biogases. Each group does not only effectively describe the form of the fuel, but also hints at the uses for which the fuel is intended. The growing concern with greenhouse gas emissions and global warming can hardly have escaped anyone's attention. Being in many respects the most talked about topic of the new century, it should be now common knowledge that humanity's relies on fossil fuels as energy sources is gradually wrecking the ozone layer that protects the world from the less endearing powers of the sun. Yet the increasingly palpable threat of global warming and its consequences has at least resulted in a growing awareness of the problems inherent to oil-based economies. In this paper the focus is on a toxic plant known as "Jatropha". It is a genus of approximately 175 succulent plants, shrubs and trees. It is resistant to drought and pests, and produces seeds containing 27-40% oil, averaging 34.4%.[1] The remaining press cake of jatropha seeds after oil extraction could also be considered for energy production. However, despite their abundance and use as oil and reclamation[1] plants, none of the Jatropha species have been properly domesticated and, as a result, their productivity is variable, and the long-term impact of their large-scale use on soil quality and the environment is unknown.

1. INTRODUCTION:

Green fuel is defined as solid, liquid or gaseous fuel derived from relatively, recently dead biological green material and is distinguished from fossil fuels. Theoretically, green-fuels can be produced from any (biological) carbon source; although, the most common sources are photosynthetic plants. Various plants and plant-derived materials are used for green fuel manufacturing. Globally, green fuels are most commonly used to power vehicles, in heating homes, and cooking. Green fuel industries are expanding in Europe, Asia and the USA [1].

1.1 What is jatropha?

It is a small tree which is native to Central America but can be grown in most tropical and subtropical areas. It is drought and pest resistant. The seeds are 40% oil which can be processed to use in a standard diesel engine. It is also highly toxic.

1.2 What is the chemical formula of Jatropha oil?

Jatropha oil itself is a substance. So not being a (pure) compound, it has no chemical formula. It might be toxic. There are tens of different formulas, because it's not a pure chemical by itself but a mixture. It is a non-food, biodiesel energy oil from pressed seeds (35% oil) of *Jatropha curcas* (plant family: Euphorbiaceous) [2].

1.3 Background based on Literature Review

Jatropha curcas, is from the family Euphorbiaceae. The name is derived from the Greek words ἰατρός (iatros), meaning "physician," and τροφή (trophe), meaning "nutrition," hence the common name physic nut. Mature plants produce separate male and female flowers. As with many members of the family Euphorbiaceae, Jatropha contains compounds that are highly toxic. In 2007 Goldman Sachs cited *Jatropha curcas* [1] as one of the best candidates for future biodiesel production.

The former President of India, Dr. Abdul Kalam, is one of the strong advocaters of jatropha cultivation for production of bio-diesel. In his speech, the Former President said that , out of the 6,00,000 km² of waste land that is available in India & over 3,00,000 km² are suitable for Jatropha cultivation. Once this plant is grown the plant has a useful lifespan of several decades. During its life, Jatropha requires very little water when compared to other cash crops.

Photo 1: Jatropha curcas seeding in a greenhouse

Photo 2: Jatropha Plant

1.4 Objective

There are two methods currently brought into use to produce the bio fuel. In the first one, sugar crops or starch are grown and through the process of fermentation, ethanol is produced. In the second method, plants are grown that naturally produce oil like jatropha and algae. These oils are heated to reduce their viscosity after which they are directly used as fuel for diesel engines. This oil can be further treated to produce biodiesel which can be used for various purposes.

2. Materials & method

In the process of manufacturing the biofuels, all the fats and oils are turned into esters, separating the glycerin. At the end of the process, all the glycerin sinks down at the bottom and all the biofuel rests at the top. The process through which the glycerin is separated from the biodiesel is known as transesterification. This process also uses lye as a catalyst in the whole process. Some of the chemicals which are used in the manufacturing of biofuels are ethanol or methanol which brings into use methyl esters. Methanol is derived from fossil fuels while ethanol is derived from plants. One of the advantages of using ethanol is that they can be distilled even at the home without any problem.

2.1 Types Of Green Fules

(A) First generation green fuels
  1) Vegetable oil 2) Bio alcohols 3) Bio ethers
  4) Biogas 5) Solid bio fuels
(B) Second generation green fuels
(C) Third generation green fuels

Algae, such as Botryococcus braunii and Chlorella vulgaris, are relatively easy to grow, but the algal oil is hard to extract. There are several approaches, some of which work better than others. Second and third generation green fuels are also called advanced biofuels.

2.2 Bio Fuels

It is also known as agrofuel, these fuels are mainly derived from biomass or bio waste. Biofuels are the best way of reducing the emission of the greenhouse gases. They can also be looked upon as a way of energy security which stands as an alternative of fossil fuels that are limited in availability. Today, the use of biofuels has expanded throughout the globe. Some of the major producers and users of biogases are Asia, Europe and America. Theoretically, biofuel can be easily produced through any carbon source; making the photosynthetic plants the most commonly used material for production. Almost all types of materials derived from the plants are used for manufacturing biogas. One of the greatest problems that is being faced by the researchers in the field is how to covert the biomass energy into the liquid fuel.
Biofuel is considered to be the most pure and the easiest available fuels on the planet. These biofuels can be a lot more economic if used in the kitchen for cooking purpose. These fuels also encourage the recycling process as most of them are manufactured from waste products.

2.3 Procedure:

The process of manufacturing biofuel can be classified in the following stages.

1. **Filtering:** - In this process, waste vegetable oil is filtered to remove all the food particles. This process generally involves warming up the liquid a little. After warming up the liquid, it can be filtered with the use of coffee filter.

Photo 3: Jatropha

2. **Removing of water*:*-** All the water contained in the residual has to be removed which will make the reaction faster. The water can be easily removed by making the liquid boil at 100^{o} C for some time.

3. **Titration:** -This process is carried out to determine the amount of lye that would be required. This process is the most crucial and the most important stage of biofuel manufacturing.

4. **Preparation of sodium methoxide:**-In this process, methanol is mixed with sodium hydroxide to produce sodium methoxide. In most of the cases, the quantity of methanol used is generally 20 percent of waste vegetable oil.

5. **Heating and mixing:**-The residue is heated in between 120 to 130 degree F after which it is mixed well. It should be remembered that process should be done carefully avoiding splashing of the liquid.

Photo 4: Heating and Mixing

6. **Settling and separation: -** After mixing the liquid, it has to be allowed to cool down. After the cooling process, the biofuel will be found floating at the top while the heavier glycerin would be found at the bottom. The glycerin can be easily separated by allowing it to drain out from the bottom. The person is left over with pure biofuel which can be used for various purposes.

3. Discussion

Using biofuels can reduce the amount of greenhouse gases emitted. They are a much cleaner source of energy than conventional sources. As more and more biofuel is created there will be increased energy security for the country producing it, as they will not have to rely on imports or foreign volatile markets. First generation biofuels can save up to 60% carbon emissions and second-generation biofuels can save up to 80%. Biofuels will create a brand new job infrastructure and will help support local economies. There can be a reduction in fossil fuel use. Biofuels operations help rural development. Biodiesel can be used in any diesel vehicle and it reduces the number of vibrations, smoke and noise produced. Biodiesel is biodegradable. They are non-toxic and renewable. Biodiesel has a high flash point, making it safer and less likely to burn after an accident.

3.1 Benefits of Bio-fuel.

- It can be blended with regular diesel fuel in any ratio.
- It has about the same amount of energy as petroleum diesel fuel.
- Its use reduces the amount of required oil changes.

3.2 Toxicity Of Jathropha:-

Much like other members of the family Euphorbiaceae, *Jatropha* plants contain several toxic compounds, including lectin, saponin, carcinogenic phorbol, and a trypsin inhibitor. The seeds of this genus are also a source of the highly poisonous toxalbumin curcin. Despite this, the seeds are occasionally eaten after roasting, which reduces some of the toxicity. Its sap is a skin irritant, and ingesting as few as three untreated seeds can be fatal to human.

3.3 Disadvantages of bio fuel:

a) The capital cost is over 700 million dollars to develop secondary biofuel processes which would yield a better quality and more efficient fuel and reduce greenhouse gas emissions even more.
b) Sometimes the production of some biofuels actually leads to more greenhouse gas emissions then they decrease such as in the case of rapeseed corn.
c) The techniques used to find out how good biofuels are for the environment usually do not take into account other gasses emitted such as nitrous oxide which sometimes happen to be more prominent after biofuels have been used.
d) Biofuel may raise the price of certain foods, which are also used for biofuel such as corn.
e) New technologies will have to be developed for vehicles for them to use these fuels. This will increase their process significantly.
f) Biofuel development and production is still heavily dependent on Oil.
g) A lot of water is used to water the plants, especially in dry climates.

Conclusion

The potential benefits to society of the spread of Biodiesel Crops are far more than just reduced environmental damage. Through adopting technologies that reduce energy, water and resource usage, societies will increase their productivity, their global competitiveness and drive local economic development and employment. The category will then not be something special: it will just be the way things are done. This is one of the reasons that investing in the sector has merit. Those technologies that do become 'ManTech' will generate extremely healthy returns. Clean Technology investing is therefore not just about providing the scientific foundation for future technologies. Green energy is just an essential part of the transition to a world in which efficiency is improved, productivity and economic growth improves and communities function more effectively. Jatropha was significantly cheaper than crude oil, costing an estimated $43 a barrel. Oil from trees can also be used in the production of biodiesel. On small scale production, the cost of production is low, but if mass production and accuracy is the goal, the cost is high. Glycerin which is the by-product of the chemical reaction can be sold to the pharmaceutical companies, since it is used to produce valuables such as creams and toothpaste. Each state has passed specific bills to promote the use of Biodiesel by reduction of taxes. The economics of biodiesel fuels compared to traditional petroleum resources are marginal; public policy needs to be revised to encourage development. Increased Jatropha oil production would require a significant commitment of resources. Land for production would need to be contracted, crushing and biodiesel production plants need to be built, distribution and storage facilities constructed, and monitoring of users for detection of problems in large-scale use are all needed to encourage development of the industry. The final words about Jatropha *"Poisonous plant could help to cure the planet"*

References

[1]. https://en.wikipedia.org/wiki/Jatropha_curcas
[2]. Van Eijck, J.A.J; Romijn, H.A.: Prospects for Jatropha biofuels in developing countries :An analysis for Tanzania with strategic niche management
[3]. Ebtisam K. Heikal, Salah A. Khalil, and Ismaeil K.Abdou :Jatropha Bio-Diesel Production Technologies; www.greenfuelsamerica.com

[4]. Wilson Parawira; Biodiesel production from Jatropha curcas :A review ; Department of Applied Biology, Kigali Institute of Science and Technology (KIST), Avenue de I' Armee, B. P. 3900 Kigali, Rwanda

[5]. Mansfield SD, Mooney C, Saddler JN. Substrate and enzyme characteristics that limit cellulose hydrolysis. Biotechnol Prog. 1999;15:804–16

[6]. Kazi Mostafijur Rahman, Mohammad Mashud, Md. Roknuzzaman and Asadullah Al Galib; Biodiesel from Jatropha Oil as an Alternative Fuel for Diesel Engine; Department of Mechanical Engineering, Khulna University of Engineering and Technology (KUET) Khulna-9203, Bangladesh.

[7]. Joshua Folaranmi; Production of Biodiesel (B100) from Jatropha Oil Using Sodium Hydroxide as Catalyst ; Department of Mechanical Engineering, Federal University of Technology, Niger State, Minna, Nigeria