# Second Generation Biofuels from Nelumbo Nucifera (lotus) Seeds

[1]Chintada Varun Kumar Acharya, [2]Kotni Srikanth
Student, Department of mechanical engineering,
Godavari Institute of Engineering and Technology, Rajahmundry, Andhra Pradesh, India.

**Abstract - The present study was carried out to identify the seeds of the plant species Nelumbo Nucifera (lotus) that can produce biodiesel.**

## I. INTRODUCTION

The global economy literally runs on energy, the economic growth combined with the rising population has led to a steady rise or increase in the global energy demands. If the world government will stick to the current global policies on energy, then the world will be needing almost 60% more energy in 2030 than our present day, of this, 60% and 45% will be accounted for by China and India alone (International Energy Agency Publication: Paris, France 2007).

Transportation is one of the fastest growing sectors of our economy using about 27% of the primary energy. The continued use of fossil fuel is not sustainable, as they are finite or limited resources and their combustion will eventually lead to increase energy related emissions of Green House Gases (GHG) viz Carbon dioxide (CO2), Nitrogen Oxide (NO2) etc.

The future reduction in the emission of this gases or in the ecological footprint of energy generation will reside or rest in a multi – faceted approach that includes nuclear, solar, wind, hydrogen, fossil fuel and bio fuels. Bio-fuel can be broadly defined as solid, liquid or gas fuel consisting of or derived from biomass. Rudolph Diesel first demonstrated the use of bio-diesel from a variety of crops in 1990. However the widespread availability of cheap petroleum during the 20th century determined otherwise, generally shifting society dependence away from petroleum to renewable biomass will contribute to the development of sustainable industrial society and effective management of GHG (Demirbas and Deinirbas 2007).

The major criticism often levelled against biomass, partially against large scale fuel production are that it will consume vast swaths of farmlands and native habitat, drive up food prices and results in little reduction in GHG emission (Pacala, 2004 and Socolow, 2004). However, this so called "food versus fuel" controversy appears to have been exaggerated in many cases. Credible studies show that, with plausible technology developments, biofuels could supply some 30% of global demand in an environmentally friendly manner without affecting food production.

To tackle the problem of food scarcity due to the use of food crops like sugarcane, sugar beet, maize (corn), sorghum wheat etc in fuel production, other alternative sources of energy is being developed. These new developments in biofuel production are what is referred to as "second generation biofuels", which are derived from non – food feedstuff. They are extracted from microalgae and other microbial sources, Lingo – cellular biomass, rice straws etc.

## II. BIOFUEL

A biofuel is a fuel that uses energy for from a carbon fixation. These fuels are produced from living organisms. Examples of this carbon fixation are plants and microalgae These fuels are made from a biomass conversion. Biomass refers to recently living organisms, most often referring to plants or plant-derived materials. This biomass can be converted to energy in three different ways: thermal conversion, chemical conversion, and biochemical conversion. This biomass conversion's can be in solid , liquid ,or gas form. This new biomass can be used for biofuels. Biofuels have increased in popularity because of the raising oil prices and need for energy security. However,according to the European Environmental Agency, biofuels address global warming concerns only in specific cases.

Ethanol can be used as a fuel for vehicles in its pure form, but it is usually used as a gasoline additives to increase octane and improve vehicle emissions. Current plant design does not provide for converting the lignin portion of plant raw materials to fuel components by fermentation. . Hence, when mixed with petrol, it helps reduce the amount of sulfur dioxide emissions.Ethanol also contains small traces of sulfur compared to petrol

Biodeasel is made from vegetable oils and animal fats. Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a diesel additive to reduce levels of particulates,carbon monoxide, and hydrocarbons from diesel-powered vehicle

## III. ABOUT THE LOTUS PLANT

The Botanical name of the lotus seeds is Nelumbo nucifera . its belongs to the Nymphaeaceae. The parts used in the lotus plant are Lotus flower petals, lotus seeds, lotus leaves, lotus root. The products which the lotus plant offered are Seeds, roots, fruits, flower, oil, leaves. There are no alkaloids present in this plant. Its common name is Sacred water lotus, sacred water lilly, pink lotus , nelumbo lutea.these are usually found in ponds and swamps.

Table 1

| | |
|---|---|
| Botanical name | Nelumbo Nucefea |
| Name | Nymphaeaceae |
| Parts used | lotus flower petals ,lotus seeds ,lotus leaves ,lotus roots |
| Products offered | seeds, roots, fruits, flowers, oil, leaves |
| Habitat | found in ponds and swamps |

Fig 1

## IV. NELUMBO NUCIFERA (LOTUS) SEEDS

Nelumbo Nucifera is considered an important traditional Chinese herb. The seed extracts have shown hepatoprotective and free radical scavenging effects.Lotus plumele, also known as Lian fang, Lien Tze Hsin, and Lian xu, is the green germ of the mature Lotus seed and is rich in compounds such as alkaloids (demethylcolaurine, isoliensinine, liensinine, Lotusine, methylocrypalline, neferine, nuciferine, and pronuciferine), flavonoids (galuteolin, hyperine, rutin) and some microelements [Zn, Fe, Ca, and Mg] .Lotus seeds or lotus nuts are the seeds of plants in the genus Nelumbo, particularly the species Nelumbo Nucefera. The seeds are of great importance to East Asian cuisine and are used extensively in traditional Chinese medicine and in Chinese desserts. The seeds are most commonly sold in the shelled and dried form. Fresh lotus seeds are relatively uncommon in the market except in areas of lotus root and seed production, where they are sometimes sold as a raw snack.

Table 2

| | |
|---|---|
| Product name | lotus seed extract |
| Botanical name | Nelumbo nucifera Gaertn |

Fig 2

Fig 3

***Types of Nelumbo Nucifere (Lotus) Seeds***

Two types of dried lotus seeds can be found commercially; brown peel and white. The former is harvested when the seed head of the lotus is ripe or nearly ripe and the latter is harvested when the seed head is still fully green, but with almost fully developed seeds. White lotus seeds are de-shelled and de-membraned. The bitter tasting germ of the seed is also removed at the time of harvest using a hollow needle, though some may still remain in the seed due to production oversight. Brown peel lotus seeds are brown because the ripened seed has adhered to its membrane. These seeds are usually cracked in half in order to remove the germ since the seeds are hard enough to make the germs' removal by needle difficult.Eating fresh lotus seeds from a lotus (Nelumbo) seed head.Dried lotus seeds that are sold in packages or in bulk at many Asian markets must first be soaked in water overnight prior to use due to their hardness and toughness. They can then be added directly to soups and congee, or used in other dishes.Lotus seeds or lotus nuts are the seeds of plants in the genus Nelumbo, particularly the species Nelumbo nucifera.

***Nutrients Present In Lotus Seeds***

Table 3

| CALORIES | % IN DAILY LIFE |
|---|---|
| Total fat 2 g | 3 |
| Saturated fat 0.3 g | 1 |
| Cholesterol 0 mg | 0 |
| Sodium 5 gms | 0 |
| Potassium 1,368 mg | 39 |
| Total Carbohydrate 64 g | 21 |
| Protein 15 g | 30 |

| | |
|---|---|
| Vitamin A | 1 |
| Vitamin c | 0 |
| Vitamin b-6 | 30 |
| Vitamin b-12 | 0 |
| Calcium | 16 |
| Iron | 19 |
| Magnesium | 52 |
| Ph range | 7 to 8.5 |
| Soil range | undefiined |
| Energy | 278 kJ (66 kcal) |
| Sugars | 0.5 g |
| Total phenolic content | 7.61 ± 0.04% (w/W) |

## V. EFFECTS OF THE NELUMBO NUCIFERA

Nelumbo nucifera seed extract sedative effect.Effects of extracts and neferine from the embryo of Nelumbo nucifera seeds on the central nervous systemThe effects of embryos of the seeds of Nelumbo nucifera on the central nervous system were studied in mice. MeOH extracts of embryos of Nelumbo nucifera seeds significantly inhibited locomotor activity in mice. Our results suggest that neferine has several central effects and that neferine may participate in the efficacy of the sedative effects of embryos of the seeds of Nelumbo nucifera.

- ***Blood glucose***: In animal study, lotus and its constituents reduced blood sugar .
- ***Blood pressure***: In preliminary research, neferine and isoliensinine have been noted as two major constituents of the lotus plumule (rudimentary terminal bud) that may have antihypertensive effects .
- ***Body temperature***: In animal study, an ethanol extract of stalks of Nelumbo nucifera (NNSE) was shown to have antipyretic potential on normal body temperature and yeast-induced pyrexia in rats .
- ***Body weight***: In animal study, lotus leaf extract had antiobesity effects .
- ***Coagulation panel***: In animal study, neferine from Nelumbo nucifera has been noted to have inhibitory activity on platelet aggregation .
- ***Corticosterone***: In animal study, a lotus leaf extract attenuated acute and chronic restraint stress-induced increases in corticosterone levels .
- ***Cytokines***: In animal study, neferine, a constituent of lotus green seed embryo, reduced levels of tumor necrosis factor-alpha .
- ***Heart rate***: Alkaloids isolated from Nelumbo nucifera, including liensinine, daurisoline and neferine, have been noted to have antiarrhythmic activity .
- ***Lipid profile*:**Lipid profile: In animal study, a lotus leaf extract reduced triglyceride and total cholesterol levels .
- ***Neurotransmitters*** : In animal study, a lotus leaf extract attenuated acute and chronic restraint stress-induced increases in neurotransmitter levels (norepinephrine, dopamine, and 5-hydroxytryptamine) in the brain .
- ***Protein***: In animal study, a lotus leaf extract attenuated acute and chronic restraint stress-induced increases in total protein levels .
- ***Serum insulin***: In animal study, neferine, a constituent of Nelumbo nucifera, reduced levels of fasting blood insulin

### *Effects of Extracts and Neferine from the Embryo of Nelumbo Nucifera Seeds on the Central Nervous System*

The effects of embryos of the seeds of Nelumbo nucifera on the central nervous system were studied in mice. MeOH extracts of embryos of Nelumbo nucifera seeds significantly inhibited locomotor activity in mice. The MeOH extract was successively partitioned between H2O and n-hexane, between H2O and CHCl3, and between H2O and n-BuOH. CHCl3 extracts strongly inhibited locomotor activity in mice, although other extracts had no effect on locomotor activity. The main alkaloid of CHCl3 extracts, neferine, dose-dependently inhibited locomotor activity in mice. Neferine induced hypothermia in mice and apparently potentiated thiopental-induced sleeping time. An anxiolytic, diazepam, decreased locomotor activity, rectal temperature and enhanced sleep elicited by thiopental, similar to neferine. In addition, neferine and diazepam showed anti-anxiety effects in the elevated plus maze test. Neferine did not affect muscle coordination by the rota-rod test. Neferine did not affect strychnine- nor picrotoxin-induced seizure. In contrast, diazepam had apparent muscle relaxant and anti-convulsant effects. These results suggest that neferine has several central effects and that neferine may participate in the efficacy of the sedative effects of embryos of the seeds of Nelumbo nucifera. The mechanisms of the sedative effects of neferine are not similar to those of diazepam.

## VI. PRODUCTION OF BIODIESEL

Biodiesel can be produced by the transesterification reaction of FATTY ACID and the biodiesl thus produced can be used for analysis.

### *Transesterification*

In organic chemistry , transesterification is the process of exchanging the organic group R″ of an ester with the organic group R′ of an alcohol .These reactions are often catalyzed by the addition of an acid or base catalyst .The reaction can also be accomplished with the help of enzymes (biocatalysts) particularly lipases.


Transesterification: alcohol + ester → different alcohol + different ester

Fig 4

Biodiesel production is the process of biofuel, biodiesel, through either transesterification or alcoholysis .It involves reacting vegetable oils or animal fats catalytically with a short-chain aliphatic alcohols (typically methanol or ethanol)

## VII. CONCLUSION

The global economy literally runs on energy, the economic growth combined with the rising population has led to a steady rise or increase in the global energy demands. If the world government will stick to the current global policies on energy, then the world will be needing almost 60% more energy in 2030 than our present day, of this, 60% and 45% will be accounted for by China and India alone. To tackle the problem of food scarcity due to the use of food crops like sugarcane, sugar beet, maize (corn), sorghum wheat etc in fuel production, other alternative sources of energy is being developed. These new developments in biofuel production are what is referred to as *"second generation biofuels",* which are derived from non – food feedstuff. They are extracted from microalgae and other microbial sources, Lingo – cellular biomass, rice straws etc.Presently from the seeds of nelumbo also we can produce bio -diesel.