# Performance Study of Production bio fertilizer from biofuel waste

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**Abstract** - *The post green revolution era witnessed a multiple nutrient deficiency because of higher crop harvest in the intensively cultivated areas where use of organic manure had declined while chemically pure fertilizers like Urea, Di-Ammonium Phosphate, Murate of Potash and other allied items became the major source of plant nutrients. As a result of continued use of chemical fertilizer soil became poorer due to the deficiency of microbial contents of the soil. Agriculture devoid of organic manures / crop residues has resulted in reduction of physicochemical and Biological properties of the soil.*

*With the growing demerits of fossil fuels - its finitude and its negative impact on the environment and public health - renewable energy is becoming a favored emerging alternative. For over a millennium, anaerobic digestion (AD) has been employed in treating organic waste (biomass). The two main products of anaerobic digestion, biogas and biofertilizer, are very important resources. Since organic wastes are always available and unavoidable, too, anaerobic digestion provides an efficient means of converting organic waste to profitable resources.*

***Key Words***: Biodiesel, biofertilizer,Biomass, Bio gas, Ethonal, Algae etc…

## 1.INTRODUCTION

In order to ameliorate the already deteriorated soil conditions and also to reduce dependence on the use of chemical fertilizer and pesticide to arrest the grave ecological damage, Indians took up the program to supplement the national objective. We are implementing a major Biogas program along with implementing Bio-Manure Program throughout the Country. For vermicomposting, pre-digested organic matter is essential (15 to 30 days pre-digestion) as earthworm cannot resist high temperature generated during pre-digestion.

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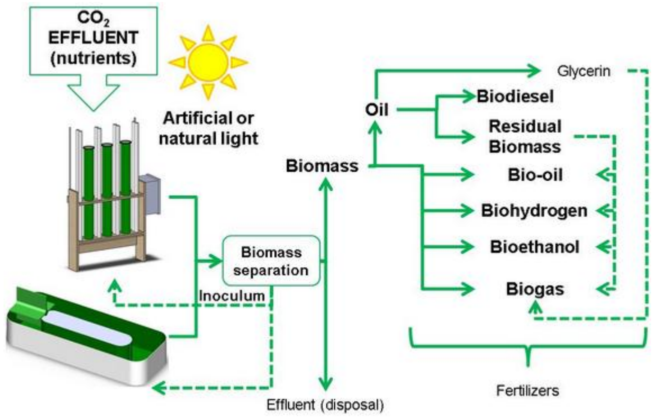


**Fig -1**: **Production fertilizer from biofuel waste**

## 2. BIOFUELS PRODUCTION, INVESTMENT LOCATION

Biofuels can be ether wholly or partially substituted for petrol or diesel. Bioethanol is mainly made from starch or sugar crops (such as wheat, corn, sugarcane). It can be used as a 5% blend with petrol. This blend requires no engine modification, but higher proportions of ethanol only can be used with engine modification. Brazil is the world leader in producing ethanol from sugarcane[4], while corn is the main crop for ethanol production in the US. About 90% of global bio-ethanol in 2007 was produced in the US, Brazil and the EU. There is also strong interest in other countries, for example, China, India and Canada (Figure 2). Cars are currently produced in Sweden, Canada and the US that can run on up to 85% ethanol. More than half of Brazil's sugarcane crop is planted for ethanol production. Bioethanol accounts for about 20% of Brazil's fuel supply. Brazil introduced its biofuel policy via two approaches: - a blend requirement (now about 25%) and tax incentive favoring ethanol use and the purchase of ethanol-using or flex-fuel vehicles. Today, more than 80% of Brazil s newly produced cars have flexible fuel capability and some 32,000 petrol stations supply motorists with ethanol[5].

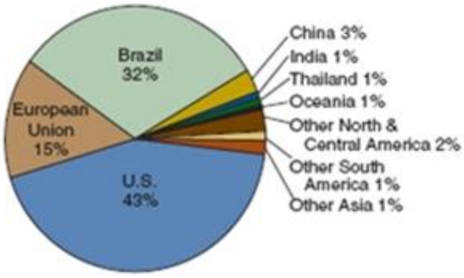


**Fig -2:** Global distribution of bio-ethanol production

Many uncertainties remain for the future of biofuels, including competition from unconventional fossil fuel alternatives and concerns about environmental trade-offs. Perhaps the biggest uncertainty is the extent to which the land intensity of cur-rent biofuel production can be reduced. The amount of biofuel that can be produced from an acre of land varies from 100 gallons per acre for EU rapeseed to 400 gallons per acre for U.S. corn and 660 gallons per acre for Brazilian sugarcane.

Cellulosic ethanol could raise per acre ethanol yields to more than 1,000 gallons, significantly reducing land requirements. Cellulosic ethanol is made by breaking down the tough cellular material that gives plants rigidity and structure and converting the resulting sugar into ethanol. Cellulose is the world's most widely available biological material, present in such low-value materials as wood chips and wood waste, fast-growing grasses, crop residues like corn Stover, and municipal waste.

U.S. cellulosic fuel production costs are now estimated at more than $2.50 per gallon, compared with $1.65 per gallon for corn ethanol. Venture capital and government subsidies are supporting companies interest- ed in making cellulosic ethanol commercially viable, primarily in the United States, but also in several other countries, including Canada, Brazil, China, Japan, and Spain.

In the meantime, other costs of cellulosic ethanol production need to be fully assessed, such as the impacts of harvesting grasses, trees, and crop residues on the erodibility and fertility of land resources. There are also questions regarding the upstream logistical and environmental costs of harvesting, transporting, and storing large volumes of bulky feedstock used in processing.

## 3.BIOFUEL PRODUCTION TECHNOLOGY

The technology of biofuel production has and continues to be improved with more advanced technology development across different sciences, notably biology, biochemistry, engineering and IT. The biofuel production process began with transformation from starch or sugar to ethanol. More recently innovators have practised production of ethanol from cellulose and, as will be shown, may have the greatest affordable fuel supply from algae in the near future.

### 3.1 From sugarcane, starchy crop to ethanol

In history for thousands of years, fruit and grains have been converted into ethanol via fermentation. Today, sugars and starches are turned into ethanol using similar process. During the process, a series of enzymes help convert starch into sugar, and then ferment the sugar into ethanol via yeast (Figure 3). Corn, wheat and other cereals contain starch that can relatively easily be converted into sugar. Traditional fermentation processes rely on yeasts that convert six-carbon sugars (mainly glucose) to ethanol. In the US, corn grains are the preferred feedstock, where it is sugarcane in Brazil, as sugarcane is the most common crop in Brazil and many other tropical countries[6]. The organisms and enzymes for starch conversion and glucose fermentation on a commercial scale are readily available (Figure 3)

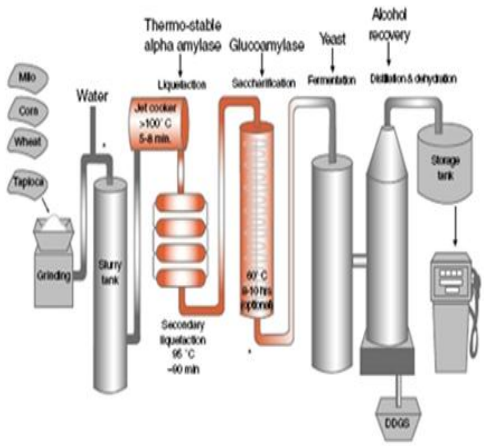


**Fig -3: Conventional ethanol production process**

In conventional grain-ethanol processes, only the starchy part of the crop plant is used. The starchy products represent a small proportion of the total plant biomass, leaving considerable fibrous remains (e.g. the seed husks) (IEA, 2004). Current research on cellulosic ethanol production is focused on how to utilize the remaining materials to create fermentable sugar to maximize the production of ethanol than from using only sugar and starches directly available [7].

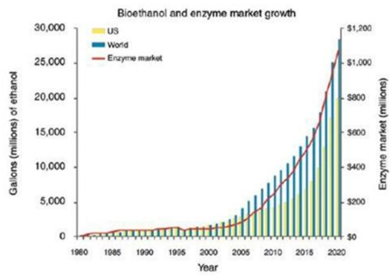


**Chart -1: Rising production of biofuel**

## 4. BIODIESEL PRODUCTION

The other main biofuel, biodiesel can be produced from any biological feedstock that contains oil or animal fat, through a chemical process (called "transesterification"), reacting feedstock oil or fat with methanol and apotassium hydroxide catalyst. Soybean, sunflower, rapeseed andpalm fruit are oil-seed crops used to produce biodiesel. Animal fat, or even used frying oil can be used to produce biodiesel too. Biodiesel also includes synthetic diesel fuel made through gasification or some other approach. The biodiesel process involves well-established technologies that are not likely to change significantly in the future, but efficiency can be improved by large scale production. There are some useful by-products such as glycerine, a valuable chemical used for making many types ofcosmetic, medicines and foods.

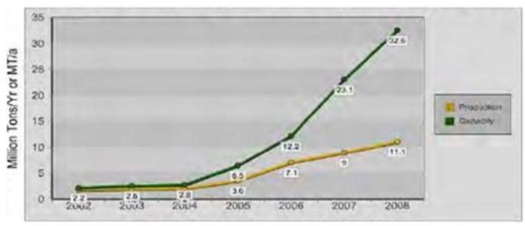


**Chart -2**: **World Biodiesel production and capacity**

This is likely to be constrained by environmental concerns outside Indonesia against the destruction of mangrove and other rainforest resources necessary to make way for palm-oil based biodiesel production. The global market for biodiesel is expected to increase in the next ten years (Figure 5). Europe currently represents 80% of global consumption and production, but the US is now catching up with a faster rate in production than Europe, from 25 million gallons in 2004 to 450 million gallons in 2007 (Emerging Markets Online, 2008). Brazil is expected to surpass US and European biodiesel production by 2015. Europe, Brazil, China and India each have targets to replace 5% to 20% of total diesel with biodiesel. If governments continued to invest more in R&D on biofuel exploitation, it would be possible to reach the targets sooner. But, as noted, the effort has a downside.

## 5. BIOFERTILIZERS

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. They accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants.Very often microorganisms are not as efficient in natural surroundings as one would expect them to be and therefore artificially multiplied cultures of efficient selected microorganisms play a vital role in accelerating the microbial processes in soil.

Use of biofertilizers is one of the important components of integrated nutrient management, as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable agriculture. Several microorganisms and their association with crop plants are being exploited in the production of biofertilizers. They can be grouped in different ways based on their nature and function.

### 5.1 Different types of bio fertilizers

***Rhizobium:*** Rhizobium is a soil habitat bacterium, which can able to colonize the legume roots and fixes the atmospheric nitrogen symbiotically. The morphology and physiology of Rhizobium will vary from free-living condition to the bacteroid of nodules. They are the most efficient biofertilizer as per the quantity of nitrogen fixed concerned. They have seven genera and highly specific to form nodule in legumes, referred as cross inoculation group.

**Fig -4: *Rhizobium***

***Azospirillum:*** *Azospirillum lipoferum and A. brasilense (Spirillum lipoferum in earlier literature) are primary inhabitants of soil, the rhizosphere and intercellular spaces of root cortex of graminaceous plants. They perform the associative symbiotic relation with the graminaceous plants.*

***Phosphate solubilizing microorganisms(PSM):*** *Several soil bacteria and fungi, notably species of Pseudomonas, Bacillus, Penicillium, Aspergillus etc.* secrete organic acids and lower the pH in their vicinity to bring about dissolution of bound phosphates in soil. Increased yields of wheat and potato were demonstrated due to inoculation of peat based cultures of Bacillus polymyxa and Pseudomonas striata. Currently, phosphate solubilizers are manufactured by agricultural universities and some private enterprises and sold to farmers through governmental agencies. These appear to be no check on either the quality of the inoculants marketed in India or the establishment of the desired organisms in the rhizosphere.

**Silicate solubilizing bacteria (SSB**): Microorganisms are capable of degrading silicates and aluminum silicates. During the metabolism of microbes several organic acids are produced and these have a dual role in silicate weathering. They supply H+ ions to the medium and promote hydrolysis and the organic acids like citric, oxalic acid, Keto acids and hydroxy carbolic acids which from complexes with cations, promote their removal and retention in the medium in a dissolved state[8].

## 6. PRODUCTION BIO FERTILIZER FROM BIOFUEL WASTE

There are several things need to be considered in biofertilizer making such as microbes' growth profile, types and optimum condition of organism, and formulation of inoculum. The formulation of inocula, method of application and storage of the product are all critical to the success of a biological product. In general, there are 6 major steps in making biofertilizer. These includes choosing active organisms, isolation and selection of target microbes, selection of method and carrier material, selection of propagation method, prototype testing and large scale testing. First of all, active organisms must be decided For example, we must decide to use whether organic acid bacteria or nitrogen fixer or the combination of some organisms. Then, isolation is made to separate target microbes from their habitation. Usually organism are isolate from plants root or by luring it using decoy such as putting cool rice underground of
bamboo plants[3].

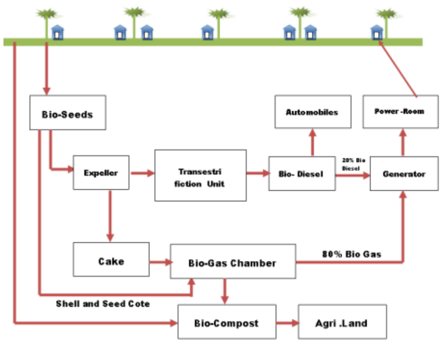


**Fig -5:** Production bio fertilizer from biofuel waste

Biofertilizers are usually prepared as carrier-based inoculants containing effective microorganisms. Incorporation of microorganisms in carrier material enables easy-handling, long-term storage and high effectiveness of biofertilizers. Sterilization of carrier material is essential to keep high number of inoculant bacteria on carrier for long storage period. Gamma-irradiation or autoclaving can be used as method for sterilization.

Various types of material can be used as carrier for seed or soil inoculation. The properties of a good carrier material for seed inoculation are inexpensive and available in adequate amounts. It must non-toxic to inoculants bacterial strain and non-toxic to plant itself. Because it acts as carrier for seed inoculation, it should have good moisture absorption capacity and good adhesion to seeds. Last but not the least; carrier should have good pH buffering capacity, easy to process and sterilized by either autoclaving or gamma radiation[6].

## 7. CONCLUSIONS

The paper has discussed first and second generation biofuel ,concept of bio refineries, different types of bio fertilizer, and associated technical challenges. However, growing concerns over first generation biofuels in terms of their impact on food prices and the environment have led to an increasingly bad press in the last year. By implementing these methods problem of energy as well as bad effect of artificial fertilizers on human, animals and environment can completely stopped. Farmers spend large amount for buying artificial fertilizers per year this cost reduced by producing bio-fertilizers as result farming profession can become more beneficial than previous. Basic need of power for cooking, generation of electricity can obtained pollution free without using separate processes. This is sustainable way of production of energy.

## ACKNOWLEDGEMENT

The authors can acknowledge any person/authorities in this section. This is not mandatory.

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