

# Production of Ethanol by waste

*Mr. Saurabh R. Thakare*

*Department of Mechanical engineering, J.D.I.E.T, Yavatmal MS, India  
saurabhthakare007@rediffmail.com*

## Abstract

A biofuel is a fuel that uses energy from a carbon fixation. These fuels are produced from living organisms. Biofuel holds significant promise as a potential fuel displacement. our aim is to produce second generation bioethanol from the organic fraction of Municipal Solid Waste (MSW). Since now feedstock to produce biofuels is affecting the food market, but recently the prices of this market have increased, therefore reducing the profitability of the bioethanol projects. The composition of organic fraction of MSW is similar to lignocellulosic materials. The cellulose and hemicellulose will be hydrolyzed and fermented obtaining bioethanol. In the process the lignin is separated and used to cogenerate the power and heat necessary for the process. It must be taken heed of using waste in biodiesel production process can give weight to developing biodiesel production process. In this we elaborate production, properties and chemical process related to biofuel.

Keyword:- ethanol, MSW(municipal solid waste),thermochemical process,biofuel,.

## 1.INTRODUCTION

### BIOFUEL:-

A biofuel is a fuel that uses energy from a carbon fixation. These fuels are made from a biomass conversion. biomass can be used for biofuels. Biofuels have increased in popularity because of the raising oil prices and need for energy security.

### PRODUCTION OF ETHANOL BY MUNICIPAL SOLID WASTE (MSW):-

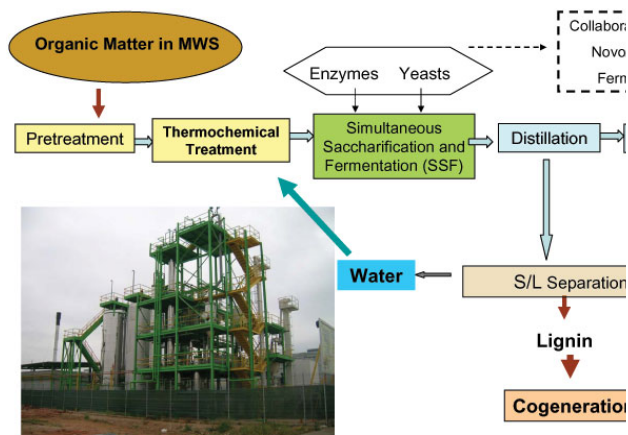
As a result, the use of alternative nonedible crops such as Jatropha, animal fats, and waste cooking oil is on the rise. Municipal solid waste is also gaining traction in the US and around the world as a lipid feedstock for biodiesel production. First, MSW consists of significant concentrations of lipids. Second, it is plentiful. Third, sludge management poses formidable environmental challenges. most sludge that will be used for

biodiesel production may fall under a particular Class.

There are several generations related to Biofuel.

where **Production of Bioethanol by MSW is related to second generation biofuel.**

## 2. PROCESS FOR PRODUCTION OF EHTANOL:-



**Pre-treatment:-** In this process the waste of particular class is taken out and allow to approach to following processes.

**Thermo-chemical Process:-** The gasification(Thermo-chemical) process does not rely on chemical decomposition of the cellulose chain (cellulolysis). Instead of breaking the cellulose into sugar molecules, the carbon in the raw material is converted into synthesis gas, using what amounts to partial combustion. The carbon monoxide, carbon dioxide and hydrogen may then be fed into a special kind of fermenter. Instead of sugar fermentation with yeast, this process uses *Clostridium ljungdahlii* bacteria. This microorganism will ingest carbon monoxide, carbon dioxide and hydrogen and produce ethanol and water. The process can thus be broken into three steps:

1. Gasification — Complex carbon-based molecules are broken apart to access the carbon as carbon monoxide, carbon dioxide and hydrogen
2. Fermentation — Convert the carbon monoxide, carbon dioxide and hydrogen into ethanol using the *Clostridium ljungdahlii* organism
3. Distillation — Ethanol is separated from water

the synthesis gas from gasification may be fed to a catalytic reactor where it is used to produce ethanol.

### 3.PROPERTIES RELATED TO ETHANOL(BIODIESEL):-

**Viscosity:-** The viscosity of diesel must be high enough to provide sufficient lubrication for the engine parts but slow enough to flow at operational temperature. High viscosity can plug the fuel filter and injection system in engines.

biodiesel viscosity remains higher than that of diesel, and the engine may not be able to use the fuel at low temperatures due to the slow flow through the fuel filter.

**Compression Ratio:-** . For maximum use of ethanol's benefits, a much higher compression ratio should be used. Current high compression neat ethanol engine designs are approximately 20 to 30% less fuel efficient than their gasoline-only counterparts

**Octane no.:-** Biodiesel has better lubricating properties and much higher cetane ratings than today's lower sulfur diesel fuels. Biodiesel addition reduces fuel system wear, and in low levels in high pressure systems increases the life of the fuel injection equipment that relies on the fuel for its lubrication.

#### calorific value:-

The calorific value of biodiesel(Ethanol) is about 37.27 MJ/kg. This is 9% lower than regular Number 2 petrodiesel. Variations in biodiesel energy density is more dependent on the feedstock used than the production process. Still, these variations are less than for petrodiesel. It has been claimed biodiesel gives better lubricity and more complete combustion thus increasing the engine energy output and partially

compensating for the higher energy density of petrodiesel.

#### 4.Engine Performance

Biodiesel has higher brake-specific fuel consumption compared to diesel, which means more biodiesel fuel consumption is required for the same torque. However, B20 biodiesel blend has been found to provide maximum increase in thermal efficiency and lowest brake-specific energy consumption. The engine performance depends on the properties of the fuel, as well as on combustion, injector pressure and many other factors. Since there are various blends of biodiesel, that may account for the contradicting reports in regards engine performance.

Brake specific fuel consumption :- Decrease in B.S.F.C. was found with increase in brake power. It can be seen that as Brake Power increases, B.S.F.C. decreases to minimum at full load condition.

Brake specific energy consumption:- Decrease in B.S.E.C. was found with increase in brake power.

#### Performance Parameter of Engine Operation Using Biodiesel:-

##### 1. Engine Performance:-

Biodiesel produces about 3-5% less engine power and torque due to its lower energy compared to diesel. It is expressed in terms of kWh/litre of fuel or as Brake specific fuel consumption (BSFC) in gm/kWh.

##### 2. Deposit and Clogging :-

Deposits and clogging problems are widely reported and are generally attributed to sub standard quality of biodiesel or due to its less oxidation stability and therefore engine wear is relatively more when run on biodiesel.

##### 3. Pollution from engine exhaust:-

Biodiesel results in much less air pollution due to its higher oxygen content and absence of "aromatic compounds" and sulphur. The NOx tends to be slightly higher compared to biodiesel which can be minimized by proper engine timing.

##### 4. Cold-weather performance:-

Diesel engines operated in cold weather experience the problems of clogging of the filters and/or choking of the injectors. The use of flow improving additives and "winter blends" of biodiesel and kerosene has proved effective in the operating range of climate temperatures B100 tends to operate well at temperatures down to about 5°C. Additives reduce the range by about 5-8°C, while the winter blends have proved effective at temperatures as low as -20°C or below.

#### Performance of diesel engine with biodiesel fuel :-

Literature survey reveals that biodiesel perform satisfactorily during diesel engine operation. and B20 blend provides the fuel economy almost similar to the diesel. Due to its high lubricity, it causes less wear and tear to engine part. Various studies have reported on the performance and emission of CI engines, fuelled by B100 biodiesel as well as its blends with diesel. It oxygenated nature leads to more complete combustion, resulting in lower emission due to higher combustion temperature. The biodiesel blends with diesel give performance similar to diesel as the fuel properties of biodiesel and diesel are almost similar as seen from data given in table 3 which shows that the cetane number, flash point and lubricity of biodiesel are higher while the calorific value is lower.

#### VARIOUS BLENDS OF ETHANOL

Much of the world uses a system known as the "B" factor to state the amount of biodiesel in any fuel mix:



- 100% biodiesel is referred to as **B100**.
- 20% biodiesel, 80% petrodiesel is labeled **B20**.
- 5% biodiesel, 95% petrodiesel is labeled **B5**.
- 2% biodiesel, 98% petrodiesel is labeled **B2**.

### WORLD REVIEW

The world's top ethanol fuel producers in 2011 were the United States with 13.9 billion U.S. liquid gallons (bg) (52.6 billion liters) and Brazil with 5.6 bg (21.1 billion liters), accounting together for 87.1% of world production of 22.36 billion US gallons (84.6 billion liters).<sup>[2]</sup> Strong incentives, coupled with other industry development initiatives, are giving rise to fledgling ethanol industries in countries such as Germany, Spain, France, Sweden, China, Thailand, Canada, Colombia, India, Australia, and some Central American countries.

3	 European Union	1,199.31	1,176.88	1,039.52	733.60	570.30
4	 China	554.76	541.55	541.55	501.90	486.00
5	 Thailand			435.20	89.80	79.20
6	 Canada	462.3	356.63	290.59	237.70	211.30
7	 India			91.67	66.00	52.80
8	 Colombia			83.21	79.30	74.90
9	 Australia	87.2	66.04	56.80	26.40	26.40
10	Other			247.27		
	World Total	22,356.09	22,946.87	19,534.993	17,335.20	13,101.7

### ANNUAL FUEL PRODUCTION BY COUNTRIES (2007-2011) OVER 10 YEARS:-

(Millions of U.S. liquid gallons per year)						
World rank	Country/Region	2011	2010	2009	2008	2007
1	 United States	13,900	13,231	10,938	9,235	6,485
2	 Brazil	5,573.24	6,921.54	6,577.89	6,472.2	5,019.2

### CHALLENGES

#### Modifications to engines

The use of ethanol blends in conventional gasoline vehicles is restricted to low mixtures, as ethanol is corrosive and can degrade some of the materials in the engine and fuel system. Also, the engine has to be adjusted for a higher compression ratio as compared to a pure gasoline engine to take advantage of ethanol's higher oxygen content, thus allowing an improvement in fuel efficiency and a reduction of tailpipe emissions. The following table shows the required modifications to gasoline engines to run

smoothly and without degrading any materials. This information is based on the modifications made by the Brazilian automotive industry at the beginning of the ethanol program in that country in the late 1970s, and reflects the experience of Volkswagen do Brasil.

### **Powered trucks or heavy duty vehicles**

Instead of using Gasoline or Propane we can use Ethanol(which gives high output) as a fuel.

### **Railway usage**

British train operating company Virgin Trains claimed to have run the UK's first "biodiesel train", which was converted to run on 80% petrodiesel and 20% biodiesel.

The Royal Train on 15 September 2007 completed its first ever journey run on 100% biodiesel fuel supplied by Green Fuels Ltd. His Royal Highness, The Prince of Wales, and Green Fuels managing director, James Hygate, were the first passengers on a train fueled entirely by biodiesel fuel. Since 2007, the Royal Train has operated successfully on B100 (100% biodiesel).

Similarly, a state-owned short-line railroad in eastern Washington ran a test of a 25% biodiesel / 75% petrodiesel blend during the summer of 2008, purchasing fuel from a biodiesel producer sited along the railroad tracks. The train will be powered by biodiesel made in part from canola grown in agricultural regions through which the short line runs.

Also in 2007, Disneyland began running the park trains on B98 (98% biodiesel). The program was discontinued in 2008 due to storage issues, but in January 2009, it was announced that the park would then be running all trains on biodiesel manufactured from its own used cooking oils. This is a change from running the trains on soy-based biodiesel.

### **Aircraft use**

A test flight has been performed by a Czech jet aircraft completely powered on biodiesel. Other recent jet flights using biofuel, however, have been using other types of renewable fuels.

On November 7, 2011 United Airlines flew the world's first commercial aviation flight on a microbially derived biofuel using Solajet™, Solazyme's algae-derived renewable jet fuel. The Eco-skies Boeing 737-800 plane was fueled with 40 percent Solajet and 60 percent petroleum-derived jet fuel. The commercial Eco-skies flight 1403 departed from Houston's IAH airport at 10:30 and landed at Chicago's ORD airport at 13:03.

## **CONCLUSION**

Following are conclusions based on ethanol biofuel studies

Engine can be run with biodiesel, ethanol and its diesel blends, i.e. B20,B5,B2 without any abnormality and engine modification. Blend B100 is very difficult to use as a fuel,required specially designed vehicle

The use of biodiesel will lead to loss in engine power mainly due to the reduction in heating value of biodiesel compared to diesel, and it result in the increase in biodiesel fuel consumption. From the review it can be concluded that the use of biodiesel favours to reduce carbon deposit and wear of the key engine parts, compared with diesel.

It is realible to produce Biofuel by Munciple Solid Waste

## **REFERENCES**

1. Municipal Solid Waste Energy Information Administration.
2. J.B. Heywood, " Internal Combustion Engine Fundamentals," McGraw Hill.
3. V. ganesha , "Internal Combustion Engine.
4. Pathak S.C., Soni S. L., "Performance and Emission Characteristics of Direct Injection

Diesel Engine using Neem- Diesel Blends.”IE(I) Journal

5. Hazar. H. “Cotton methyl ester usage in a diesel engine equipped with insulated combustion chamber”, Applied Energy,
6. Mohanan P., “Evaluation of Performance and Emission Characteristics of 4-Stroke Single Cylinder Direct Injection Diesel Engine Fuelled with Sesame Methyl Ester and Diesel Fuel Blends”.

IJSER