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Biofuel

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Abstract **: Biofuels are produced from living organisms or from metabolic by-products (organic or food waste products). In order to be considered a biofuel the fuel must contain over 80 percent renewable materials. It is originally derived from the photosynthesis process and can therefore often be referred to as a solar energy source. 'First-generation' or conventional biofuels are made from sugar, starch, or vegetable oil. These are given as: ethanol, biodiesel, green diesel, biofuel gasoline, vegetable oil, bio ethers, biogas etc. Second generation biofuels, also known as advanced biofuels, are fuels that can be manufactured from various types of biomass. The world leaders in biofuel development and use are Brazil, the United States, France, Sweden and Germany. Research is on-going into finding more suitable biofuel crops and improving the oil yields of these crops. Using the current yields, vast amounts of land and fresh water would be needed to produce enough oil to completely replace fossil fuel usage.**

Biofuel development in India centres mainly on the cultivation and processing of Jatropha plant seeds which are very rich in oil (40%). The drivers for this are historic, functional, economic, environmental, moral and political. Jatropha oil has been used in India for several decades as biodiesel for the diesel fuel requirements of remote rural and forest communities; jatropha oil can be used directly after extraction (i.e. without refining) in diesel generators and engines.

Several passenger vehicles come with a flex-fuel option that allows them to run on ethanol/gasoline blends from 0 percent to 85 percent ethanol. The generation of electricity is the single largest use of fuel in the world.

INTRODUCTION

A biofuel is defined as any fuel whose energy is obtained through a process of biological carbon fixation. Carbon fixation is a process that takes inorganic carbon (in the form of things like CO2) and converts it into organic compounds. In other words, any process that converts carbon dioxide into a molecule that would be found in a living organism is carbon fixation. It is also known as agro fuel, these fuels are mainly derived from biomass or bio waste. These fuels can be used for any purposes, but the main use for which they have to be brought is in the transportation sector. Most of the vehicles require fuels which provide high power and are dense so that storage is easier. These engines require fuels that are clean and are in the liquid form.

Biofuels Research by Institution

While the process of producing biofuel from feedstock is relatively straightforward, the process of developing efficient organisms to use as feedstock is not. Jatropha, Camelina, Corn, Sugarcane, Algae, and a number of other living organisms are all under consideration for potential use in producing biofuels. Producing viable feedstock from these organisms requires a great deal of expertise in chemistry and biology, with an increasing emphasis on genetic engineering. The money required to develop superior biofuel feedstock is often massive in quantity, but the potential benefits of biofuels are too great to ignore. To that end, a number of national governments and government collaborations have put their considerable resources into research and development of biofuels.

CLASSIFICATION OF BIOFUEL

First Generation Biofuel

First generation biofuels are produced directly from food crops. The biofuel is ultimately derived from the starch, sugar, animal fats, and vegetable oil that these crops provide. **Second Generation Biofuel**

Second generation biofuels are also known as advanced biofuels. What separates them from first generation biofuels the fact that feedstock used in producing second generation biofuels are generally not food crops.

In fact, several second generation biofuels, like Switch grass, are cultivated specifically to act as direct biomass.

Third Generation Biofuel

The term third generation biofuel has only recently enter the mainstream it refers to biofuel derived from algae. Previously, algae were lumped in with second generation biofuels.

The list of fuels that can be derived from algae includes: Biodiesel, Butanol, Gasoline, Methane, Ethanol, Vegetable Oil, Jet Fuel.

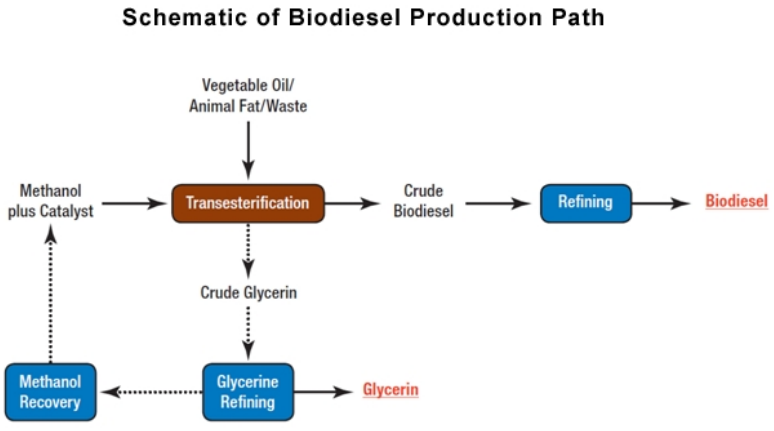
Fuel	Feedstock	Energy Density (megajoules/kilogram)	Greenhouse Gas CO_2(kg/kg)	Notes
First Generation				
Bio alcohol	Starches from wheat, corn, sugar cane, molasses, potatoes, other fruits	By Type	By Type	
Ethanol		30	1.91	
Propanol		34	N/A	
Butanol		36.6	2.37	
Biodiesel	Oils and fats including animal fats, vegetable oils, nut oils, hemp, and algae	37.8	2.85	
Green Diesel	Made from hydrocracking oil and fat feedstock	48.1	3.4	Chemically identical to fossil fuel diesel
Vegetable Oil	Unmodified or slightly modified	By Type	By Type	
Castor Oil		39.5	2.7	
Olive Oil		39	2.8	
Fat		32	N/A	
Sunflower Oil		40	2.8	
Biogas	Methane made from waste crop material through anaerobic digestion or bacteria	55	2.74 (does not take into account the direct effect of methane, which is 23X more effective as a GHG than CO_2	Same properties as methane from fossil fuels
Solid Biofuels	Everything from wood and sawdust to garbage, agricultural waste, manure	By Type	By Type	This category includes a very wide variety of materials. Manure has low CO_2 emissions, but high nitrate emissions.
Wood		16-21	1.9	
Dried plants		10-16	1.8	
Bagasse		10	1.3	
Manure		10-15	N/A	
Seeds		15	N/A	
Second Generation				

Cellulosic ethanol	Usually made from wood, grass, or inedible parts of plants			
Algae - based biofuels	Multiple different fuels made from algae	Can be used to produce any of the fuels above, as well as jet fuel	See specific fuels above	More expensive, but may yield 10-100X more fuel per unit area than other biofuels
Methanol	Inedible plant matter	19.7	1.37	More toxic and less energy dense than ethanol
Fischer-Tropsch Biodiesel	Waste from paper and pulp manufacturing	37.8	2.85	Process is just an elaborate chemical reaction that makes hydrocarbon from carbon monoxide and hydrogen

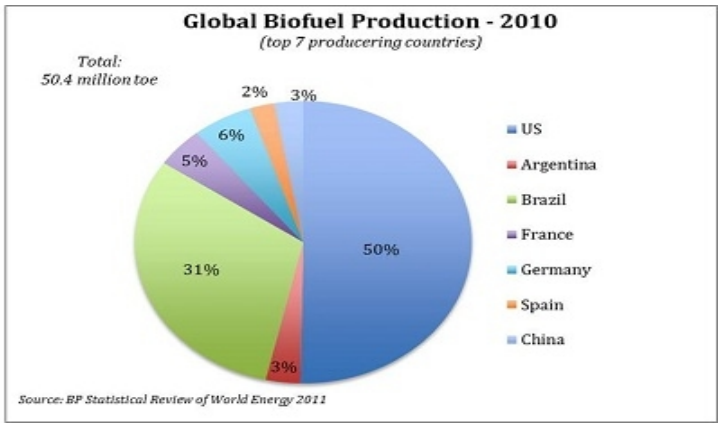
Source-http://biofuel.org.uk/types-of-biofuels.html

PRODUCTION PROCESS

Biodiesel is produced from vegetable oils, yellow grease, used cooking oils, and tallow. The production process converts oils and fats into chemicals called long-chain mono alkyl esters, or biodiesel. These chemicals are also referred to as fatty acid methyl esters, and the process is referred to as transesterification. Roughly speaking, 100 pounds of oil or fat are reacted with 10 pounds of a short-chain alcohol (usually methanol) in the presence of a catalyst (usually sodium hydroxide [NaOH] or rarely, potassium hydroxide [KOH]) to form 100 pounds of biodiesel and 10 pounds of glycerin.

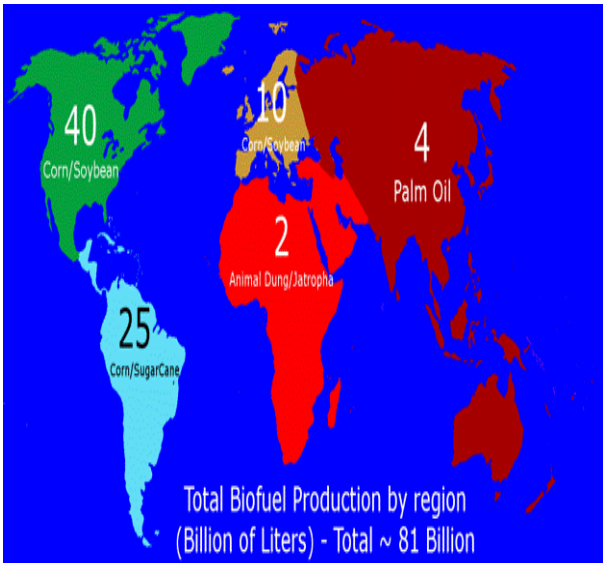


Source-http://www.afdc.energy.gov/fuels/images/Biodiesel-production-schematic.png



Source-http://chinawaterrisk.org/wp-content/uploads/2012/04/Global-Biofuel-Production-2010.jpg

Whereas the food versus biofuels issue is global in nature, most countries and regions have implemented their own policies to research, develop and manage biofuels. In China, the picture is notably different and biofuel production is virtually non-existent. In the US, the discussion is mostly centred on corn and ethanol; the US Government encouraging the production of ethanol from corn through grants and subsidies. Corn has historically been produced in surplus in the US, largely being used to feed livestock and poultry. As mentioned previously, 2011 was the first year that US ethanol refiners consumed more domestic corn than livestock and poultry farmers2. As a result, the ethanol industry's hunger for corn is being blamed for increasing food prices across the US



Region	Fuel Production (litres)	Major Feedstock
Europe	10 Billion	Corn/Soybean
North America	40 Billion	Corn/Soybean
South America	25 Billion	Corn/Sugar Cane
Africa (including Middle East)	2 Billion	Animal Dung/Jatropha
Australia/ Asia	4 Billion	Palm Oil
TOTAL	~81 Billion	Corn

Source-http://biofuel.org.uk/major-producers-by-region.html

ADVANTAGES OF BIOFUEL

•**Cost:** Biofuels have the potential to be significantly less expensive than gasoline and other fossil fuels. This is particularly true as worldwide demand for oil increases, oil supplies dwindle, and more sources of biofuels become apparent.

•**Source material:** Whereas oil is a limited resource that comes from specific materials, biofuels can be manufactured from a wide range of materials including crop waste, manure, and other by-products. This makes it an efficient step in recycling.

• **Renewability:** It takes a very long time for fossil fuels to be produced, but biofuels are much more easily

renewable as new crops are grown and waste material is collected.

• **Lower carbon emissions**: When biofuels are burned, they produce significantly less carbon output and fewer toxins, making them a safer alternative to preserve atmospheric quality and lower air pollution.

DISADVANTAGES

• **Energy output**: Biofuels have a lower energy output than traditional fuels and therefore require greater quantities to be consumed in order to produce the same energy level. This has led some noted energy analysts to believe that biofuels are not worth the work.

• **High cost**: To refine biofuels to more efficient energy outputs, and to build the necessary manufacturing plants to increase biofuel quantities, a high initial investment is often required.

• **Food prices**: As demand for food crops such as corn grows for biofuel production, it could also raise prices for necessary staple food crops.

• **Food shortages**: There is concern that using valuable cropland to grow fuel crops could have an impact on the cost of food and could possibly lead to food shortages.

• **Water use**: Massive quantities of water are required for proper irrigation of biofuel crops as well as to manufacture the fuel, which could strain local and regional water resources.

CONCLUSION

- Biofuel is very important since it contributes to the pollution free environment.
- Promotional government policies have to ensure that the production condition for biofuel is free competitive disadvantages.
- Biofuel reduces the dependence of imported fossil fuel.

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