

BIOFUELS

Dr. Md. Osaid Alam

Guest Faculty

(Environmental Science & Management)

Department of Zoology

Patna University

Introduction

- Biofuels are combustible fuels created from biomass; in other words, fuels created from recently living plant matter as opposed to ancient plant matter in hydrocarbons.
- **Biofuel**, is derived from biomass— that is, plant or algae material or animal waste. Since such feedstock material can be replenished readily, biofuel is considered to be a source of renewable energy, unlike fossil fuels such as petroleum, coal, and natural gas.
- Biofuel is commonly advocated as a cost-effective and environmentally benign alternative to petroleum and other fossil fuels, particularly within the context of rising petroleum prices and increased concern over the contributions made by fossil fuels to global warming.

Introduction

- The two most common types of biofuels in use today are bioethanol or simply ethanol and biodiesel, both of which represent the first generation of biofuel technology.
- The simplest way to distinguish between the two is to remember ethanol is an alcohol and biodiesel is an oil. Ethanol is an alcohol formed by fermentation and can be used as a replacement for, or additive to, gasoline whereas biodiesel is produced by extracting naturally occurring oils from plants and seeds in a process called transesterification. Biodiesel can be combusted in diesel engines.
- Transesterification is a chemical process, whereby the glycerin is separated from the fat or vegetable oil. The process leaves behind two products – methyl esters and glycerin. Methyl esters is the chemical name for biodiesel and glycerin is used in a variety of products, including soap.

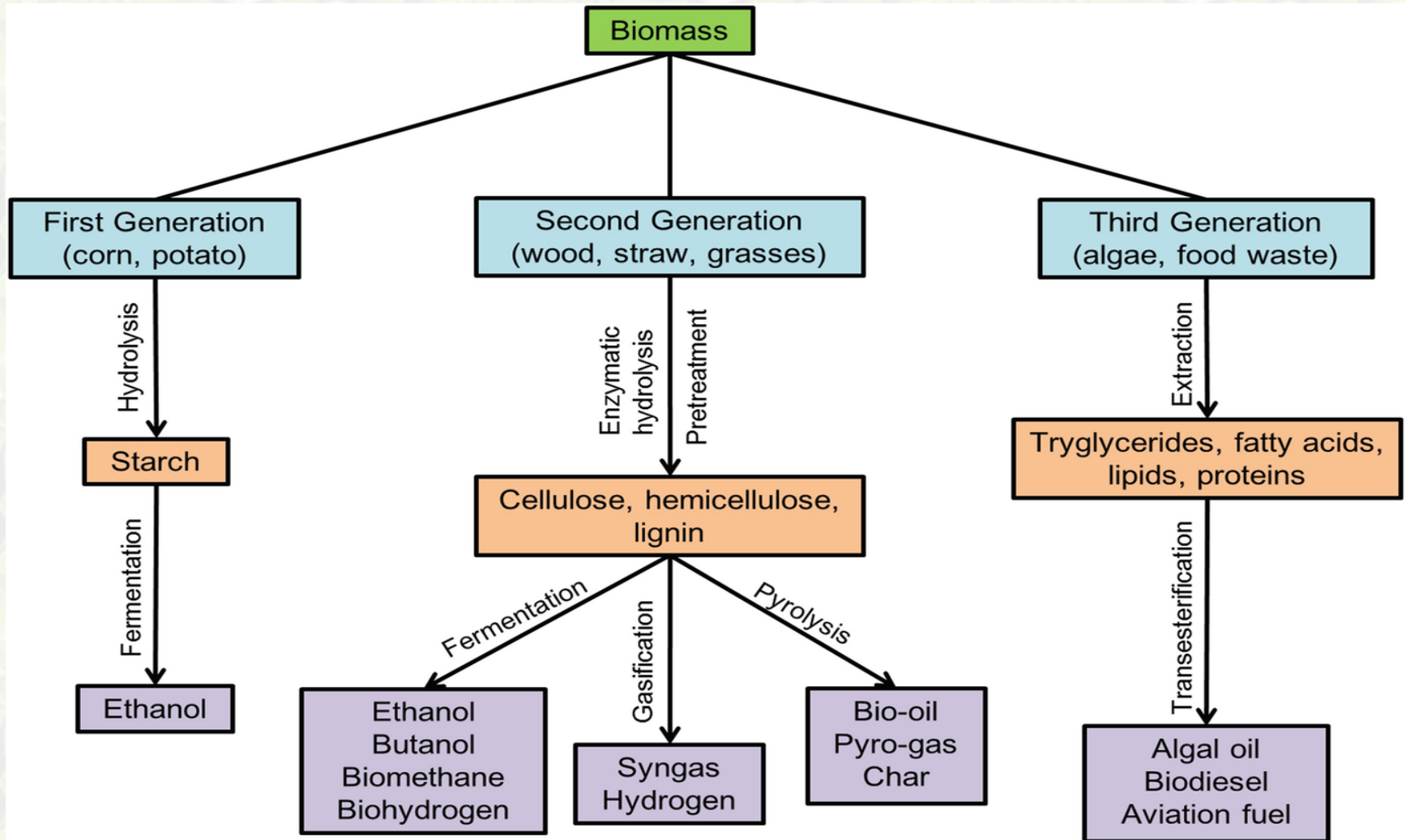
Types of Biofuel

- Biofuels are grouped by categories - first generation, second generation, and third generation – based on the type of feedstock (the input material) used to produce them.
- **First generation biofuels** are produced from food crops. For ethanol, feedstocks include sugarcane, corn, maize, etc. For biodiesel, feedstocks are naturally occurring vegetable oils such as soybean and canola.
- **Second generation biofuels** are produced from cellulosic material such as wood, grasses, and inedible parts of plants. This material is more difficult to break down through fermentation and therefore requires pre-treatment before it can be processed.

Types of Biofuel

- **Third generation biofuels** are produced using the lipid production from algae.
- In addition, the term “**Advanced Biofuels**” is used to describe the relatively new technological field of biofuel production that uses waste such as garbage, animal fats, and spent cooking oil to produce liquid fuels.
- Biofuels are not as energy dense as conventional transportation fuels. 1 gallon of biodiesel has 93% of the energy of 1 gallon of diesel and 1 gallon of ethanol (E85) has 73% of the energy of 1 gallon of gasoline.

Types of Biofuel



Comparison of Bioethanol and Biodiesel

	Bioethanol	Biodiesel
Process	Dry-mill method: yeast, sugars and starch are fermented. From starch, it is fermented into sugar, afterwards it is fermented again into alcohol.	Transesterification: methyl esters and glycerin which are not good for engines are left behind.
Environmental Benefit	Both reduce GHG emissions as biofuels are primarily derived from crops which absorb CO ₂ .	
Compatibility	Ethanol has to be blended with fossil fuel like gasoline, hence only compatible with selected gasoline powered automobiles	Able to run in any diesel generated engines.
Costs	Cheaper	More expensive
Gallon per acre	420 gallons of ethanol can be generated per acre.	60 gallons of biodiesel per acre soybeans.
Energy	Provides 93% more net energy per gallon.	Produces only 25% more net energy.
GHG emission	12% less GHG emission than the production and combustion of regular diesel.	41% less compared to conventional gasoline.

Advantages of Biofuels

- 1. Cost benefit:** As of now, biofuels cost the same in the market as gasoline does. However, the overall cost benefit of using them is much higher. They are cleaner fuels, adaptable to current engine designs, engine requires less maintenance and brings down overall pollution check costs. With the increased demand of biofuels, they have a potential of becoming cheaper in future as well.
- 2. Easy to source:** Biofuels are made from many different sources such as manure, waste from crops and plants grown specifically for the fuel.
- 3. Renewable:** Since most of the sources like manure, corn, switchgrass, soyabeans, waste from crops and plants are renewable and are not likely to run out any time soon. These crops can be replanted again and again.

Advantages of Biofuels

- 4. Reduce greenhouse gases:** To reduce the impact of greenhouse gases, people around the world are using biofuels. Studies suggests that biofuels reduces greenhouse gases up to 65 percent.
- 5. Economic security:** Not every country has large reserves of crude oil. For them, having to import the oil puts a huge dent in the economy. If more people start shifting towards biofuels, a country can reduce its dependance on fossil fuels. More jobs will be created with a growing biofuel industry, which will keep our economy secure.

Advantages of Biofuels

- 6. Reduce dependance on foreign oil:** While locally grown crops has reduce the nation's dependance on fossil fuels, it will take a long time to solve our energy needs. As prices of crude oil is touching sky high, we need some more alternative energy solutions to reduce our dependance on fossil fuels.
- 7. Lower levels of pollution:** Since biofuels can be made from renewable resources, they cause less pollution to the planet. However, that is not the only reason why the use of biofuels is being encouraged. They release lower levels of carbon dioxide and other emissions when burnt. Although the production of biofuels creates carbon dioxide as a byproduct, it is frequently used to grow the plants that will be converted into the fuel. This allows it to become something close to a self sustaining system.

Disadvantages of Biofuels

- 1. High cost of production:** Biofuels are quite expensive to produce in the current market. Such a disadvantage is still preventing the use of biofuels from becoming more popular.
- 2. Monoculture:** Monoculture refers to practice of producing same crops year after year, rather than producing various crops through a farmer's fields over time. While, this might be economically attractive for farmers but growing same crop every year may deprive the soil of nutrients that are put back into the soil through crop rotation.
- 3. Use of fertilizers:** Biofuels are produced from crops and these crops need fertilizers to grow better. The fertilizers have harmful effects on surrounding environment and may cause water pollution.

Disadvantages of Biofuels

4. Shortage of food: Biofuels are extracted from plants and crops that have high levels of sugar in them. However, most of these crops are also used as food crops. Even though waste material from plants can be used as raw material, the requirement for such food crops will still exist. It will take up agricultural space from other crops, which can create a number of problems. Even if it does not cause an acute shortage of food, it will definitely put pressure on the current growth of crops. One major worry being faced by people is that the growing use of biofuels may just mean a rise in food prices as well.

Disadvantages of Biofuels

- 5. Industrial pollution:** The carbon footprint of biofuels is less than the traditional forms of fuel when burnt. But biofuel production is largely dependent on lots of water and oil. Large scale industries meant for churning out biofuel are known to emit large amounts of emissions and cause small scale water pollution as well. Unless more efficient means of production are put into place, the overall carbon emission does not get a very big dent in it.
- 6. Water use:** Large quantities of water are required to irrigate the biofuel crops like corn and it may impose strain on local and regional water resources, if not managed wisely.

Disadvantages of Biofuels

7. Future rise in price: Current technology being employed for the production of biofuels is not as efficient as it should be. Scientists are engaged in developing better means by which we can extract this fuel. However, the cost of research and future installation means that the price of biofuels will see a significant spike. As of now, the prices are comparable with gasoline and are still feasible. Constantly rising prices may make the use of biofuels as harsh on the economy as the rising gas prices are doing right now

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