Environmental Biotechnology

- **Biomass can be used for production of heat, power, transport fuels, and bioproducts.**
- **When produced and used on a sustainable basis, it is a carbon-neutral carrier and can make a large contribution to reducing greenhouse gas emissions.**

Biofuel the future of energy

Biofuels

- Biofuels are solid, liquid or gaseous fuels that can be produced from biochemical/biological or thermochemical routes from a wide variety of substrates ranging from lignocellulosic biomass to renewable waste materials.

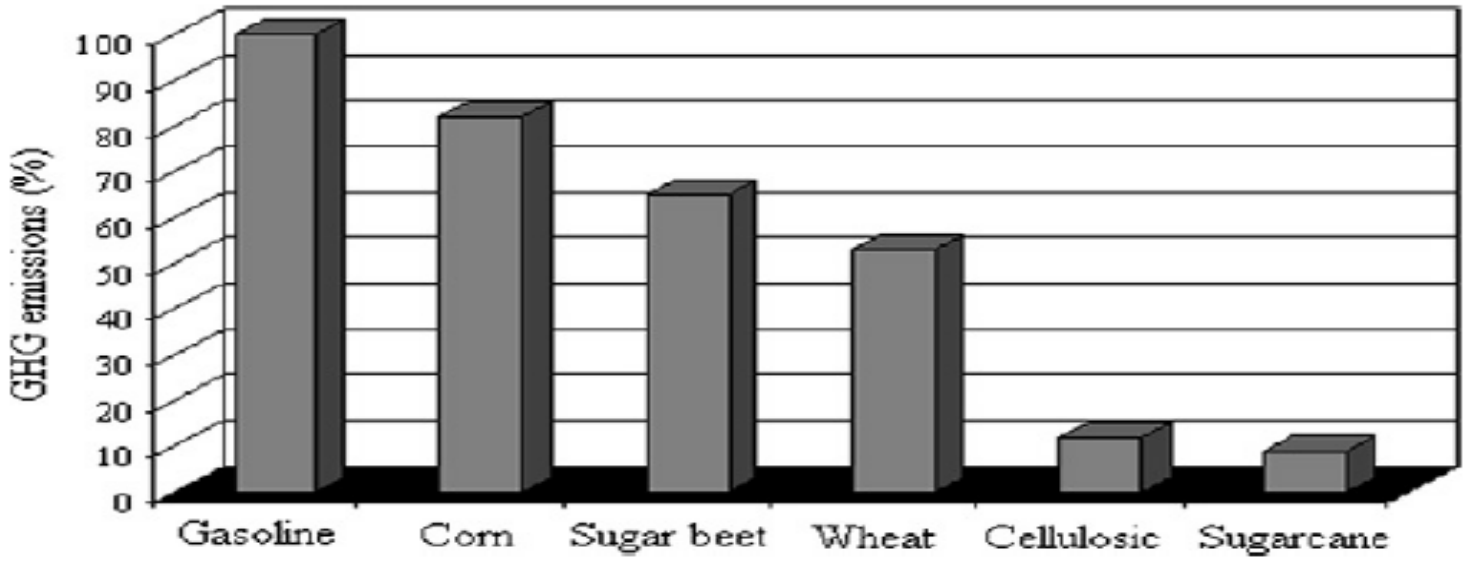
Advantages over petroleum-based fuels:

1) Biofuels can be easily extracted from many renewable resources either directly from plants, or indirectly from agricultural, commercial, domestic, and/or industrial wastes.

2) They are sustainable due to biodegradable property and their combustion based on carbon-dioxide.

3) The use of biofuels can contribute to the mitigation of greenhouse gas (GHG) emissions as it provides a clean and sustainable energy source.

- The utilization of organic wastes for biofuels production is the innovative approach towards the resolution of issues pertinent to waste management, fossil fuel dependency and harmful greenhouse gases (GHG) emissions.
- For example, the using of sugarcane and cellulosic bioethanol result in almost 90% lower GHG emissions



Biofuel examples

Ethanol

Ethanol (CH_3CH_2OH) is a renewable fuel used:

- **As feedstock for the chemical industry, as energy carrier and in alcoholic beverages.**
- **Moreover, it is the most widely used biofuel for transportation worldwide.**
- **It can be used as a complete transportation fuel or as a supplement to gasoline which improving octane and reducing emissions.**

Higher Alcohols

- **Butanol** is considered a chemical of great industrial importance and also can be used as an advanced biofuel or in a blend with gasoline to enhance the octane rating.
- Its energy density (27 MJ/L) is close to that of gasoline (32 MJ/L) and it can be blended with it at basically any concentrations.
- **Butanol** is superior to ethanol as a fuel due to its higher energy content (ethanol 21 MJ/L vs n-butanol 27 MJ/L), less hygroscopic, less volatile, less corrosive and less explosive which makes it safer to use than ethanol.

Therefore, there is no need for any adjustment in vehicles or engines run on butanol rather than fossil fuels.

Dr. Rasma Omar

Hexanol

- **Hexanol** is another alcohol that can be blended with biodiesel or gasoline and has more advantages as a fuel than ethanol or n-butanol.
- Hexanol has several other industrial applications. It is also is also used in the pharmaceutical, cosmetic/ perfumes, textile, detergents, pesticides and leather industry.
- **n-Propanol** has also been considered as a candidate for the replacement of gasoline and is an important chemical for ink, cosmetics, vegetable oils, polymer and pharmaceutical industries
  - Therefore, the higher alcohols have been the focus of recent research initiatives.

2,3-butanediol

- **2,3-butanediol** the organic compound with the formula $(CH_3CHOH)_2$.
- Has various applications in manufacturing industries, such as in the production of food, pharmaceuticals, printing inks, perfumes, fumigants, synthetic rubbers, octane boosters, or plasticizers.