

Power Alcohol

When ethyl alcohol is used as fuel in internal combustion engine, it is called as "power alcohol". Generally ethyl alcohol is used as its 5-25% mixture with petrol.

Advantages of Power Alcohol:

- Ethyl alcohol has good antiknocking property and its octane number is 90, while the octane number of petrol is about 65. Therefore, addition of ethyl alcohol increases the octane number of petrol.

- Alcohol has property of absorbing any traces of water if present in petrol.
- If specially designed engine with higher compression ratio is used, then disadvantage of lower Calorific value of ethyl alcohol can be overcome.
- Ethyl alcohol contains 'O' atoms, which helps for complete combustion of power alcohol and the polluting emissions of CO, hydrocarbon, particulates are reduced largely.
- Use of ethyl alcohol in petrol reduces our dependence on foreign countries for petrol and saves foreign considerably.
- Power alcohol is cheaper than petrol.

Disadvantages of Power Alcohol:

- Ethyl alcohol has calorific value 7000cal/gm much lower than calorific value of petrol 11500cal/gm. Use of power alcohol reduces power output upto 35%.
- Ethyl alcohol has high surface tension and its atomisation, especially at lower temperature, is difficult causing starting trouble.
- Ethyl alcohol may undergo oxidation reaction to form acetic acid, which corrodes engine parts.
- As ethyl alcohol contains 'O' atoms, the amount of air required for complete combustion of power alcohol is lesser and therefore carburettor and engine need to be modified, when only ethyl alcohol is used as fuel.

Biodiesel

A fuel derived from organic oils, such as vegetable oil, rather than petroleum. Biodiesel's use and production are increasing. It's typically used for aircraft, vehicles and as heating oil.

Vegetable oils comprise of 90–95% triglycerides with small amount of diglycerides, free fatty acids, phospholipids, etc. The viscosity of vegetable oils are higher and their molecular weights are in the range of 600 to 900, which are about 3 times higher than those of the diesel fuels.

Problems in using Vegetable Oils directly

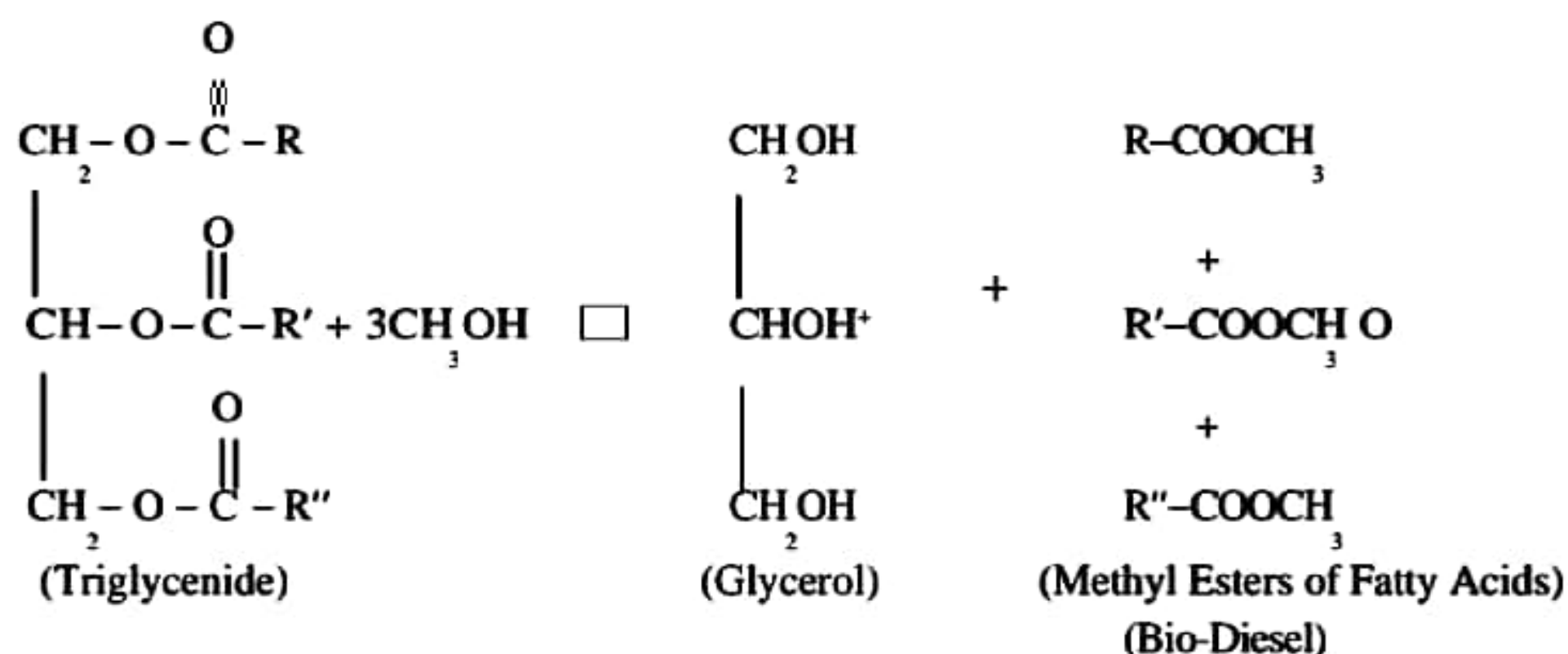
- (i) As the viscosity of vegetable oils are high, atomization is very poor and hence inefficient mixing of oil with air leads to incomplete combustion.
- (ii) Oxidation and Thermal polymerization of vegetable oils cause deposit formation.
- (iii) Their high viscosity and consequent high flash point lead to more deposit formation.

Manufacture: Trans-Esterification (or) Alcoholysis

The above problems are overcome by reducing the viscosity of the vegetable oils by the process known as **trans-esterification or alcoholysis**. Alcoholysis is nothing but displacement of alcohol from an ester by another alcohol.

It involves treatment of vegetable oil (sunflower oil, palm oil, soybean oil, mustard oil, etc.) with excess of methanol in the presence of catalyst to give mono ethyl esters of long chain fatty acid and glycerine. It is allowed to stand for some time and glycerine is separated.

Alcoholysis reaction is represented as $0.994 \times 587 \text{ kcal / kg}$



Methyl esters of fatty acids, thus formed, are called "Bio-diesel". **Bio diesel is defined as mono-alkyl esters of long chain fatty acids derived from vegetable oils or fats.**

Advantages

1. It can be produced from renewable, domestic resources.
2. Biodiesel is energy efficient (The total fossil fuel energy efficiency of biodiesel is 320% vs. 83% for petroleum diesel) (National Biodiesel Board, 1998)
3. It can be used directly in most diesel engine applications.
4. It can reduce global warming and tailpipe emissions (-41%)
5. It is nontoxic and biodegradable.
6. It is a good solvent and may clean out fuel line and tank sediments. (Note that this may result in fuel filter clogging during initial use)

Limitations

1. It contains approximately 8% less energy per gallon.
2. It generally has a higher cloud and pour point (will freeze at a higher temp) than conventional diesel.
3. It is not compatible with some hose and gasket materials, which may cause them to soften, degrade, and rupture.
4. It is not compatible with some metals and plastics.
5. It may increase nitrogen oxide emissions