

EXPERIMENT NO:

Alternative Fuels

Aim:-

To study different alternative fuels for I.C. engines.

Introduction:-

The development of alternative fuels was motivated by 'Twin Crises' i.e. increasing environmental pollution and reduction of fossil fuels. Hence, the alternative fuels have been developed for the auto industry, power industry and jet propulsion industry.

Benefits of alternative fuels:-

1. Reduce the dependence of fossil fuels
2. Reduce environmental pollution
3. Renewable in nature
4. Economically cheaper
5. Higher energy content on weight basis
6. Higher octane ratings
7. obtained from devised sources

Current alternative fuels:-

CNG, LPG, LNG, Bio diesel, alcohols (ethanol & methanol), Gasohol (gasoline + alcohol), piped natural gas (PNG)

Future Alternative Fuels:-

Hydrogen, Hythane (hydrogen + CNG), Biogas, Dimethyl Ether etc.

Compress Natural Gas:-

This is an alternative fuel used now days.

Advantages:-

1. It is cleaner and ecofriendly.
2. Its octane number is greater than 120.
3. It has very good lean combustion characteristics.
4. It is safe to use.
5. It has a good calorific value.

Disadvantages:-

1. Less volumetric efficiency which leads to power loss.
2. Low energy density.
3. Fast filling of the fuel heats the cylinders.
4. There is a great possibility of engine valve seat wear.

Liquid Nitrogen Gas:-

Advantages:-

1. Reduced leakage as storage pressure are low
2. LNG does not explode
3. Ease of transportation
4. It can be easily converted to CNG.

Disadvantages:-

1. Expensive infrastructure is required
2. It is costier as compared to CNG.

Liquid Petroleum Gas:-

Advantages:-

1. It is a cleaner burning fuel.
2. Its octane number is as high as 100.
3. Low storage capacity.

Disadvantages:-

1. Costier as compared to CNG.
2. Leakage of LPG can cause pools.
3. Lesser volumetric efficiency causes power loss.

Hydrogen:-

Hydrogen is a clean burning fuel used in IC engine and fuel cells. It is not an energy source but an energy carrier which has to be produced and this requires energy. But there are certain technical difficulties in its use as an automotive fuel.

Methods of production:-

1. Electrolysis of water
2. Thermal cracking of methane
3. Coal gasification
4. Ethanol reforming
5. Steam reforming
6. Decomposition of biomass

Technical issue:-

Hydrogen as a fuel has great flammability limits which ignites cylinder walls and causes metal embrittlement of iron and zinc.

Safety Issue:-

1. It has low density and viscosity, thus requires leak tight joints for storage.
2. Backfire may occur due to hot spots (like valve, spark plugs, etc.)
3. It has high flow rate ignition configuration.

Advantages:-

1. It is the cleanest burning fuel.
2. Renewable in nature.
3. It is non toxic.
4. High octane rating.

Disadvantages:-

1. High flammability.
2. Hydrogen is odorless, hence leak detection is difficult.
3. Burns with invisible flame.

Biodiesel:-

This is one of the alternative fuels used these days.

Advantages:-

1. It lowers toxic emissions and particulate matter drastically.
2. It is safe to store and has high flash period.
3. Grater octane number (50-56).
4. It has better lubricity (more than 30%) than diesel fuels.

Disadvantages:-

1. Higher viscosity than diesel.
2. Lower energy content than diesel fuels
3. Lower calorific value, cold filter plugging points which lead to starting problems.
4. It has higher foaming tendency.

Hythane:-

Hythane is a blend of 15% hydrogen in CNG by energy content on 5% blend by volume. Hythane gives more stable and faster combustion, thus gives higher combustion efficiency. When Hythane is used as a fuel, the fuel consumption as well as all emissions (hydrocarbons CO_x , CO_2 , NO_x) is reduced. The vehicle cost also reduces.

Biogas:-

Biogas is an organic matter produced by plants and animals. It is a product of fermentation of biomass. Biogas essentially contains methane along with CO_2 and traces of water vapor, Nitrogen and Hydrogen Sulphide. It can be used for cooking, heating or as an automotive fuel.

Advantages:-

1. Less polluting.
2. Leak detection is easy.
3. Renewable in nature.
4. Economically cheaper.
5. Higher energy content.
6. Higher octane rating.
7. Promotes rural economy.
8. Wide range of application.

Producer Gas:-

This is also known as wood gas and is considered as a future alternative fuel because of its low calorific value. Producer gas is a mixture of Carbon Monoxide, Hydrogen and Methane produced by blowing air over hot water.

Absorbed Natural Gas:-

It is Methane absorbed on activated carbon, heating the active carbon releases Methane for combustion. The advantage of absorbed natural gas is that it needs lower storage volume and storage pressure is low.

Dimethyl Ether (DME):-

It is a clean burning alternative fuel for transportation sector and its chemical formula is CH_3OCH_3 . Its octane number is more than 55.80. It is a suitable fuel for compression ignition engine.

Properties of DME:-

1. It is an inflammable liquid.
2. It is heavier than air.
3. It burns with a blue flame.
4. It is non toxic as well as non corrosive.
5. It has lower leakage tendency.

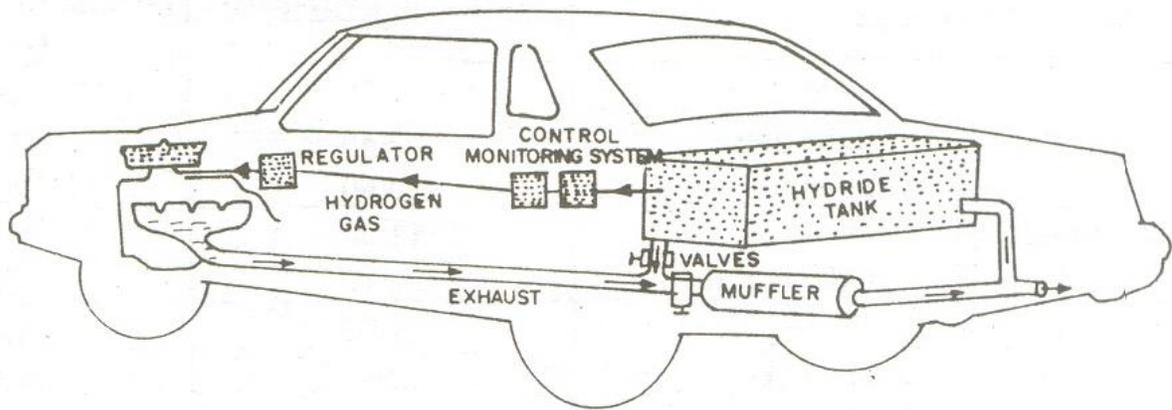


Fig. 22.23. Exhaust Hydride Storage System.

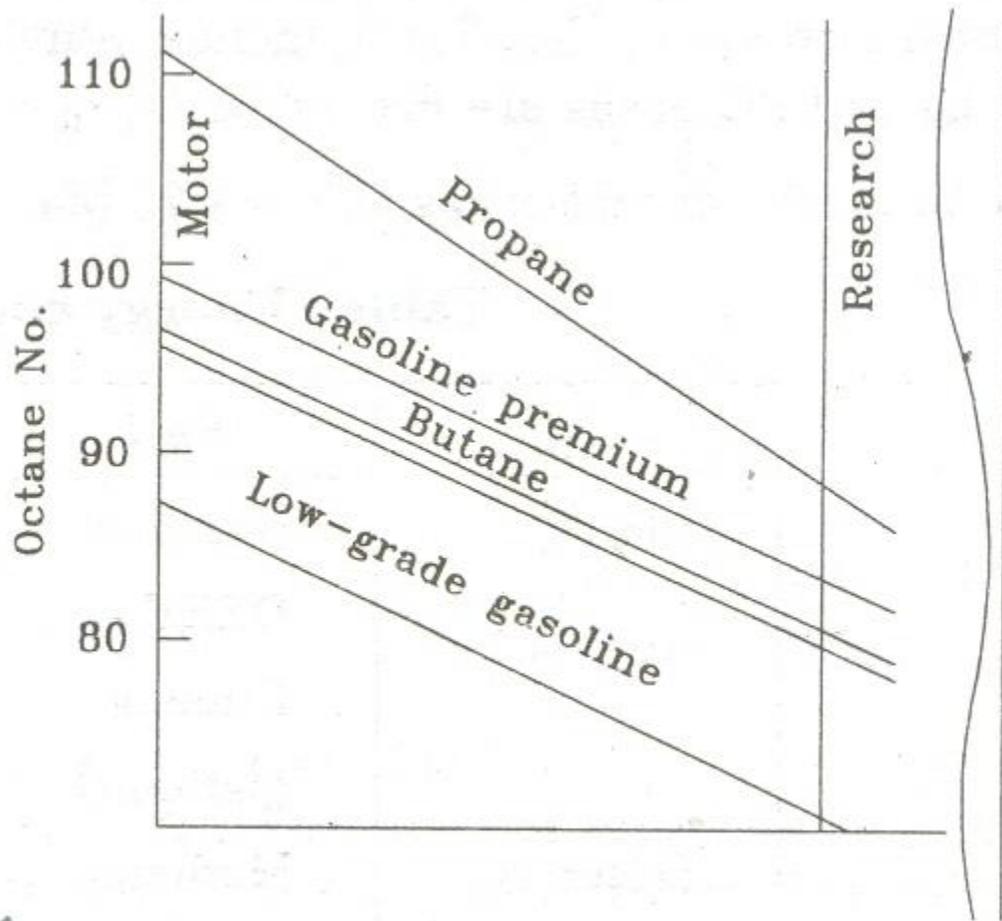
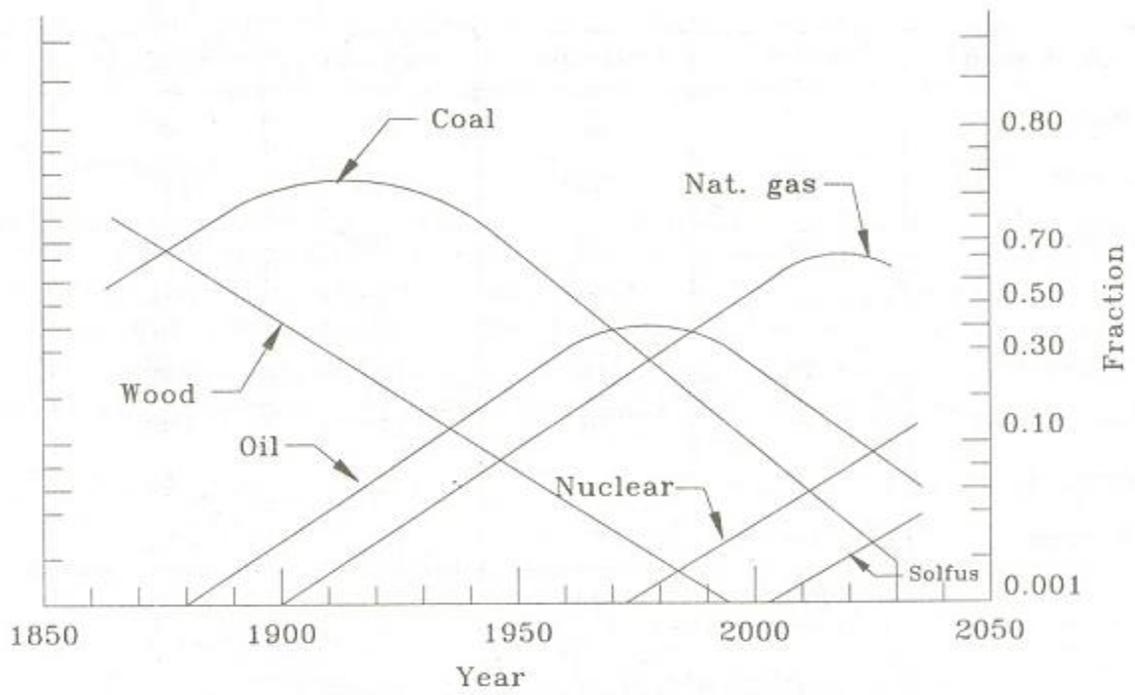
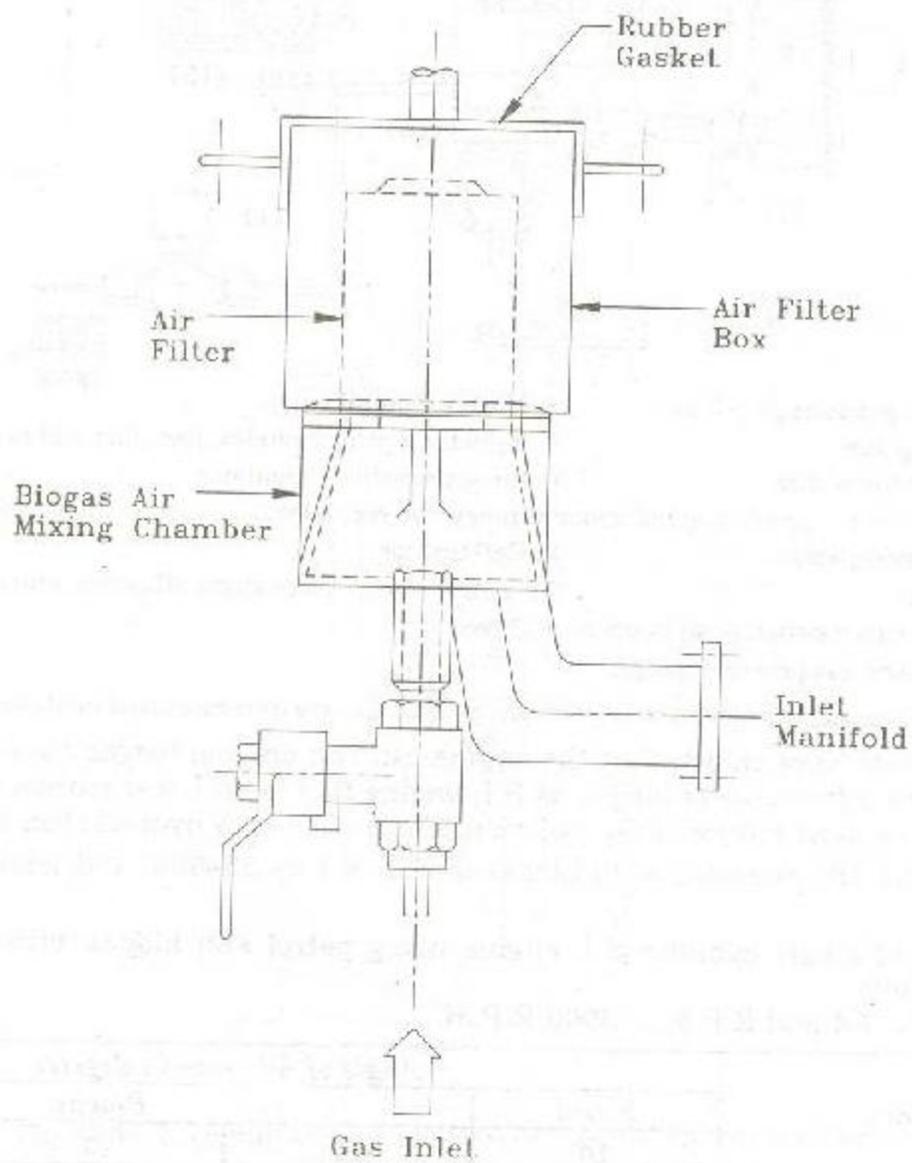


Fig. 22.42. Octane ratings for LPG and related fuels.



✓ Fig. 22.19. World primary energy substitution.



✓ Fig. 22.32. Details of Mixing Chamber.