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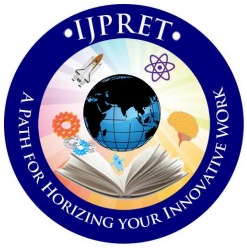

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A REVIEW: ETHANOL AS A POWER ALCOHOL

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Abstract

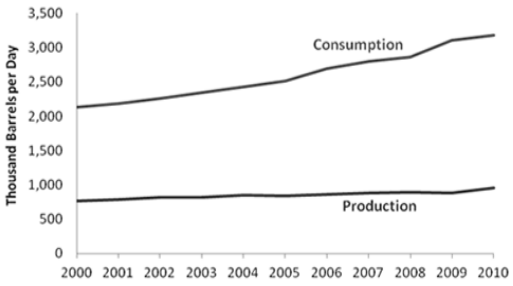
This paper reviews the use of alcohol as a power alcohol, its history, chemical composition and the benefits and drawbacks over the use of petrol. It also discusses the global and Indian scenario of the production and utilization of ethanol.

INTRODUCTION:

India is the fifth largest consumer of energy in the world, and is likely to surpass Japan and Russia to become the world's third biggest energy consumer by 2030.

India's average oil and liquids production for 2011 is estimated at 1.04 million barrels per day (B/D) which will touch the peak production at 1.06 million B/D in 2012. Further, giving its demand outlook, BMI projects consumption to rise sharply to 4.29 million B/D by 2016 from 3.44 million B/D in 2011(Business Monitor International (BMI)'s India Oil and Gas Report for first quarter of 2012).

India’s oil production and consumption (2000-2010)



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Courtesy: US Energy Information Administration, In Energy Statistics

Demand for petrol is expected to have expanded by 7.6 per cent (363,000 B/D) in 2011 and is projected to increase by another 6.7 per cent (388,000 B/D) in 2012. The Ministry of Petroleum anticipates a growth of 4.6 per cent in the sale of oil products in the FY12.

Petroleum is one of the most precious natural energy resources. With India growing at a fast pace, the demand for oil is set to rise. India and China will account for 45 per cent of the increase in global primary energy demand by 2030.

BASIC FUEL THEORY CHEMICAL COMPOSITION:

Alcohol and gasoline, despite the fact that they are from different chemical classes, are remarkably similar. Gasoline is mostly a mixture of hydrocarbons. Alcohols can be thought of as hydrocarbons in which one of the hydrogen atoms has been replaced by a hydroxyl group which consists of a hydrogen atom bonded to an oxygen atom. Thus methane becomes the simplest alcohol, methanol. Ethane becomes ethanol; propane becomes propane and so on. Like hydrocarbons, there are many alcohols of ever increasing complexity.

UTILIZATION OF ALCOHOL FUELS:

Alcohol fuels may be utilized in three basic ways: as a blend with gasoline; as a straight, unblended fuel; or as an alcohol/water mixture in an injection system. Each method has certain advantages and disadvantages.

Alcohol Blends:

Alcohol blends have the advantage that up to a 10, 20 or even 25% concentration of alcohol may be used without modification to the engine. The actual concentration that may be used varies with each engine type, but generally a four-cylinder engine will tolerate a stronger blend than a six or eight. Small single-cylinder engines, such as lawn mowers, can often be run on pure alcohol by merely adjusting the mixture control screw. Even with larger engines, slight modification such as adjusting the carburetor and, perhaps, advancing the timing a little may allow the use of blends in the 25-40% range. If you are producing your own blend, you have the advantage of being able to use the cheapest gasoline available and ending up with a good, high octane fuel.The disadvantage is that the alcohol you use must be perfectly dry. The highest concentration of alcohol that can be achieved by ordinary methods is 190 proof or 95%. In order to blend the alcohol with gasoline, the remaining 5% water must be removed.

Pure Alcohol:

The advantages of burning relatively pure 80-95% alcohol are several. First of all, because the drying step is unnecessary, you should be able to produce the fuel for less than the cost of gasoline. Secondly, there will be little, if any performance penalty, and by leaving 5-15% or more water in the alcohol you also gain the benefits of water injection. The only disadvantage is the trouble and expense of modifying your engine(s) to burn alcohol and the lack of dual-fuel capability.

ETHANOL PRODUCTION – GENERAL DISCUSSION:

Raw Materials:

Ethyl alcohol may be made by the fermentation process from three basic types of raw materials, called feedstock. The three basic types of feedstock are:

Saccharine:

Sugar containing materials in which the carbohydrate (the actual substance from which the alcohol is made) is present in the form of simple, directly fermentable six and twelve carbon sugar molecules such as glucose, fructose, and maltose. Such materials include sugar cane, sugar beets, fruit (fresh or dried), citrus molasses, cane sorghum, whey and skin milk.

Starchy Materials:

That contains more complex carbohydrates such as starch and insulin that can be broken down into the simpler six and twelve carbon sugars by hydrolysis with acid or by the action of enzymes in a process called malting. Such materials include corn, grain sorghum, barley, wheat, potatoes, sweet potatoes, Jerusalem artichokes, cacti, manioc, arrowroot, and so on.

Cellulose Materials:

Such as wood, wood waste, paper, straw, corn stalks, corn cobs, cotton, etc., which contain material that can be hydrolyzed with acid, enzymes or otherwise converted into fermentable sugars called glucose.

MANUFACTURING STEPS:

Certain materials require less processing than others. Generally, small scale production is easiest (and most economical in terms of labor and energy consumption) from the saccharine materials. However, starchy materials usually produce the most alcohol on a weight/weight basis, and cellulose materials are the cheapest. Manufacturing alcohol from saccharine feedstock generally requires: (1) extraction or crushing to make the sugars available to the yeast enzymes during fermentation: (2) dilution. Which is only required with certain materials; (3) fermentation; and (4) distillation. Starchy materials require the steps of: (1) milling to free the starchy material from, for example, grain kernels; (2) dilution; (3) cooking to dissolve and "gelatinize" the starch; and (4) conversion of the starch to fermentable sugars by malting, enzymes, or acid hydrolysis in addition to the steps of fermentation and distillation. Cellulose materials are similar to starchy materials in that they must be converted prior to fermentation.

CONCLUSION:

From the above studies the following concluding remarks appear to be justified that, as a motor fuel, the use of ethanol is not new to us. Moreover, at times it appears to be a better fuel than gasoline. Bearing in mind the shorter supply time period of petroleum products in near future, mankind has been constantly trying to find out an alternative as efficient as gasoline. In this quest, ethanol presents enormous opportunities as a fuel and the beauty is that it can be produced even from the most noxious of weeds. There is a large scope for research in the field of blending limits and blending combinations for alcohol generated from various sources.

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