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## Production of Alternative Fuels and its Properties

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**ABSTRACT:** Alternative fuel (alternate fuel), also known as non-conventional fuels, is any material or substance that can be used as a fuel, other than fossil fuels, or conventional fuels of petroleum (oil), coal, propane, hydrogen, and natural gas. The term "alternative fuels" usually refers to a source of which energy is renewable. Some well known alternative fuels include biodiesel, ethanol, butanol, chemically stored electricity (batteries and fuel cells), hydrogen, methane, natural gas, wood, vegetable oil, biomass, and peanut oil. Some of the alternative fuels' application, properties, production and availability are dealt in this paper

### I. INTRODUCTION

In the year 2000, there were about eight million vehicles around the world that ran on alternative fuels, indicating the increasing popularity of alternative fuels. There is growing social interest, and an economic and political need for the development of alternative fuel sources. This is due to general concerns of sustainability, both environmental, economic, and geopolitical. A primary concern is that the fact that the use of conventional fuels directly contributes to the global warming crisis. Another concern is the problem of peak oil, which predicts a rising cost of oil derived fuels caused by severe shortages of oil during an era of growing energy consumption. According to the 'peak oil' phenomenon, the demand for oil will exceed supply and this gap will continue to grow, which could cause a growing energy crisis by the year 2010 or 2020. Lastly, the majority of the known petroleum reserves are located in the middle east. There is general concern that worldwide fuel shortages could intensify the unrest that exists in the region, leading to further conflict and war

### II. PETROLEUM

Currently nearly 435 million gallons of gasoline is burned each day by Americans, remember, this is just in the United States. Gasoline for your car isn't the only thing that petroleum is used for, it can also be use for plastic creation and other medical uses. When petroleum is gone, a lot of the products that we have grown to rely on, will also be gone. The problem with using petroleum freely is that as we use the "easy petroleum" sources, we eat up the reserves and then we must turn to harder to extract sources, and that has environmental issues attached. One thing that a lot of people forget is that we have polluted the earth even before we place gasoline in out gas tank. This is because when you extract gasoline from petroleum, it takes energy, and that energy isn't exactly from the cleanest sources.

#### **Petroleum from Unconventional Sources:**

Some of the unconventional sources, such as tar sands. a mixture of sand, clay and bitumen. Unlike conventional crude that is pumped from the ground as a liquid as you would expect from an oil derrick, or from oil fields around the world, tar sands are solid and cannot be extracted through traditional oil drilling methods. Instead, tar sands are removed either through the environmentally un-friendly method of strip-mining or by a process that uses steam to heat the tar sands in the ground until the bitumen separates and rises to the surface. Both processes are energy-intensive and it wont be clean and it will harm the environment. UC Berkeley researchers recently estimated that tar sands and extra-heavy oil were estimated to have upstream greenhouse gas emissions that were between 1.7 and 2.9

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times higher than those of conventional crude oil. Producing oil from other non-traditional sources, such as coal or oil shale, leads to even greater increases in greenhouse gases emissions and its harmful effects.

### III. HYDROGEN FUEL SOURCES

Cars being powered by hydrogen have always been something that many presidents and environmentalists have discussed. Supporters have always said that one day we will need to free from our dependence on oil, and hydrogen is the way to do this. Production of hydrogen has huge advantages over other fuels due to the abundance of the fuel. Luckily, hydrogen is so abundant that it can be found in many fossil fuels, in alcohols and hydrogen can even be found in water. Today, common ways of producing hydrogen include reforming natural gas (in which four hydrogen atoms are separated from a carbon atom) and electrolyzing water (which decouples two hydrogen atoms from an oxygen atom). The fact that hydrogen can be produced in so many ways means that, unlike petroleum, supplies of hydrogen can't run out, nor will they be concentrated in one area of the world.

#### Hydrogen Capture:

Pure hydrogen is more difficult to find than impure hydrogen, making hydrogen capture a very difficult task. In order for hydrogen to be a useable source of fuel, it must be detached or removed from other elements, and that takes energy. Finding the balance between hydrogen separation and the energy that hydrogen produces will be the key in making hydrogen an effective fuel source.

The hydrogen capture or hydrogen separation situation can be explained by electrolysis, you can turn 1 kilogram of hydrogen by using water, this would require roughly 55 kWh of electricity from another source.

### IV. SOLAR ENERGY

The term solar panel is best applied to a flat solar thermal collector, such as a solar hot water or air panel used to heat water, air, or otherwise collect solar thermal energy. But 'solar panel' may also refer to a photovoltaic module which is an assembly of solar cells used to generate electricity. In all cases, the panels are typically flat, and are available in various heights and widths.



An array is an assembly of solar-thermal panels or photovoltaic (PV) modules; the panels can be connected either in parallel or series depending upon the design objective. Solar panels typically find use in residential, commercial, institutional, and light industrial applications.

Recently there has been a surge toward large scale production of PV modules. In parts of the world with significantly high insolation levels, PV output and their economics are enhanced. PV modules are the primary component of most small-scale solar-electric power generating facilities. Larger facilities, such as solar power plants typically contain an array of reflectors (concentrators), a receiver, and a thermodynamic power cycle, and thus use solar-thermal rather than PV.

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The largest solar panel in the world is under construction in the south of Portugal. A 52,000 photovoltaic module, 11-megawatt facility covering a 60-hectare south-facing hillside in the southern Alentejo region and it will produce electricity for 21,000 households.

### V. BIODIESEL

Biodiesel (methyl ester), a clean burning bio-fuel made purely from straight vegetable oil (SVO) or waste vegetable oil (WVO), is biodegradable, non-toxic and non-petro based. It can be used on compression-ignition engines (diesel engines) with no modification. Clean emission, non polluting and essentially free of sulphur and aromatics.



No equipment supplier can really guarantee the quality of biodiesel that meets the different standards unless the quality of feedstock and other raw materials are known and the process monitored carefully. There are different recipes as guidelines but making good biodiesel may take a little time and practice. Today blending B100 into petro diesel is common. B5 is 5% biodiesel to 95% petro-diesel and B20 is 20% biodiesel to 80% petro-diesel respectively

#### Properties:

The calorific value of biodiesel is about 33 MJ/L. This is 9% lower than regular Number 2 petrodiesel. Variations in biodiesel energy density is more dependent on the feedstock used than the production process. Still these variations are less than for petrodiesel. It has been claimed biodiesel gives better lubricity and more complete combustion thus increasing the engine energy output and partially compensating for the higher energy density of petrodiesel.

Biodiesel is a liquid which varies in color — between golden and dark brown — depending on the production feedstock. It is immiscible with water, has a high boiling point and low vapor pressure. \*The flash point of biodiesel (>130 °C, >266 °F) is significantly higher than that of petroleum diesel (64 °C, 147 °F) or gasoline (-45 °C, -52 °F). Biodiesel has a density of ~ 0.88 g/cm<sup>3</sup>, less than that of water

Biodiesel has a viscosity similar to petrodiesel. Biodiesel has high lubricity and virtually no sulfur content, and it is often used as an additive to Ultra-Low Sulfur Diesel (ULSD) fuel.

#### Distribution:

Biodiesel use and production are increasing rapidly. Fueling stations make biodiesel readily available to consumers across Europe, and increasingly in the USA and Canada. A growing number of transport fleets use it as an additive in their fuel.

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Biodiesel is often more expensive to purchase than petroleum diesel but this is expected to diminish due to economies of scale and agricultural subsidies versus the rising cost of petroleum as reserves are depleted.

### **Production:**

Biodiesel was produced using specialized equipments and plants. Some of the modern processes are shown below

### **Applications:**

Biodiesel can be used in pure form (B100) or may be blended with petroleum diesel at any concentration in most modern diesel engines. Biodiesel has different solvent properties than petrodiesel, and will degrade natural rubber gaskets and hoses in vehicles, although these tend to wear out naturally and most likely will have already been replaced with FKM, which is nonreactive to biodiesel. Biodiesel has been known to break down deposits of residue in the fuel lines where petrodiesel has been used. As a result, fuel filters may become clogged with particulates if a quick transition to pure biodiesel is made. Therefore, it is recommended to change the fuel filters on engines and heaters shortly after first switching to a biodiesel blend. Biodiesel can also be used as a heating fuel in domestic and commercial boilers, sometimes known as bioheat.

### **Environmental effects:**

The surge of interest in biodiesels has highlighted a number of environmental benefits associated with its use. These include reductions in greenhouse gas emissions, deforestation, pollution and the rate of biodegradation.

## VI. ETHANOL

Ethanol, also called ethyl alcohol, grain alcohol, or drinking alcohol, is a volatile, flammable, colorless liquid. It is best known as the type of alcohol found in alcoholic beverages and in thermometers. In common usage, it is often referred to simply as alcohol. Ethanol is also known as EtOH, using the common organic chemistry notation of representing the ethyl group (C<sub>2</sub>H<sub>5</sub>) with Et. It has a long history as a fuel for heat and light and also as a fuel for internal combustion engines.

### **Physical properties:**

Ethanol is a volatile, flammable, colorless liquid that has a strong characteristic odor. It burns with a smokeless blue flame that is not always visible in normal light.

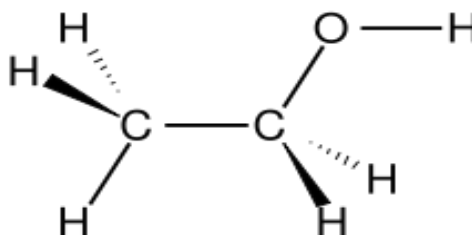
Ethanol is a versatile solvent, miscible with water and with many organic solvents, including acetic acid, acetone, benzene, carbon tetrachloride, chloroform, diethyl ether, ethylene glycol, glycerol, nitromethane, pyridine, and toluene. It is also miscible with light aliphatic hydrocarbons, such as pentane and hexane, and with aliphatic chlorides such as trichloroethane and tetrachloroethylene. Mixtures of ethanol and water that contain more than about 50% ethanol are flammable and easily ignited. Alcoholic proof is a widely used measure of how much ethanol such a mixture contains. In the 18th century, proof was determined by adding a liquor to gunpowder. If the gunpowder burned, that was considered to be "100% proof" that it was "good" liquor — hence it was called "100 proof." Ethanol is slightly more refractive than water, having a refractive index of 1.36242 (at  $\lambda=589.3$  nm and 18.35 °C).

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### Chemical properties:



Chemical structure of ethanol

Ethanol is classified as a primary alcohol, meaning that the carbon to which its hydroxyl group is attached has at least two hydrogen atoms attached to it as well. It is however, so very slightly basic it is almost neutral, like pure water. The pH of 100% ethanol is 7.33, compared to 7.00 for pure water. Combustion of ethanol in an internal combustion engine yields many of the products of incomplete combustion that are produced by gasoline and significantly larger amounts of formaldehyde and related species such as formalin, acetaldehyde, etc..<sup>[15]</sup> This leads to a significantly larger photochemical reactivity that generates much more ground level ozone.<sup>[16]</sup> This data has been assembled into The Clean Fuels Report comparison of fuel emissions<sup>[17]</sup> and shows that ethanol exhaust generates 2.14 times as much ozone as does gasoline exhaust.

### Production:

Ethanol is produced both as a petrochemical, through the hydration of ethylene, and biologically, by fermenting sugars with yeast. These processes are more economical and are dependent upon the prevailing prices of petroleum and of grain feed stocks.

### Applications:

The largest single use of ethanol is as a motor fuel and fuel additive. The largest national fuel ethanol industries exist in Brazil (gasoline sold in Brazil contains at least 25% ethanol and anhydrous ethanol is also used as fuel in more than 90% of new cars sold in the country). The Brazilian production of ethanol is praised for the high carbon sequestration capabilities of the sugar cane plantations, thus making it a real option to combat climate change. Henry Ford designed the first mass-produced automobile, the famed Model T Ford, to run on pure anhydrous (ethanol) alcohol—he said it was "the fuel of the future". Today, however, 100% pure ethanol is not approved as a motor vehicle fuel in the U.S.



Ethanol pump station in Sao Paulo, Brazil

World production of ethanol in 2006 was 51 gigalitres ( $1.3 \times 10^{10}$  US gal), with 69% of the world supply coming from Brazil and the United States. More than 20% of the Brazilian fleet of cars on the streets are able to use 100% ethanol as fuel, which includes ethanol-only engines and flex-fuel. Ethanol may be used as a fuel to power Direct-ethanol fuel cells (DEFC) in order to produce electricity and the by-products of water and carbon dioxide engines. Ethanol was commonly used as fuel in early bipropellant rocket vehicles, in conjunction with an oxidizer such as liquid oxygen.

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## **VII.CONCLUSION**

Thus the various alternative fuels' production, properties and applications are studied and their scope was analyzed.

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