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Butanol: The New Biofuel

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Butanol is a type of alcohol that has received renewed interest recently as a potential green alternative to petroleum fuels. This factsheet gives a basic history and description of butanol and its potential use as a biofuel in gasoline and diesel engines.

History

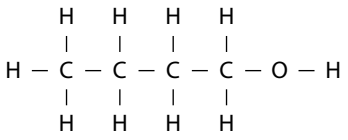
Butanol first gained widespread industrial use during the prohibition era in the 1920s. The booming automotive industry at that time was utilizing byproducts from the alcohol production industry as solvents for their lacquer paints. When the legal production of alcohol was halted and that stream of solvents dried up, the industry discovered that butanol could fulfill their needs. Since then, butanol has become an important industrial chemical. It is most commonly used as a precursor for the production of chemicals used to make products such as adhesives, detergents, dental products, makeup, personal hygiene products, hydraulic brake fluids, paint thinners, pesticides, plastics, synthetic fruit flavorings, and vitamins.

Though researchers looked at the possibility of using butanol as a fuel for internal combustion engines in the 1970s and 1980s, its use did not gain much visibility until 2005 when a man named David Ramey toured the United States in a butanol-powered car.

Butanol as a Fuel

Though 100 percent butanol could be used to power a spark ignition engine, it probably has a more realistic potential to be blended with other petroleum or bio-based fuels. Several research studies suggest that butanol can be blended into either gasoline or diesel to as much as 45 percent without engine modifications or severe performance degradation.

The Chemistry of Butanol, C_4H_9OH:



Butanol can be created in mass quantities using a process called acetone-butanol-ethanol (ABE) fermentation. Depending on the microorganism used, this process creates a mixture of approximately 70% butanol, 25% acetone, and 5% ethanol.

One of the advantages of butanol is that it can be synthesized from either petroleum or from biomass feedstocks. Butanol can be made from biomass through fermentation using organisms found in soil and ruminant animals. This bio-renewable version of butanol is sometimes called biobutanol. The first phases of biobutanol fermentation from biomass can be conducted on agricultural farms close to the point where much of the biomass is produced, which opens many opportunities for alternative agricultural enterprises.

Butanol Facts

When produced from biomass, butanol is a **biofuel** that will help reduce net production of greenhouse gasses and meet federal mandates for fuels produced from renewable resources.

While the **energy content** of butanol is not as great as gasoline, it is higher than ethanol. That means that engines burning blends of butanol with gasoline should exhibit more power and/or less fuel usage than blends with ethanol.

Butanol is a good **oxygenate,** which means that like ethanol it will help to reduce the amount of carbon monoxide in engine exhaust.

It is **not hygroscopic,** which means it does not attract and hold water like ethanol does. One result is that fuels with butanol should have a longer shelf life. They can be blended at the refinery instead of waiting until just before distribution to blend the fuel. Another result is that in the event of a spill, butanol will be easier to remediate than ethanol.

Butanol is **less corrosive** than ethanol, so there should be fewer problems using existing storage and handling infrastructure. It also means that there may be more potential for distributing butanol via pipeline instead of batch movement by truck or rail as is required for ethanol.

Butanol has a **lower vapor pressure** so it is not as volatile as other fuels. This means that it won't evaporate as quickly making storage easier and it will be less susceptible to vapor lock in engine fuel systems.

Butanol has a **lower surface tension** than diesel or biodiesel, which means that blending butanol with diesel will improve atomization of the fuel in the cylinder. Better atomization of the fuel will make it burn more completely in the engine thereby giving more power and cleaner exhaust gasses.

For more information about research involving butanol, contact the Biosystems and Agricultural Engineering Department at the University of Kentucky.

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