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## **Ethanol**

**By Harry Braun**

Ethyl Alcohol (Ethanol) is a clear, colorless toxic liquid that can be generated from renewable agricultural resources, such as corn or sugar cane. Ethanol can be blended with gasoline, and as such, minimal changes to the existing refueling infrastructure are needed. As such, federal subsidies for ethanol production are supported by both Republicans and Democrats, which primarily benefit large agribusiness corporations like Arthur Daniels Midland. There are, however, significant issues associated with using agricultural crops for fuel, and the resulting substantial increases in the requirements of water, fertilizers, pesticides, and land.

Indeed, according to Dr. Peter Glaser of Arthur D. Little, the low energy conversion efficiency of photosynthesis (i.e., 1%), means that if corn were to be converted to ethanol on a scale to displace gasoline and other petroleum-based fuels in the U.S., twice the total existing land area of the U.S. would be required for the transportation fuel needs alone. No land would be left available for food production, and given that transportation fuels only account for about 1/3 of the total U.S. energy requirements, agricultural-sourced ethanol could only have a marginal impact on oil imports -- much less accomplishing the critical task of making America fundamentally energy independent of oil, coal, natural gas and nuclear energy resources.

### **Environmental & Safety Considerations**

Although vehicles that use ethanol-blended gasoline reduce greenhouse gases by about 5%, this slight improvement is off-set by the fact that ethanol increases the vapor pressure and volatility of gasoline. This results in higher emissions of smog-forming Volatile Organic Compounds and aldehydes, the major constituent of which is formaldehyde. Although even short-term exposure to formaldehyde can be fatal, irritation of the eyes and mucous membranes typically occurs before fatal levels are achieved. However, long-term exposure to even low levels of formaldehyde may cause respiratory difficulty and eczema.

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Formaldehyde is classified as a human carcinogen by OSHA and has been linked to nasal and lung cancer, with possible links to brain cancer and leukemia. Because ethanol is a toxic and hazardous substance, its use is regulated by OSHA, DOT, NFPA and NIOSH. Ethanol must be handled with extreme caution because it can enter the blood stream from breathing the fumes, or by penetration through the skin or mouth. Exposure can irritate the eyes, nose, mouth, and throat. As such, protective clothing, including gloves and splash-proof chemical goggles and face shields should be worn by anyone coming in contact with ethanol.

Moreover, people should not eat, smoke or drink where ethanol is handled, processed, or stored since the chemical can easily be swallowed. Moderate exposure can cause headaches, eye and skin irritation, nausea, and drowsiness, whereas higher levels of exposure (over 1000 parts per million over an 8-hour period) can cause shortness of breath, genetic mutations, damage to the liver and central nervous system and unconsciousness. Exposure to ethanol levels of over 3300 ppm can result in death. Ethanol is also a hydrocarbon molecule whereby the hydrogen is chemically bonded to carbon, which makes it a significant fire hazard in the event of an accident.

### **Hydrogen Production**

Although ethanol can be used as a feedstock for hydrogen production, the reformers that separate the hydrogen from the carbon generate carbon dioxide emissions. The only pollution-free method that eliminates the need for fertilizers and pesticides is to simply extract hydrogen from water with wind or other non-polluting solar technologies. It is worth noting that farmers that earn \$100 per acre/year growing corn would make \$2,000 per acre/year in royalties from the wind-powered hydrogen production systems. Given these economic, safety and environmental realities, the focus needs to be on mass-producing wind and other solar powered hydrogen production systems.



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