

Brief Overview

A variety of fuels can be produced from biomass resources including liquid fuels, such as, ethanol, methanol, biodiesel, Fischer-Tropsch diesel and gasoline, and gaseous fuels, such as hydrogen and methane. Biofuels are primarily used to fuel vehicles, but can also fuel engines or fuel cells for electricity generation.

Fuels

Ethanol

Ethanol is most commonly made by converting the starch from corn into sugar, which is then converted into ethanol in a fermentation process similar to brewing beer. Ethanol is the most widely used biofuel today with 2010 production and consumption at over 13 billion gallons based primarily on corn. Ethanol produced from cellulosic biomass is currently the subject of extensive research, development and demonstration efforts.

Biodiesel

Biodiesel is produced through a process in which organically derived oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. The biomass-derived ethyl or methyl esters can be blended with conventional diesel fuel or used as a neat fuel (100% biodiesel). Biodiesel can be made from any vegetable oil, animal fats, waste vegetable oils, or microalgae oils. Soybeans and Canola (rapeseed) oils are the most common vegetable oils used today.

Bio-oil

A totally different process than that used for biodiesel production can be used to convert biomass into a type of fuel similar to diesel which is known as bio-oil. The process, called fast or flash pyrolysis, occurs when heating compact solid fuels at temperatures between 350 and 500 degrees Celsius for a very short period of time (less than 2 seconds). While there are several fast pyrolysis technologies under development, there are only two commercial fast pyrolysis technologies as of 2009. The bio-oils currently produced are suitable for use in boilers for electricity generation. There is currently ongoing research and development to produce bioOil of sufficient quality for transportation applications.

Other Hydrocarbon Biofuels

Biomass can be gasified to produce a synthesis gas composed primarily of hydrogen and carbon monoxide, also called syngas or biosyngas. Syngas produced today is used directly to generate heat and power but several types of biofuels may be derived from syngas. Hydrogen can be recovered from this syngas, or it can be catalytically converted to methanol or ethanol. The gas can also be run through a biological reactor to produce ethanol or can also be converted using Fischer-Tropsch catalyst into a liquid stream with properties similar to diesel fuel, called Fischer-Tropsch diesel. However, all of these fuels can also be produced from natural gas using a similar process.

A wide range of single molecule biofuels or fuel additives can be made from lignocellulosic biomass. Such production has the advantage of being chemically essentially the same as petroleum-based fuels. Thus modifications to existing engines and fuel distribution infrastructure are not required. Additional information on green hydrocarbon fuels can be found on the [Green Hydrocarbon Biofuels](#) page.

Sources: U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels & Advanced Vehicles Data Center

<http://www.afdc.energy.gov/afdc/fuels/>

<http://www1.eere.energy.gov/biomass/>