

# BIODIESEL

Biodiesel is a clean burning fuel  
used in diesel engines produced  
from renewable resources

## Quality is the Key

The biodiesel coming out of the reactor is not yet ready to fuel an engine. There are impurities in it, such as unreacted oil/fat, residual methanol and glycerol, mineral from catalysts, and other impurities. These impurities can be cleaned up by water washing or with a “dry wash”, using absorbents of some sort.

To make biodiesel a high quality, commercially marketable fuel, attention needs to be paid to more than just the items mentioned above. There are a full list of fuel properties and quality standards that biodiesel has to meet before it can be sold commercially. These standards or specifications are governed by ASTM Standard D6751.

For more technical information on biodiesel production please visit our website at [www.BiodieselEducation.org](http://www.BiodieselEducation.org).

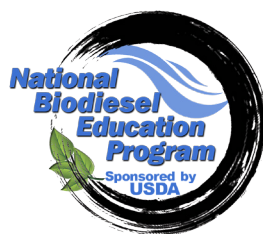
BIODIESEL IS SIMPLY  
A BETTER FUEL THAN DIESEL



## University of Idaho

A service of the  
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### DEPARTMENT OF BIOLOGICAL ENGINEERING

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For More Biodiesel Information:

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How Biodiesel  
is Prepared



# How Biodiesel is prepared

## What is Biodiesel?

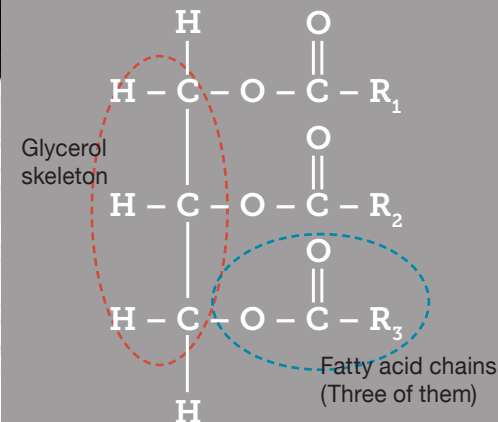
Biodiesel is a fuel that runs diesel engines. The American Society for Testing and Materials (ASTM) defines biodiesel as “a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100”. Biodiesel blended with petroleum diesel is designated as Bxx, where xx represents the volume percentage of biodiesel fuel in the blend. For example, if 20 gallons of biodiesel are blended with 80 gallons of petroleum diesel, it is called B20.

## Safety Precautions

Some chemicals, such as methanol, that are used to make biodiesel are flammable and toxic. Methanol enters the body through vapors, skin contact, or swallowing and is a cumulative poison. It is highly flammable and an extreme fire hazard. Biodiesel catalysts, such as potassium hydroxide or potassium methylate, are corrosive, fatal if swallowed, burn areas of contact, harmful if inhaled, and react with water, acid and others materials.



After reaction, biodiesel on top and glycerol at bottom.



Triglyceride, the oil molecule  
( $R_1$ ,  $R_2$ ,  $R_3$  represent the hydrocarbon)

## How is Biodiesel Made?

Biodiesel can be made from almost any vegetable oil or animal fat, including oils from mustard, canola, rapeseed, soybean, and fats or tallow, lard, and chicken. To make biodiesel from vegetable oils and/or animal fats an alcohol, either methanol or ethanol, and a catalyst, typically potassium hydroxide or methylate, are also needed.

It is not necessary to be a chemist to understand how it is made. However, it is useful to know some fundamental chemical principles. All vegetable oil and animal fats are similar in terms of their chemical composition. These consist primarily of a group of chemicals called triglycerides. They are big molecules, with three long chain fatty acids attaching to the skeleton of glycerol. These big molecules are more viscous than the chemical molecules in petroleum diesel. Therefore, vegetable oils should not be burned directly in diesel engines. To make the oils or fats similar to petroleum diesel fuel, the long chain fatty acids need to be “cut” from the glycerol skeleton and the glycerol needs to be removed from the fuel. This process is a chemical reaction called transesterification.

Simply put, the ingredients are mixed in a reactor and stirred for a period of time. After the reaction (transesterification) takes place, the heavier glycerol component (also called glycerin) settles to the bottom and the lighter biodiesel components (chemically called fatty acid esters) rise to the top.

If you start with 100 pounds of vegetable oil or animal fat, you will get roughly 100 pounds (or about 13.5 gallons) of biodiesel. To convert all of the oil or fat to biodiesel, more methanol is added than the reaction consumes - typically double the quantity or 100% in excess. This helps make the conversion of oil or fat into biodiesel complete. If so, the weight ratios in making biodiesel from oil or fat with 100% excess methanol will be:

**100 lb of oil + 23 lb of  $\text{CH}_3\text{OH}$  → 100 lb of biodiesel + 23 lb of glycerol/ $\text{CH}_3\text{OH}$**

Since 100% excess methanol is added into the reaction vessel, the unused methanol will be mixed with the reaction products, which requires another process to recover and reuse.