



## What is the Difference Between Biodiesel and Renewable Diesel? (2017)

There is a continuous search for renewable sources of fuels due to the rate of the depletion of fossil fuel. The term “biofuel” is used to define fuels that are obtainable from plants or animals. High-quality renewable diesel and traditional biodiesel are both considered biofuels but they are two different products.

Fossil fuel or petroleum diesel is a petroleum distillate rich in paraffinic hydrocarbons. Petroleum diesel is produced from fractional distillation of crude oil between 392 degrees F and 662 degrees F at atmospheric pressure. Petroleum diesel (or diesel) falls under the specifications outlined by ASTM D975. The fractional distillation process produces other petroleum products including gasoline, kerosene, fuel oil and asphalt. All of the products, including diesel fuel, may be further processed in other refining units before the final product is ready for consumption.

### Biodiesel

Biodiesel (or Fatty Acid Methyl Esters) is produced using a transesterification process. Transesterification is the reaction of vegetable oils or animal fats catalytically with a short-chained aliphatic alcohol (usually methanol or ethanol). Glycerol is a by-product of the transesterification process. Biodiesel is defined under the standard of ASTM D 6751 as a fuel containing mono-alkyl esters of long-chain fatty acids derived from vegetable oils or animal fats. Biodiesel is chemically different from petroleum diesel and renewable diesel because it contains oxygen atoms.

Biodiesel can be used in its pure form or blended with petro diesel as an additive. Biodiesel in its pure form is designated B100 where the 100 refers to 100% biodiesel. Biodiesels blended with petroleum diesel are designated by the percentage of biodiesel. For example, a blended fuel comprised of 20% biodiesel and 80% petroleum diesel is referred to as B20. Some of biodiesel’s properties present benefits over traditional petroleum diesel. Biodiesel has a higher cetane number, contains no aromatics, and is non-toxic and biodegradable. Biodiesel has low sulfur content and improves lubricity. Other biodiesel properties present concerns: it may not be compatible with zinc, copper-based alloys, tin and lead, leading to corrosion. Biodiesel can also cause certain elastomers and seals to swell and harden. Biodiesel also negatively impacts low-temperature operability and the energy content is lower than petroleum diesel. This lower value is not noticeable at blend levels around B5, however, there is a drop in power output and fuel efficiency at higher blend levels.

### Renewable Diesel

Renewable diesel, often called “green diesel” refers to petroleum diesel-like fuels derived from biological sources that are not esters. Renewable diesel is chemically the same as petroleum diesel but is made of recently living biomass. Renewable diesel can be further distinguished from biodiesel based upon the processing method to create the fuel resulting in petroleum diesel-like chemical composition. The three primary methods for creating renewable diesel are hydrotreating, thermal conversion, and Biomass-to-Liquids.

- Hydrotreating is a process where the feedstock is reacted with hydrogen under elevated temperature and pressure to change the chemical composition of the feedstock.
- The thermal conversion process is currently used to process slaughterhouse waste and other carbon-containing solid waste to create a fuel that meets the standards of ASTM D396 and ASTM D975.



- The Biomass-to-Liquid (BTL) is another process for making renewable diesel fuel by converting biomass (predominately cellulosic material) through high-temperature gasification into synthetic gas or “syngas”, a mixture rich in hydrogen and carbon monoxide. The syngas is then converted to liquid fuel by a set of chemical reactions. Renewable diesel produced using the BTL process can be created using any source of biomass while the other processes are limited to mainly lipids, oils obtained from recently living biomass.

Renewable diesel blends follow the same nomenclature as biodiesel. Renewable diesel in its pure form is R00. A blend consisting of 20% renewable diesel and 80% petroleum diesel would be R20. Renewable diesel is the same chemically as petroleum diesel (both are considered hydrocarbons) and it can be mixed in any proportion with diesel. Renewable diesel has a higher cetane rating than petroleum diesel which means the fuel burns cleanly and the engine gets more power. This also means the engine may start easier in cold temperatures.

The definition of renewable diesel is not as straight forward as that of biodiesel. Renewable diesel has been defined by the IRS as: fuel derived from biomass using a thermal depolymerization process which meets –

- (A) The registration requirements for fuels and fuel additives established by the Environmental Protection Agency (EPA) under section 211 of the Clear Air Act and
- (B) The requirements of the American Society of Testing and Materials D975 or D396.

The EPA defines the federal renewable fuel standards for biomass-based diesel to include:

- (A) mono-alkyl ester
- (B) Non-ester renewable diesel.

The EPA makes a distinction between biodiesel and renewable diesel using equivalence values. The equivalence values determine how to add volumes of different fuels together for the purpose of RFS (Renewable Fuel Standard) tracking. Biodiesel (mono-alkyl esters) has an equivalence of 1.5. Non-ester renewable diesel has an equivalence value of 1.7. The EPA further clarifies the definition of renewable diesel to state: Renewable diesel is derived from non-petroleum renewable resources that has been produced using a refinery hydro-treating process.

## Summary

Petroleum diesel fuel is a mixture of **hydrocarbons** obtained by distillation of crude oil. Petroleum diesel is classified as a fossil fuel, a non-renewable source of energy consisting of [hydrocarbon](#)-containing materials of biological origin occurring within Earth’s crust. Fossil fuels are the world’s dominant energy source, making up 82% of the global energy supply.

Biodiesel is the result of the chemical process (transesterification) of bio-mass. Biodiesel is the common name for **methyl ester**. Biodiesel can be used as a motor fuel but is chemically different from traditional petroleum based diesel (biodiesel is not a hydrocarbon).

Renewable diesel is a **hydrocarbon** fuel produced from non-petroleum renewable resources using one of the following processing methods: hydrotreating, thermal conversion, or Biomass to Liquid (BTL). The result is chemically identical to petroleum based diesel with significant environmental advantages.