

# Biodiesel Glossary

Aerosol- the dispersion of a solid or liquid in a gas.

Alcohol- a large classification of organic compounds that contains one or more hydroxyl groups attached to carbon atoms

Anhydrous- without water, the transesterification of biodiesel has to be an anhydrous process to be a success.

Aromatic- any organic compound that contains de-localised electrons in a ring structure. Such as benzoic acid or benzene.

ASTM- American society for testing and materials, an international standards organization that develops and produces technical standards for products, materials, systems, and services.

Biodiesel- a renewable alternative fuel made from fresh or waste vegetable oils. It is made commercially and privately in all parts of the world. It can be mixed with petroleum diesel. Biodiesel is environmentally safe, biodegradable, and can be used to fuel most diesel internal combustion and turbine engines.

Bubble Wash- a method of final washing the biodiesel by way of air agitation. Bubbles from an aquarium air pump

and air stone can be used to carry water up through the biodiesel by surface tension. Diffusion causes water soluble impurities to be extracted into the water. When the bubble reaches the surface and breaks, the water is freed and percolates back down through the biodiesel again.

Carboxyl- the uni-valent acid radical (COOH), present in most organic acids, which makes them bio-degradable.

Catalyst- a substance which without itself undergoing any permanent chemical change, enables or facilitates a reaction between other substances.

Cetane Number- a measure of fuel ignition characteristics. Similar to the octane number used for gasoline, the higher the value the better the performance. A higher number correlates with improved combustion, improved cold start, reduced engine noise, white smoke, HC, CO, and emissions during early warm-up phase.

Cloud Point- the temperature at which the first wax crystals appear. There is a standardized ASTM test protocol used to determine this temperature. Cloud point varies depending on what sort of climate use of biodiesel is practiced.

Colloid - A stable system of small particles dispersed in something else. A multi-phase system in which one dimension of a dispersed phase is of colloidal size. Colloids are the liquid and solid forms of aerosols, foams,

emulsions, and suspensions within the colloidal size class. Milk and smoke are both classified as colloids.

Colloidal size - .001 micron to 1 micron in any dimension. Dispersions where the particle size is in this range are referred to as colloidal aerosols, colloidal emulsions, colloidal foams, or colloidal suspensions.

Dispersion - A stable or unstable system of fine particles, larger than colloidal size, and evenly distributed in a medium.

Emulsion - A suspension of small drops of one liquid in a second with which the first will not mix. Emulsions can be formed either by mechanical agitation, or by chemical processes. Unstable emulsions will separate with time or temperature. Stable emulsions do not separate.

Esters - Any of a large group of organic compounds formed when an acid and an alcohol is mixed.  $\text{CH}_3\text{COOCH}_3$  (Methyl acetate) is the simplest ester. Biodiesel contains methyl stearate.

Ethanol - Ethyl alcohol -  $\text{C}_2\text{H}_5\text{OH}$  -  $\text{CH}_3\text{-CH}_2\text{-OH}$ . It is a good solvent. It can be used to manufacture biodiesel but is more expensive than methanol.

Flash Point- the lowest temperature at which it can form an ignitable mix with air.

Foam - A dispersion of a gas in a liquid or solid.

Glycerin – (CH<sub>2</sub>-OH--CH-OH--CH<sub>2</sub>-OH). The largest byproduct of biodiesel production. It can be used to manufacture candles.

Hydrocarbon- a compound of hydrogen and carbon, often occurring as long atomic chains in which each carbon atom is attached to two hydrogen atoms forming a long chain. They store a great deal of energy.

Hygroscopic- The tendency of something to absorb water (mostly from humidity in the air). Biodiesel absorbs water to about 1200 parts per million (PPM). Methanol and NaHO are also hygroscopic. Prevent this by keep containers closed.

Indicator- a substance which changes colour at a given stage in or as a result of a chemical reaction. Phenolphthalein is commonly used in titrations measuring the acidity of vegetable.

Kerosene- Dodecane (Kerosene) C<sub>12</sub>H<sub>26</sub> commonly used mineral fuel oil. It is used as aviation fuel and central heating consisting of many hydrocarbons containing molecules with about 10 to 16 carbon atoms. Some manufacturers mix kerosene with biodiesel.

KOH- Potassium Hydroxide, which is used to make Biodiesel from ethanol, a metallic base (acid)

Life-cycle analysis- a total valuation of a process, in which all the inputs and outcomes of the reaction are fully considered.

Lipid- a classification of organic compounds, including fatty acids, oils, waxes and steroids, that are insoluble in water but soluble in organic solvents.

Lye - See NaOH

Methanol - Methyl Alcohol -  $\text{CH}_3\text{OH}$  – a good solvent and a component of gasohol. Lethal if consumed. It is used to make methoxide in biodiesel production. Methanol absorbs water from the air, so it's important to keep the container closed tightly, and purchase methanol which is known to be dry (anhydrous) or is 99.9% pure.

Methoxide - Sodium Methoxide - Sodium Methylate - ( $\text{CH}_3\text{-O}^+ \text{Na}^-$ ). An organic salt, in pure form a white powder. In biodiesel production, "methoxide" is a product of mixing methanol and sodium hydroxide, producing a solution of sodium methoxide in methanol, and a significant amount of heat. Sodium Methoxide in methanol is a liquid that kills nerve cells before you can feel the pain. You should rinse with water and seek medical attention immediately. It is also highly explosive. Making sodium methoxide is the most dangerous step when making biodiesel. Use immediately as methoxide loses its potency over time.

NaOH - Sodium Hydroxide, lye, caustic soda (Red Devil Drain Cleaner). It has a metallic base, is strongly alkaline and extremely corrosive. Mixing with fluids usually causes heat, and can create enough heat to ignite flammables (such as methanol), so add slowly. For biodiesel, this is one of the main reactants. Make sure that you purchase "anhydrous sodium hydroxide" meaning it's dry (water turns biodiesel into soap). Store this product in an airtight container to prevent NaOH from absorbing water and CO<sub>2</sub> from the air. Store the NaOH separately.

Organic- compounds that contain carbon, which are often created as a result of a life process.

Potassium Hydroxide (KOH) – It is a metallic alkaline salt that can be used rather than sodium hydroxide for methoxide production. When KOH is used in Biodiesel production the by-product can be used as a fertiliser.

Pour Point- the temperature at which the fuel is no longer pumpable.

pH - A measure of acidity and alkalinity of a solution on a scale where 7 represents neutrality. Lower numbers indicate increasing acidity, and higher numbers increasing alkalinity. Each unit of change represents a tenfold change in acidity or alkalinity. pH is mathematically found by taking the negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity. The units are gram equivalents per liter of the solution.

Rape Seed - Rape Seed Oil - Canola oil is the food grade oil produced from rape seed. Canola is a name taken from Another early term for this oil is Colza. It makes great biodiesel.

Saponification - The reaction of an ester with a metallic base and water. Simply, the making of soap. This happens when one uses too much lye in a biodiesel reaction.

SVO - Straight Vegetable Oil. Burns well in many diesels, but should not be used to start the engine, and it can gel in the injectors as a hot engine cools. A separate tank of petro diesel or biodiesel is often used for starting and stopping the engine, and an electric valve or switch allows transfer to the SVO tank. "Grease Car Kits" are available to use SVO to fuel your vehicle.

Titration - Applied to biodiesel manufacturing, titration is the act of determining the acidity of a sample of WVO by the dropwise addition of a known base to the sample while testing with pH paper for the desired neutral pH=7 reading. The amount of base needed to neutralize an amount of WVO determines how much base to add to your entire batch.

Transesterification - Process of creating esters from vegetable oil and sodium methoxide. Products are Glycerin, Methyl Stearate, Methyl Oleate, Methyl Linoleate .

Viscosity – this is how a liquid is resistant to flow; "thinness" or "thickness". Methanol has a low viscosity and vegetable oil has a high viscosity.

WVO - Waste Vegetable Oil. WVO is the most economical starting product for the making of biodiesel. Check with your local restaurants for a good steady supply. It can be hot-water-washed for use as SVO.