

Feedstock

The BioPro 190 will not process oil of mineral origin such as motor oil.

The BioPro 190 is designed to process oil of vegetable or animal origin. This would include crude de-gummed oil, vegetable oils, tallow, lard, yellow grease, or any mixture of the above. These are collectively known as “*feedstock*”. Often animal feedstock is found in solid form, even at room temperature (think of leftover bacon grease in your frying pan.) Since the BioPro 190 can only process liquid feedstock, any solid tallow must be melted prior to processing.

Of primary concern is that the feedstock be free of water. Of secondary concern is that the feedstock have a reasonably low free fatty acid content. The more water that is present in the oil, the fewer free fatty acids (FFA) can be present without hindering the reaction. (Refer to the chart below for water and FFA correlation.) Provided the oil is water-free, it is rare that typical waste vegetable oil (WVO) will exceed the maximum level of free fatty acids.

Excessive water in oil is the most common issue that users have with their feedstock. Too much water in the feedstock can result in a complete failure of the feedstock to react. A simple way to test for water in feedstock is as follows:

Carefully warm up a sample (8oz or so) of the feedstock in question to about 120 degrees F. This will melt any bits of tallow or lard in the sample. If the sample has good clarity – although it may vary in color, and one is able to see through it clearly, then there is probably less than .2% water present in the feedstock. (Water is soluble in oil up to about .15%). This is an acceptable level of water in the oil for making biodiesel. If the sample remains cloudy, it contains suspended water droplets indicating that more than the recommended levels of water are present.

In addition, a device for testing water content in feedstock is commercially available. It uses a cartridge that chemically reacts with the water present in feedstock to produce an accurate reading of water content for the user. These are sold at www.utahbiodieselsupply.com.

Restaurant WVO will typically contain water above the recommended amounts. If one is unsure of the quality of the WVO, taking the following precautionary steps to remove any excess water is recommended.

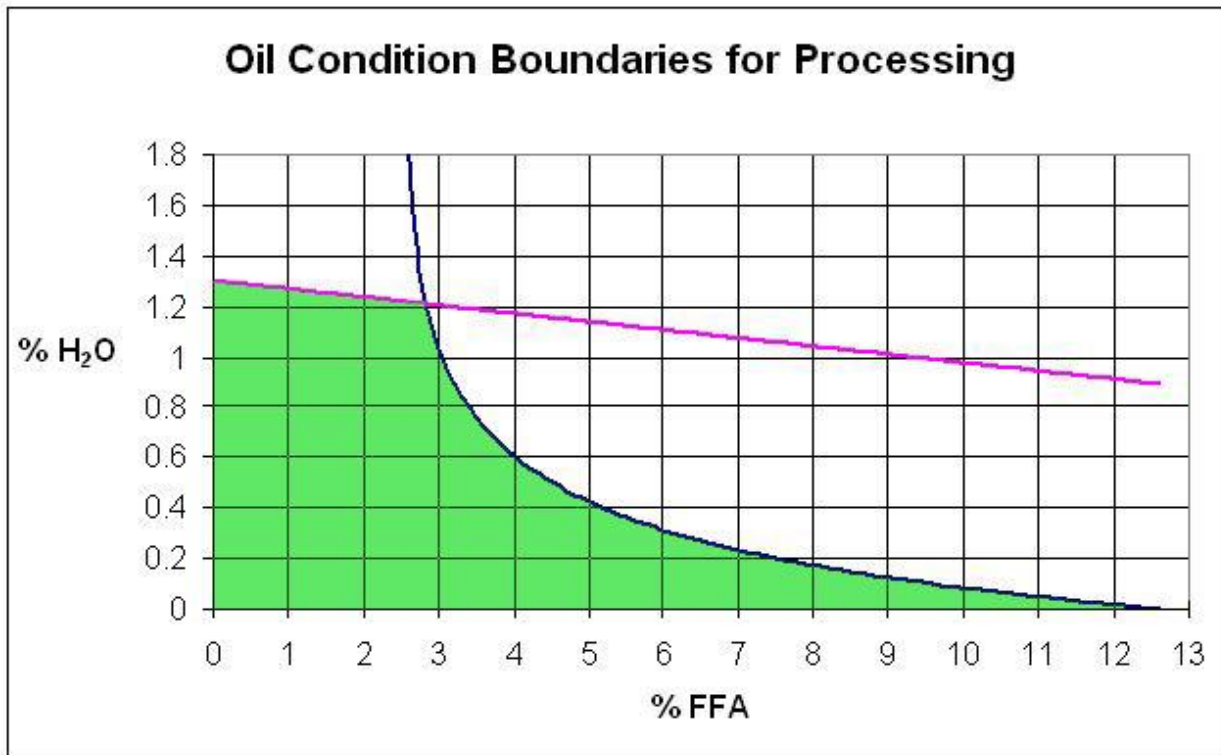
The bulk of the water may first be removed by settling. Because water is heavier than oil, most of the larger suspended droplets of water will sink to the bottom of a vessel of oil within a couple of days. Heating the oil in a separate vessel, which makes it thinner, can accelerate this settling.

This settling process can be performed in the BioPro 190. This is accomplished by filling the oil reservoir with about 60 gallons of feedstock and then turning on the manual heater. After a minimum of 24 hours, the bottom 10 gallons of wet oil are drained off using the ball valve on the bottom of the machine. ***Use caution, as the settled water/oil mixture will be very hot.***

This method is effective in reducing the water content of the oil down to the range of .3-.4%. After which, the oil will have a better appearance, but will still be cloudy due to tiny suspended water droplets that remain. For low FFA feedstock this settling technique is adequate. However, the remaining water will still be a hindrance to complete reactions over a wide range of FFA levels. When in doubt, implementation of the following fine drying process is highly recommended.

After removing the bulk of the water from the oil as described above, a user may fill the oil reservoir in the BioPro 190 to the fill line. Then, using the manual controls, the heater and stirrer should be turned on for at least six hours **with the lid removed**. This will evaporate the remaining amount of free-floating water bringing the total content to less than .15%.

Upon completing this step, the oil should have much more clarity. A sample drawn off of the top should have little or no cloudiness. Implementing this process will ensure that the BioPro 190 will be most effective in producing quality fuel from a wide range of feedstock.



On this graph the lines themselves merely mark the composite boundary of the region of FFA content versus water content that can be processed in the machine. All feedstock in the shaded area below and to the left of the lines can be processed, while a feedstock that falls outside of this shaded area cannot.

Percent FFA was used on this graph instead of titration number due to the fact that it is an unambiguous measurement. (Titration methods can vary.) If a user were to use the titration method described at utahbiodieselsupply.com, he or she could convert this to a percent FFA by first subtracting 7 from the KOH result or 5.5 from the NaOH result. Then, he or she would divide by 1.3 if using NaOH or 1.8 if using KOH. This will give the approximate percent FFA in the feedstock. For example, a KOH titration of 16 would equate to 5% FFA.

It is important to note that it is only on extremely rare occasions that a sample exceeds 5% FFA content. Therefore, if a sample falls outside of the region where it can be processed it is nearly always due to excessive water content. This problem can easily be rectified using the methods described above.

As particulate matter in the feedstock can interfere with the reactions as well as clog essential filters, we recommend that the feedstock should be filtered through at least a 50 mesh strainer before processing. Strainers may be purchased at www.utahbiodieselsupply.com.

Please note that other processors that require the user to perform a titration typically have a limit on the amount of FFA allowable in the oil. Beyond approximately 4-5 % FFA the quantity of soap formed from the excess sodium or potassium hydroxide turns the batch into an unusable coagulation.

If there are any questions please contact Springboards chemist (Daniel Bowen) at 530-894-1793.