

# HOW THE BIOPRO 190 AUTOMATED BIODIESEL PROCESSOR WORKS



The BioPro 190 and 190EX convert vegetable and animal oils into high quality (ASTM-grade) biodiesel. These oils are converted through heat, mixing and chemical processes called esterification and transesterification into biodiesel fuel which will run in any diesel engine without the need to modify that engine.

What's unique about the BioPro 190 is that the majority of this process is done by the machine with very little user interaction. Instead of having to turn valves, meter in chemicals, and carefully monitor the machine, you simply pour in your ingredients, press a button and walk away.

Before starting the process, the user fills the machine with 50 gallons of filtered, dewatered oil. The oil can be any organic oil (tallow, fats, waste vegetable oil from restaurants or virgin oil pressed from crops).

In most cases, waste vegetable oil is used due to it's wide availability.

After filling the machine with oil, the user fills the machine with a predetermined amount of catalyst and methanol. The catalyst is easily weighed and placed in the machine. The methanol is then added to the machine. The final step is to measure out the proper amount of sulfuric acid. The user then presses "**The Big Green Button**", waits for the mixing to start and then pours the sulfuric acid into the machine. Then THE USER WALKS AWAY allowing the machine to do its work. There is absolutely no need to monitor the machine at all. It does the majority of its work all by itself!



How does the machine convert the feedstock oil into clean, crystal clear, ready to use Biodiesel?

## REACTION 1 - ESTERIFICATION

a.k.a. the "Acid" stage

During this stage, the machine mixes sulfuric acid and a portion of the methanol into the oil. The sulfuric acid goes on the hunt for free fatty acids and modifies them so that the methanol can attach to them and create biodiesel.

Over the course of a few hours, a lot of heating and mixing will occur to make sure that the acid and the methanol have had a chance to do their job. A thorough Acid (esterification) stage helps to make the Base stage successful.

## REACTION 2 - TRANSESTERIFICATION

a.k.a. the "Base" stage

After the acid stage has occurred, it's time for the base reaction (transesterification). In this stage the machine mixes in the Base catalyst and the rest of the methanol into the main tank. During this stage, the catalyst, which is usually Lye (Sodium Hydroxide - NaOH) or Caustic Potash (Potassium Hydroxide - KOH), attacks the oil and begins breaking the molecules apart into glycerol and fatty acid chains (the catalyst used is extremely powerful). Just after the molecules are broken apart, the methanol begins to attach to the fatty acid chains. This causes the glycerol molecules to begin to separate out of the substance into a mixture called "glycerol".

This stage takes several hours to occur. While this stage is happening the machine is mixing the oil, chemicals, and methanol together with an extremely powerful, tri-blade impeller. This helps to thoroughly mix things together and helps ensure that all of the oil has a chance to be chemically treated.

## **SETTLING PERIOD**

### **a.k.a. Glycerin Drop Out**

After both reactions have occurred, the oil is allowed to settle for a period of time. This allows the glycerin to fall to the bottom of the tank and separate away from the freshly made biodiesel. The settling can take several hours with a standard BioPro™ or it can take a matter of minutes with the BioPro™EX. At either speed, this settling helps to ensure that the raw biodiesel is glycerin free.

## **MID POINT - DRAIN GLYCERIN**

At this point, after 24 hours (or 8 hours with an EX model), the user comes back to the machine and drains out the settled glycerin and begins the washing cycle. This is the only user interaction that is required during the entire processing cycle.

## **WASHING BEGINS**

The BioPro™ 190 now begins the washing cycle. During this process, the machine will turn on the heat and lightly spray a mist of clean, fresh water into the biodiesel to begin the process of cleaning the biodiesel. It may sound strange to add water to biodiesel, but it works. Because water is heavier than biodiesel, it quickly falls to the bottom.

As the water falls, excess methanol and soap molecules attach to the water and fall with it, thereby cleansing the biodiesel. After the first mist wash, the water is then pumped out and another mist wash is performed, only this time the big tri-blade mixing impeller comes on mixing the water and the biodiesel together to create a tremendously effective washing action. we call it an "agitated wash cycle". It mixes the water thoroughly with the biodiesel so that it maximizes separation of the impurities out of the biodiesel.

The machine then lets everything settle for a few hours, drains off the water and starts another agitated mist wash. In an effort to cleanse the biodiesel, the machine performs this last wash cycle with the massive tri-blade impeller going in full force. Once it's done, the water settles to the bottom and is once again automatically pumped out by the machine.

## **DRYING BEGINS**

Now the final settling stage begins. After the wash water has been drained off, the heat remains on and the tri-blade impeller kicks in again. The combination of the heat and the mixing help to evaporate any excess water from the freshly washed biodiesel. After the heat & mixing is done the BioPro allows the biodiesel to settle out one last time. During this time the now heated biodiesel evaporates off any excess water. When the process is complete, you're left with a clear, clean tank of biodiesel that is ready to use!

That's all there is to it. Instead of having to transfer everything around from container to container the machine does it all for you. When it's completed you can even hook up the hose to the fuel pump z(comes included) and pump the finished biodiesel straight from the machine into your vehicle. **How's that for automation!**

We hope this helps to explain the value and usefulness of this machine. We believe strongly in the quality of this product and currently have a large number of happy users. If you'd like to learn more or have a general question, please contact us at 802-846-7477