# Bio-Brew

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## The Design of an Automated Biodiesel Process

This poster presentation is to show and explain the process used for an automated biodiesel production from ordinary vegetable oil. The system is built to produce five gallon batches while using a programmable logic controller to actuate the various valves, pumps, heating elements, etc… This will make the process as hands-free as possible.

Various Chemicals and Components used in the process (clockwise from top left (Methanol, finished biodiesel, PLC Board, Actuator, Diesel Pump, Sprinkler Valve)

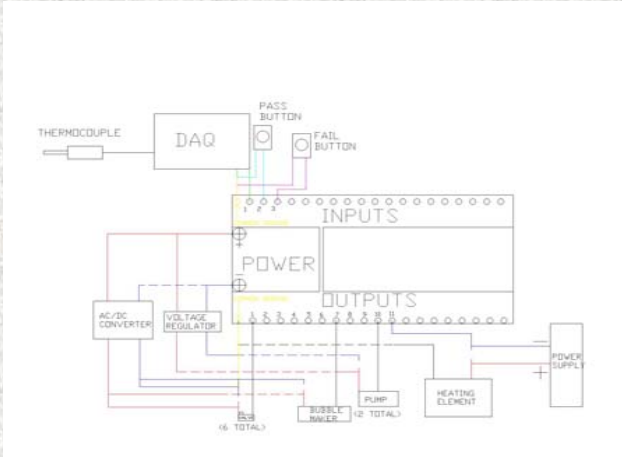
## How the Biodiesel is Made.

- Oil is poured into a colander and through a mesh filter, removing any debris from the oil.
- The oil falls into the mixing tank, where it is heated and a lye/methanol mixture is added.
- Batch continues to be mixed, and is then allowed to sit until a layer of glycerin separates out at the bottom of the tank. Glycerin is drained away and the oil is allowed to flow into the washing tank.
- Water is combined with the oil and used to “wash” the oil with the aid of a bubble maker. Mixture is allowed to sit until the water separates and is drained away.
- More water is added and the process is repeated until the pH is within an acceptable range.
- Cleaned oil is then pumped through a fine filter and into a clean tank where it is heated and allowed to sit until the solution is no longer cloudy.

## Wiring and Automation

Three inputs are used in the biodiesel process. A thermocouple is hooked to the DAQ board being used, which will interpret the signal and send it to the PLC. Two push buttons are also used for the user to actuate depending on the pH level after the wash cycle. These three inputs are hooked up to a separate input port and the common ground. A power outlet is needed to draw power to the DAQ, as well.

For the eleven outputs, a more complex solution is used for powering and controlling the various system components. The six valves and bubble maker will make use of the PLC’s 24 volt power supply. This power reaches the components through an AC/DC converter, turning the PLC’s DC output power into AC. For the two diesel fuel pumps being used, a voltage regulator is required to reduce the 24V voltage to 12V, preventing the pumps from burning out. The heating elements being used draw too much power to be hooked into the PLC’s power supply, so a separate power supply must be used. The power cable from the power supply will run into the component while the ground cable will run into the common ground. Another wire will connect the component to the specified output port on the PLC, completing the connection. This layout will allow the output ports to act as a switch, and turn the system elements on and off by opening and closing the circuit.



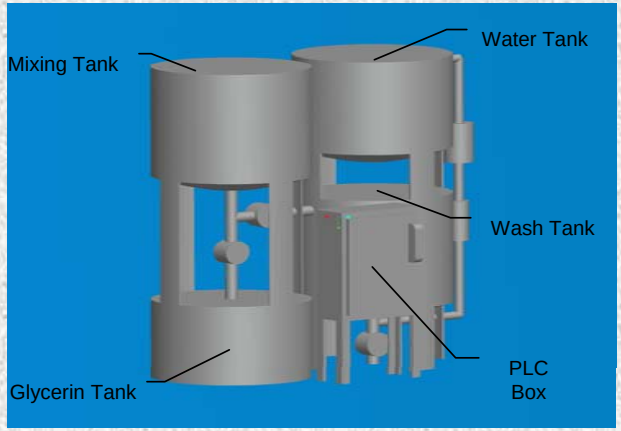

Schematic of PLC Board Wiring to Various Components

## Safety

Safety is of the utmost importance in any process or design. There are a few materials in a biodiesel system that could potentially be hazardous if handled in an unprofessional manner. The following items should be available before brewing biodiesel:

- Safety mask, glasses, and gloves
- Wash station or sink with soap
- Class B or D fire extinguisher

Methanol is a class III hazardous material, and irritation of the skin may occur after prolonged exposure. If this occurs, that area should be washed with soap and water. Lye, in dust form, could be inhaled through the nose or mouth, so a safety mask should be worn. Since biodiesel is a form of fuel, it is flammable. Although the possibility of a fire is extremely rare, a class B or D fire extinguisher should be available.




Generic Overview of Biodiesel System

## Why use Biodiesel?

- Reduces Emissions - It is the first alternative fuel to have fully completed the Health Effects testing requirements of the Clean Air Act
- Exhaust is less offensive to human senses
- Cheaper than diesel fuel (approximately **50 cents a gallon!**)
- Domestically produced, which reduces the nation’s dependence on foreign oils
- Does not require special storage
- Fun to make!

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