

# FuelPod1 With Water Wash Process Description

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## INTRODUCTION

The Green Fuels FuelPod1 is a complete system and corresponding methodology for making biodiesel.

This document is intended to be an overview of the processes and practices involved in producing biodiesel using a FuelPod1 system

## DEFINITIONS

<b>Biodiesel</b>	Biodiesel (Methyl Ester) is produced by the transesterification of vegetable oil – this is achieved by accurately mixing heated oil with carefully measured quantities of methanol and a catalyst. Methyl Ester and Glycerine are formed and because of the significant difference in densities and colour the glycerine is easily separated. This light oily fuel mimics all the fuel properties of petroleum diesel, but with much better lubricity at far lower emissions. It can be used in any diesel vehicle or diesel equipment without modifications. It can be mixed with petroleum diesel in any ratio. It cannot be used in devices made for kerosene or gasoline.
<b>Oil</b>	Refers to waste vegetable oil, but fresh vegetable oil can be used. Also known as your 'feedstock'.
<b>Titration</b>	A chemical test procedure to determine how much catalyst is required to exactly compensate for excess acidity in waste vegetable oil as a result of cooking.
<b>Catalyst</b>	The most common type used is sodium hydroxide (NaOH) which is more commonly known as caustic. This is a very pure form of this chemical required to cause the conversion of oil and methanol into biodiesel. Potassium hydroxide (KOH) can also be used but at a somewhat higher cost.
<b>Methanol</b>	Chemically known as methyl alcohol. Can be purchased from Green Fuels Ltd.
<b>Premix</b>	A solution of catalyst dissolved in alcohol. In the case of sodium hydroxide dissolved in methanol the pre-mix is referred to as "sodium methoxide". The smaller ("premix") tank makes and holds this solution.
<b>Mix</b>	Combination of oil and premix which is blended vigorously to form biodiesel with glycerine as a by-product.
<b>Process Tank</b>	This is the large tank system which mixes the oil with premix to create biodiesel plus glycerines.
<b>Glycerine</b>	A combination of "raw" glycerol, and virtually all the catalyst used in the reaction, small amounts of soap, plus a small amount of residual methanol.

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## THE PROCESS

The process as described as a series of steps:

1. Process Oil Heating
2. Oil transfer to Processor
3. Oil Recirculation
4. Methoxide Mixing
5. Reaction
6. Glycerine Separation
7. Water washing
8. Biodiesel Transfer to storage
9. General Good Practice
10. Maintenance

### 1 - Process Oil Storage

Generally recycled oil is collected or delivered on to the premises in a range of suitable sealed and approved containers.

The used oil is transferred by pump into a 205 litre drum – this drum is heated by means of a timer operated, thermostatically controlled heater band.

When the desired temperature (40 – 60 Deg C) is achieved, the heater switches off and the temperature is then maintained by intermittent switching of the heater.

### 2 - Oil Transfer to Processor

The heated oil is pumped into the process tank until the desired level is reached – the pump is then manually stopped.

All valves are then closed.

### 3 – Oil Recirculation

By operating the appropriate clearly labelled valves, oil is re-circulated around the process tank to homogenise the oil sample for approx 10 minutes.

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All valves are then closed.

A sample of the oil is then taken for a titration test in order to calculate the amount of catalyst and methanol to be added to achieve an accurate reaction.

### **4 – Methoxide Mixing**

Based on the results of the titration test from the sample of oil, the correct amount of catalyst is weighed out and placed in a hopper – a measured amount of methanol is then hand pumped from a sealed drum into a sealed methoxide mixing tank. The catalyst is dissolved completely by the methanol to form a liquid methoxide solution.

### **5 – Reaction**

The valves on the process tank are set to recirculate – by opening the valve on the base of the methoxide tank and adjusting the valve on the base of the process tank the methoxide will be drawn in at the appropriate rate. – This will take approximately 10 minutes. When the methoxide tank is empty the flow valve should be shut off.

A control timer is then used to run the pump to recirculate the oil for approx 1 hour to ensure a complete reaction. When the pump is stopped by the timer switch – all valves are then closed.

### **6 – Glycerine Separation**

After a period of time (between 3 – 5 hours) the glycerine will have settled out and will be seen as the distinctly darker phase at the bottom of the tank. The biodiesel will be seen as the clear (usually) yellow liquid at the top of the tank. The Glycerine can then be drawn off into appropriate containers (usually 2 No 20 litre drums) and then transferred into an IBC container for onward processing offsite.

### **7 – Water Washing**

Allow biodiesel to settle for approx. 1-2 hours – water is then mist sprayed onto the top of the biodiesel to kill the reaction and wash out any soaps which may have been formed and not separated out with the glycerine. The amount of water should be controlled by use of a flow meter with a shut off to ensure that that no more than 20 % of the volume of biodiesel to be washed is added. (20% of 150 litre batch = 30 litres per batch)

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After the full amount of water has been added the biodiesel should be to stand for approx 1 hour - after this time there will be a clear and distinctive transition between the biodiesel and the water. – Using the clear inspection tube at the base of the tank carefully drain off the water.

Consult your local water authority to establish an appropriate disposal route for this soapy water.

### **8 – Biodiesel Transfer to storage**

The fuel should be pumped through a 10 micron filter to final storage tank.

### **9 – General Good Practice**

1. Processor should not be left unattended during any period of oil / biodiesel transfer.
2. The oil storage area and production should be in a bunded area – all liquids outside the bunded area must be in a bunded container.
3. At the end of each stage of the process all valves should be closed – this should ensure against liquid flow being misdirected.
4. All valves are clearly labelled – if labels become damaged or illegible please replace immediately.
5. Level markings on tank are indicated by labels – if labels become damaged or illegible please replace immediately.
6. Caustic soda should always be kept in a dry sealed container.

### **10 – Maintenance**

1. On a regular basis all connections should be checked for leaks, splits etc. – we would recommend that a complete check around is carried out once each week
2. All leaks, however minor should be dealt with immediately
3. We would encourage all our operators to sign up to a service contract (approx £300 per year) to ensure that servicing and maintenance is properly dealt with. Updates and modifications to equipment can be installed during the annual service