

The Biodiesel Production Process

Types of Biodiesel Production

- **Batch Process**

- Most common small-scale and home-brewing process
- Slow reaction times 1-8 hrs.

- **In-line Shear Reactors**

- Large-scale
- Fast reaction times 1-2 hrs.

- **Ultrasonic Reactors**

- Not widely practiced in current production
- Potential to dramatically reduce amount of catalyst used and reaction time requirement 15 min.

The Raw Materials

- **Biodiesel Feedstock** – the oil starting material that will be chemically converted into alkyl esters (**biodiesel**)
- These can be oils from any biological source, botanical oils or animal fats.



Triglycerides

- Triglycerides are the most commonly converted oils.
- Phospholipids, waxes, and other polar lipids tend to emulsify and are removed via
- This is what a triglyceride molecule 'looks' like:
 - C-H₂OCOR'
 - C-H₂OCOR''
 - C-H₂OCOR'''
- The three carbons form the glycerol backbone
- The R groups represent fatty acid chains

The Reaction Tank



- Location of the transesterification
- The reaction tank is a closed vessel
- The tank must be made of solvent resistant materials: polyethylene or stainless steel

Heating the Oil

- Heat acts as a catalyst to drive the transesterification reaction
- The oil can either be heated in the reaction tank or heated prior to adding to the tank
- Oil in the reaction tank is at a temperature of 55°C
- Temperature is critical as methanol boils at 64.7°C

Transesterification of the Oil

- An **alcohol**, usually methanol, is combined with a strong **base**, potassium hydroxide (KOH) or sodium hydroxide (NaOH)
- This creates **methoxide**, which is then added to the reaction tank with the oil to initiate the transesterification reaction

Glycerol Settling

- During the transesterification reaction two products are created:
 - Alkyl esters and Glycerol
- Glycerol settles to the bottom of the reaction vessel and the Alkyl esters float on top
- The glycerol is drained from the bottom of the reaction vessel

Washing the Biodiesel

- The remaining alkyl esters contain small amounts of the **base catalyst**, free **glycerol**, and saponified **fatty acids**
- These are all **water soluble** and can be washed out of the biodiesel
- Wash water is drained off the bottom of a washing tank

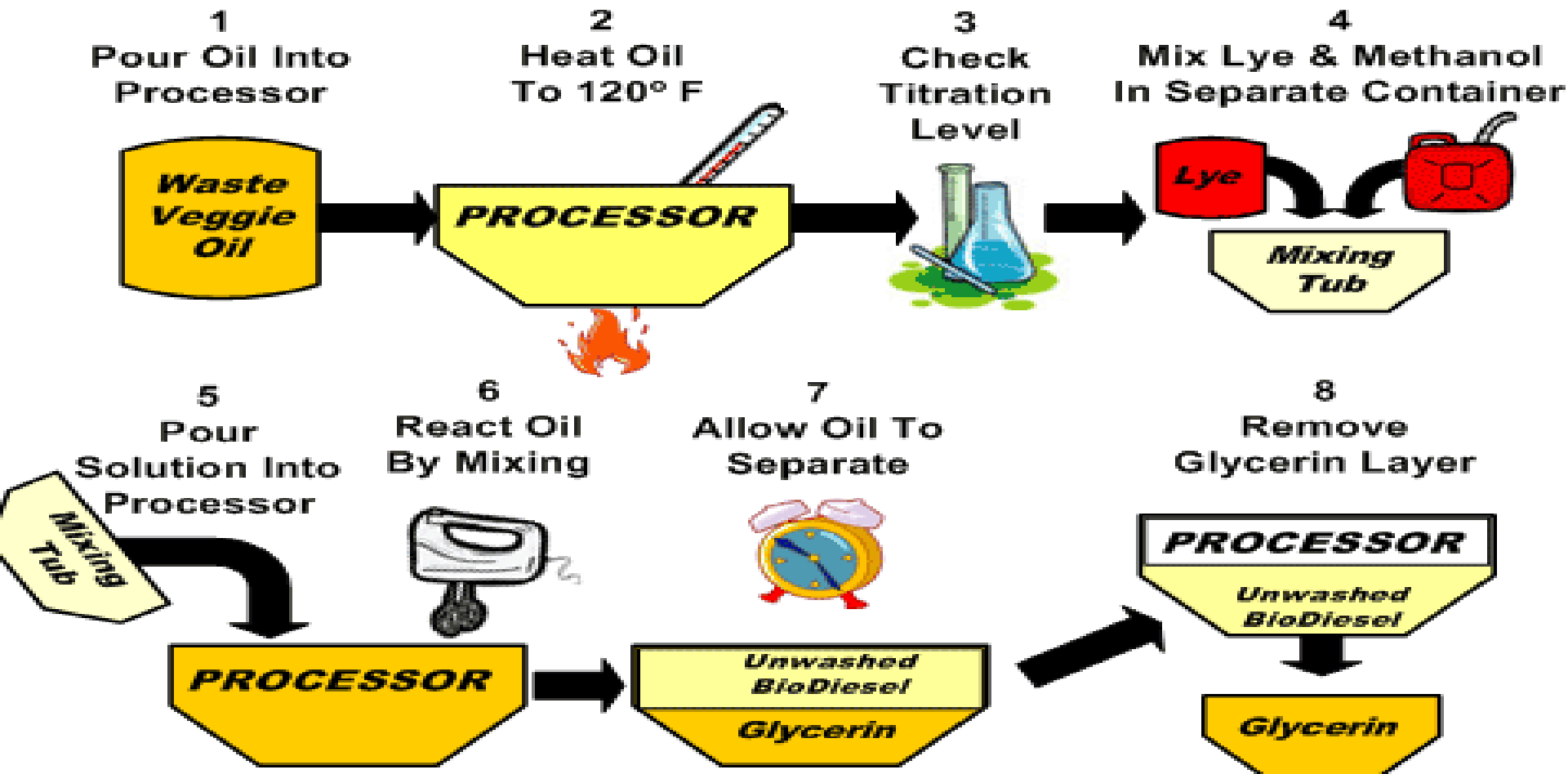
Drying Biodiesel

- Water, however, is undesirable within a diesel engine
- All residual wash water must be removed from the washed biodiesel
- Either through intensive heating (100°C), passive evaporation, or settling

Ready to use Fuel!

- Raw **vegetable** (or **animal**) **oil** has now been transesterified into **alkyl esters**
- These **alkyl esters** have been **washed** to increase the purity level
- And dried to remove all water
- The fuel is ready to run in any diesel engine

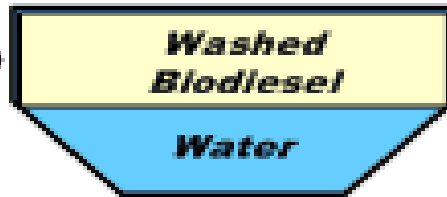
Quick Overview



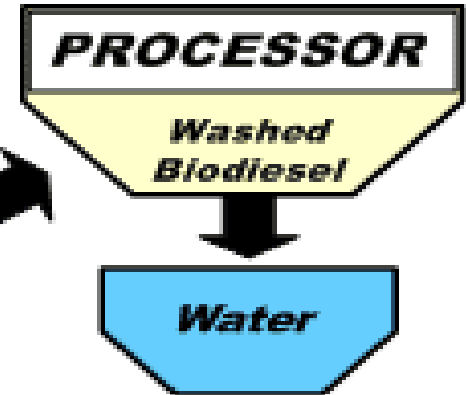
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Wash Biodiesel



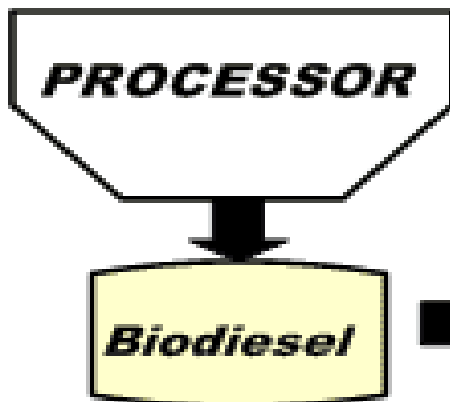
10
Allow Water &
Oil To Separate



11
Remove
Water Layer



12
Transfer To
Storage Container



13
Allow Biodiesel
To Dry



14
Fill Fuel Tank

