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

- **<u>Biodiesel Feedstock</u>** –

  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-H_2OCOR’
  - C-H_2OCOR”
  - C-H_2OCOR”’
- 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

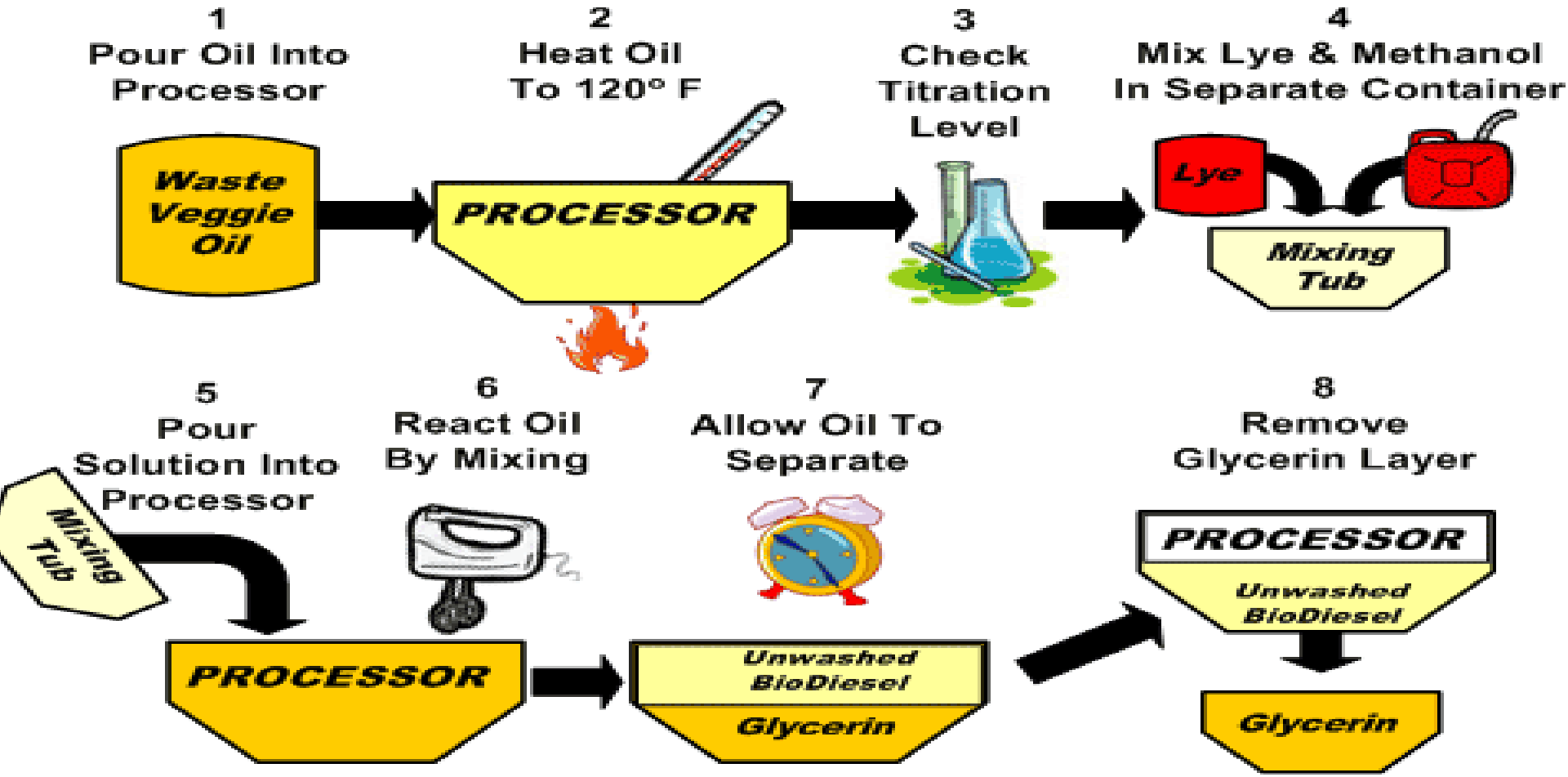
DRYING BIODIESEL

- 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!

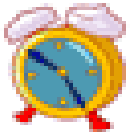
- Raw vegetable (or animal) oil has now been transesterified into alkyl esters
- These alkyl esters have been washed to increase the purity level
- And dried to remove all water
- The fuel is ready to run in any diesel engine

QUICK OVERVIEW



9
Wash Biodiesel

10
Allow Water & Oil To Separate

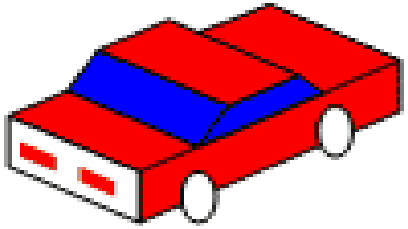


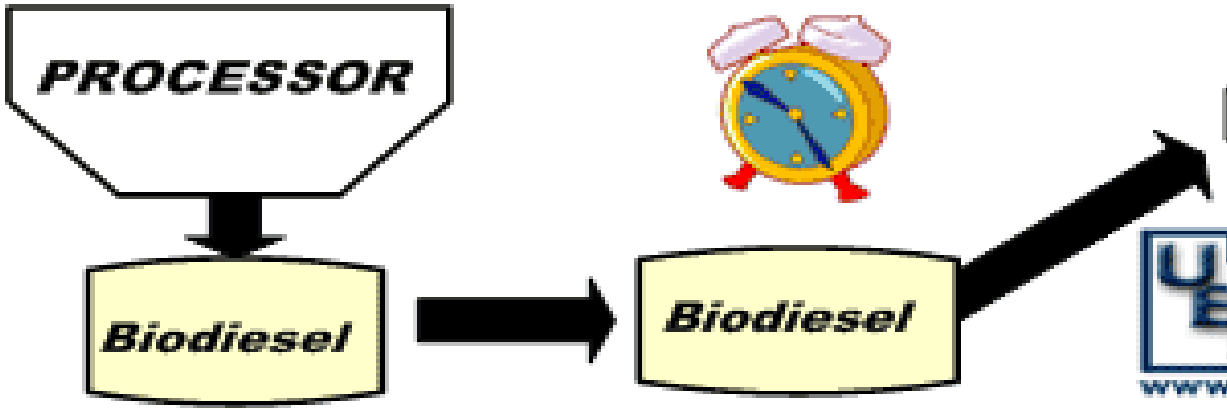
11
Remove Water Layer

12
Transfer To Storage Container

13
Allow Biodiesel To Dry

14
Fill Fuel Tank





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