

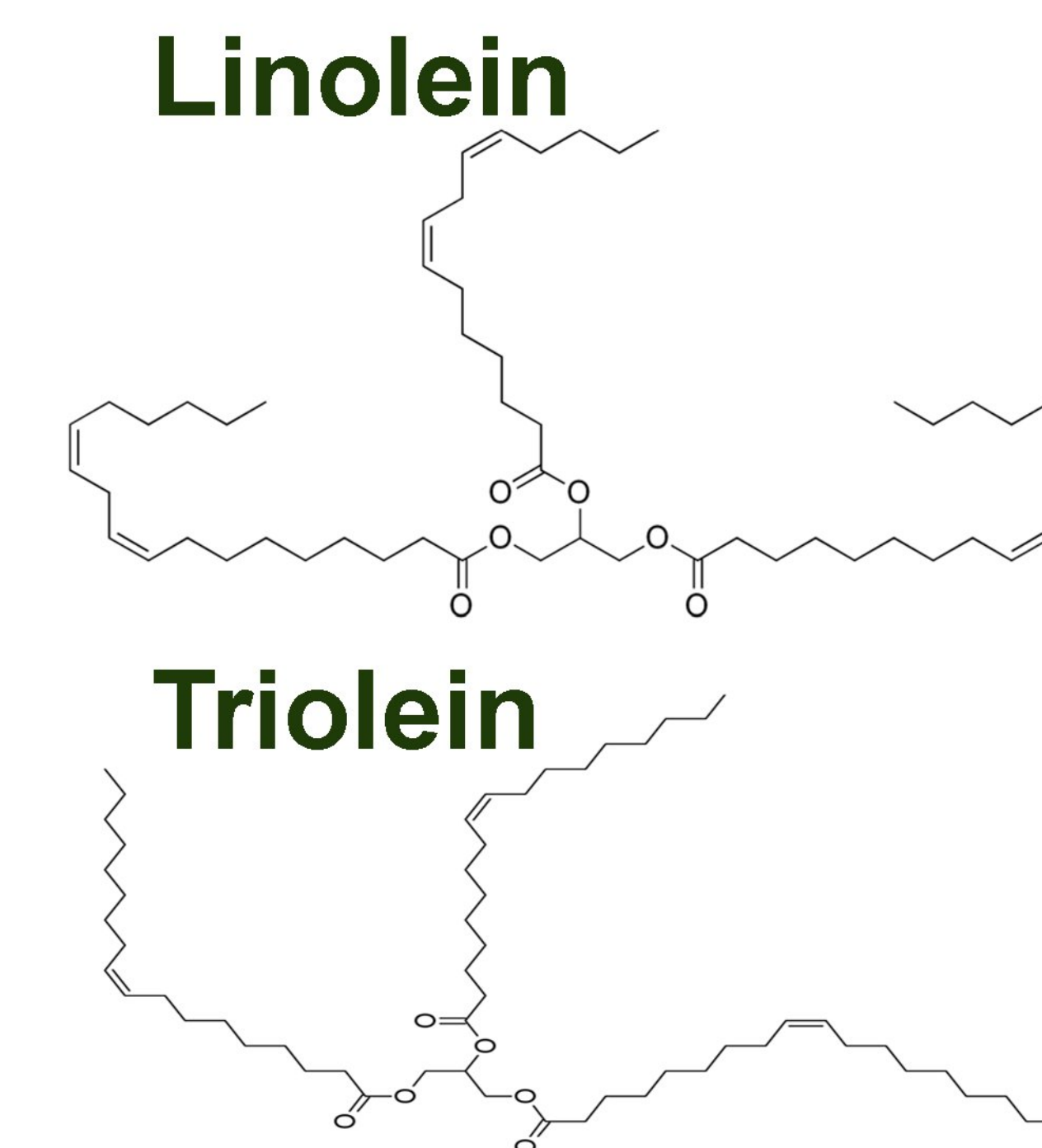


IPRO316:

Biofuels Production Facility for Renewable Energy Generation

What?

- Biodiesel is an automotive fuel alternative to fossil fuels.
- Produced by chemically altering an organic oil through the use of a catalyst and an alcohol.
- Produces methyl esters which can be burned in diesel engines.



Why?

- Renewable:**
 - Produced from vegetable oils
- Sponsor: Testa Produce**
 - Desire to be environmentally friendly
- Environment:**
 - Cleaner burning emissions
 - Recycles waste cooking oils

Biodiesel vs. Bioethanol

Bioethanol

- Produced by fermentation
- Mainly corn and sugarcane stock
- Requires flex fuel engines

Biodiesel

- Produced by transesterification
- Desired by sponsor
- Large range of feedstock oils.
- Few engine modifications required (diesel)

Group Breakdown:

Team Leader:

Kirsten Reimann

Transportation:

Kelsey Camp

Corey Hawker

Daniel Kim

Joel Meno

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Ryan Attard

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Omaditya Khanna

Mehul Patel

Nicole Reigle

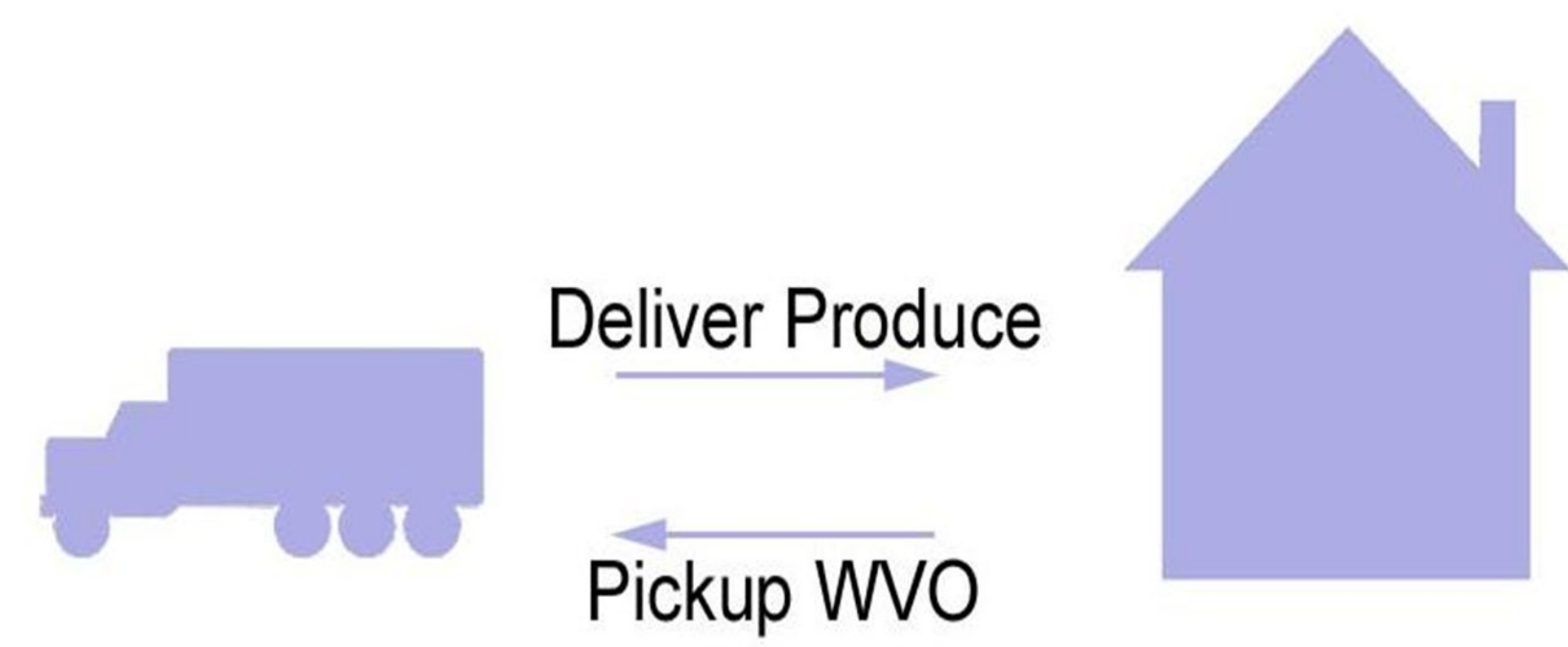
Kirsten Reimann

Hector Garza Rodriguez

Ricardo Rodriguez

Emmanuel Sakla

JongHwa Song



Transportation

While delivering produce, pick up WVO from hotels, restaurants, etc.

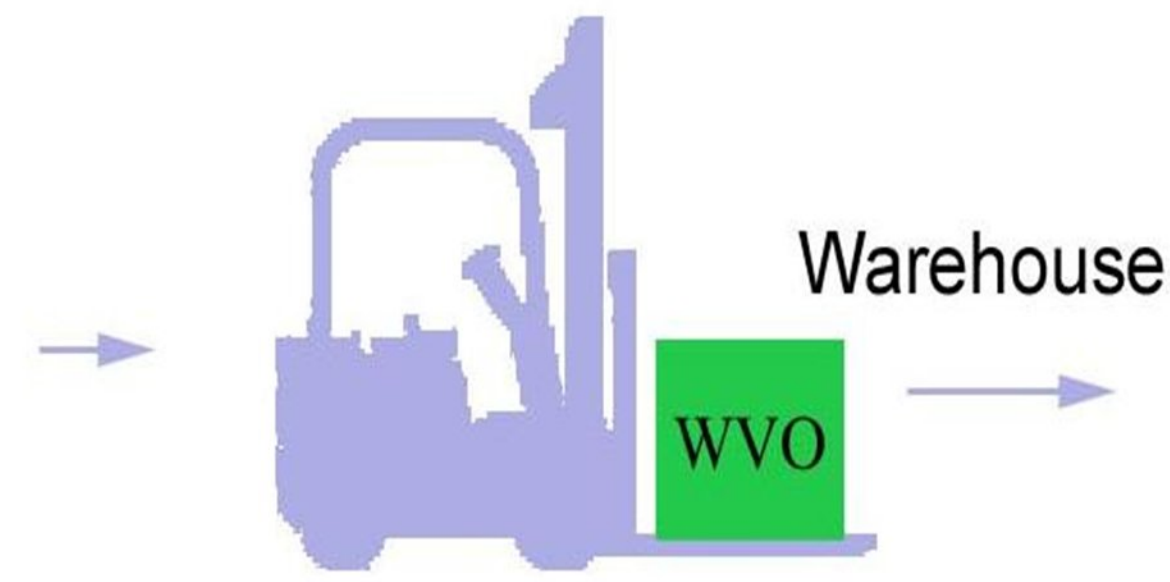
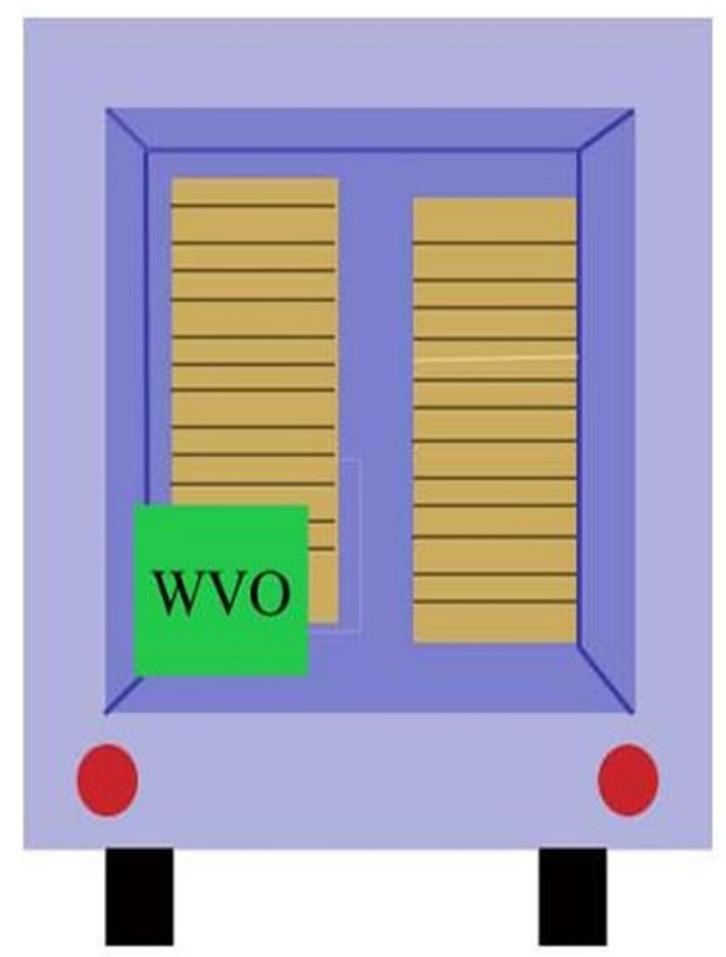
- Cooled oil return to original container (3-5 gal)
- Or pickup (1 - 3) 55gal drums
- Will only pick up "purest" WVO if necessary
- Keep WVO in separate area of truck to avoid any contamination of fresh produce, line area with plastic

Restaurants use different oils

(3 main: canola, sunflower, soybean)

Hard to keep separate, but can be processed together

May have effect on gel point



Oil Container

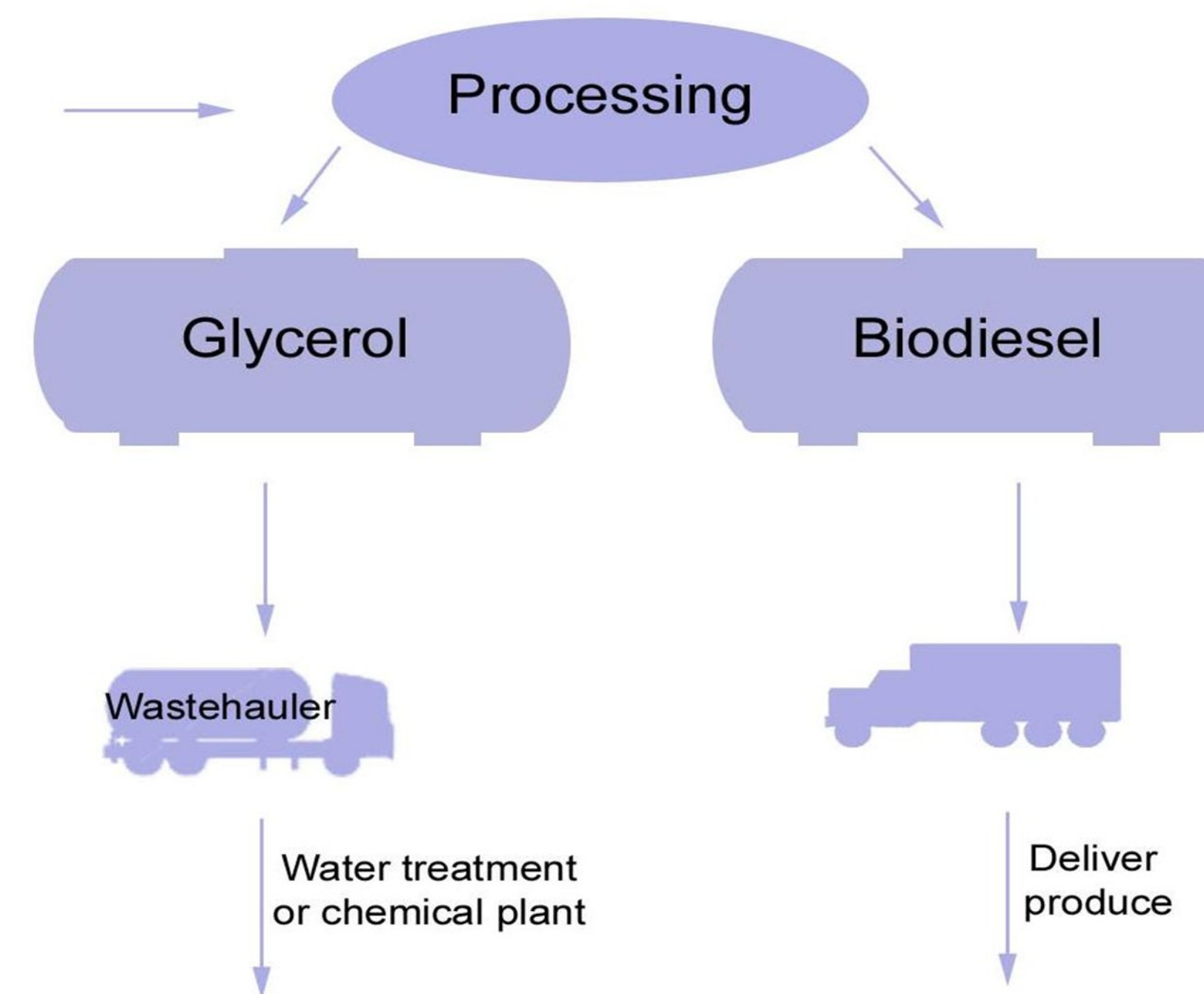
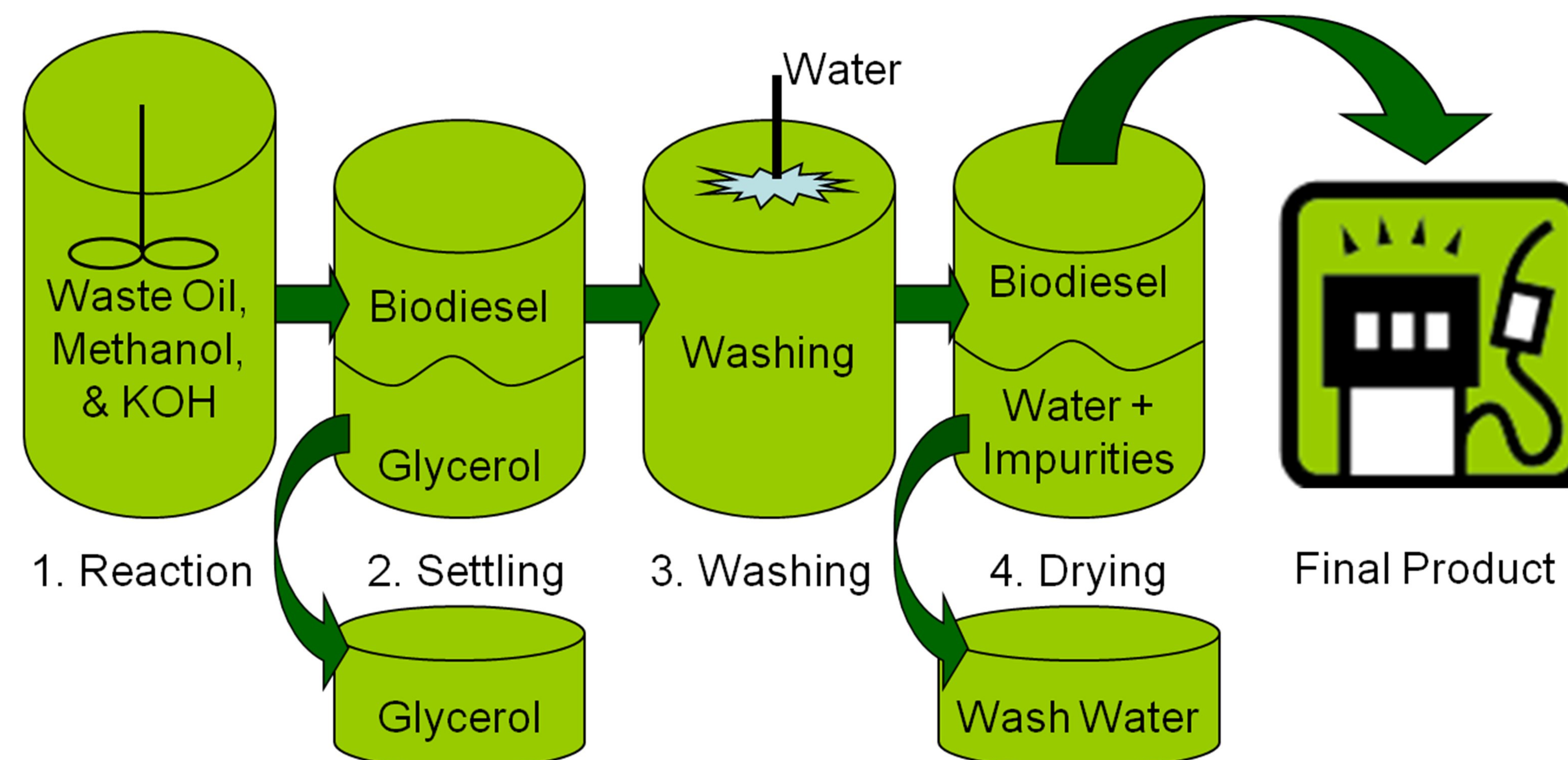
Inside Truck

Storage

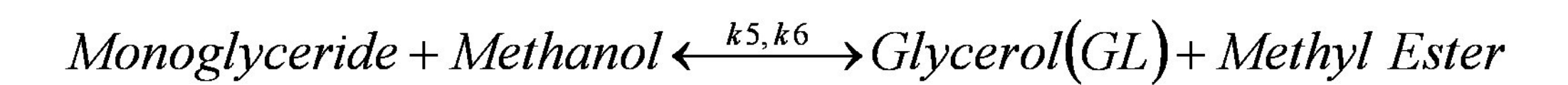
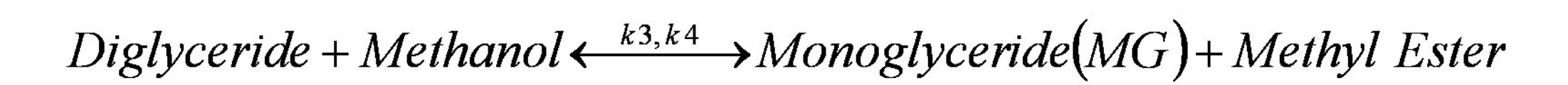
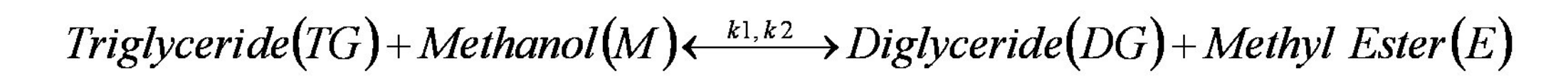
- Store WVO on site in 275 gal "Tote" or IBC (Intermediate Bulk Container)
- Store methanol on site in container (in accordance with OSHA)
- Waste glycerol can either be partially purified and sold or taken to a water treatment plant
- Waste water may have to be treated prior to disposal
- Make sure all state and federal permits are obtained for transport, storage and disposal

Production

- Break down oil molecules and replaces the glycerin portion with an alcohol molecule



Production Reactions:



$$\frac{d[TG]}{dt} = -k_1[TG][M] + k_2[DG][E]$$

$$\frac{d[DG]}{dt} = k_1[TG][M] - k_2[DG][E] - k_3[DG][M] + k_4[MG][E]$$

$$\frac{d[MG]}{dt} = k_3[DG][M] - k_4[MG][E] - k_5[MG][M] + k_6[GL][E]$$

$$\frac{d[GL]}{dt} = k_5[MG][M] - k_6[GL][E]$$

$$\frac{d[E]}{dt} = k_1[TG][M] - k_2[DG][E] + k_3[DG][M] - k_4[MG][E] + k_5[MG][M] - k_6[GL][E]$$

$$\frac{d[M]}{dt} = -\frac{d[E]}{dt}$$

*[] = molar concentration and Methyl Ester is the Biodiesel product

Required Biodiesel Reactants	1200 week	gal/
Oil	1470 week	gal/
Methanol	367.5 week	kg/
KOH (90% Pure)	52 week	kg/
Products		
Glycerol	184 week	gal/
Biodiesel	1654 week	gal/

*The biodiesel recipe must be fine-tuned based on available waste oil. For calculations a recipe of 22 vol% Methanol, 78 vol% Waste Oil, and 36grams KOH/gal Oil was used.



Murphy's Machines Design