IPRO 316

Design of Biofuels Production Facility for Renewable Energy Generation

…..lets not be cruel, use alternative fuel

Objective

- **To produce a feasible small-scale chemical reaction process for the production of environmentally-friendly biofuel that meets industrial standards**
  - Develop problem solving skills
  - Work as a team to achieve a sizable task
  - Become fluent in using programming software like Matlab and HySys

Problem Statement/ Goals

- Identified sponsor a couple of weeks into the semester: Testa Produce
- Who are they and what are they looking for?
- **Our goals for Testa Produce**
  - **Recommend feasible biodiesel production plant**
  - **Suggest options for transportation of oils and storage**

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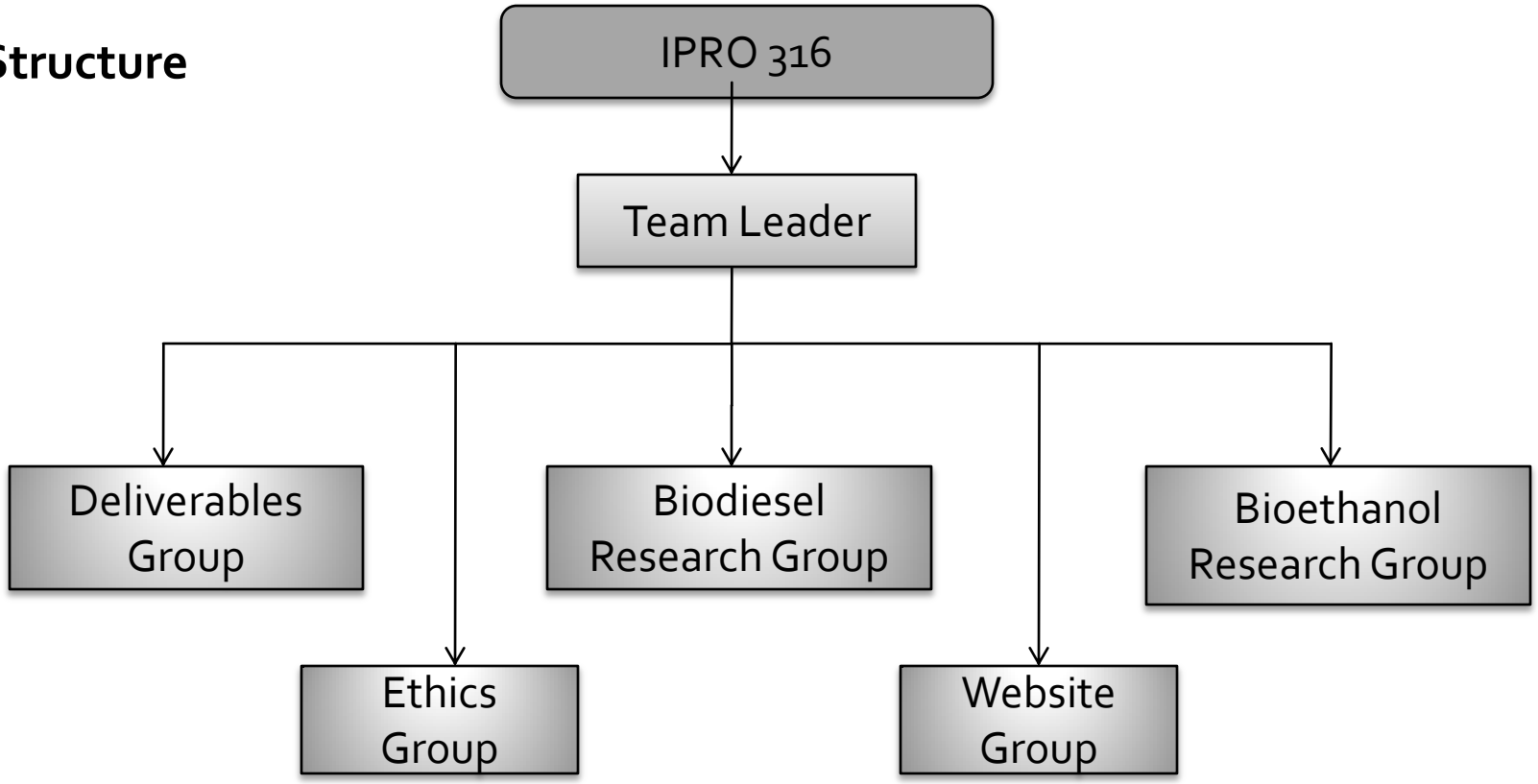
Team Organization

Initial Structure



Team Organization

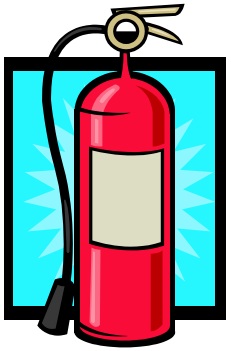
- Final Team Structure
  - Production and Transportation subgroups
- Huge team: 27 members
  - 17 Chemical Engineering Sophomores, 5 seniors
  - Four students in Computer Science, Biology, and Biochemistry fields
- Team values and expectations set early on
  - Attendance
  - Communication
  - Chain of command

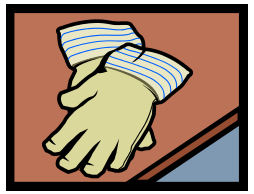
Project Importance

- Described as a "Win win win…" by Peter Testa
- Customers (restaurants, hotels and hospitals)
  - Happy to get rid of grease pits
    - Unsanitary & unattractive
  - Can advertise as being "green"
- Testa Produce
  - Meet biodiesel demand for 52 trucks
  - Ability to expand, possibly sell biodiesel

Ethical Issues

- Did not represent ourselves falsely
- Safety and Permits
  - OSHA & EPA
  - Proper methanol storage
  - Biodiesel production
  - Waste water pretreatment
  - Byproduct (glycerol) disposal
- Permission from companies
  - Equipment pictures & details
  - Testa Produce pictures & details





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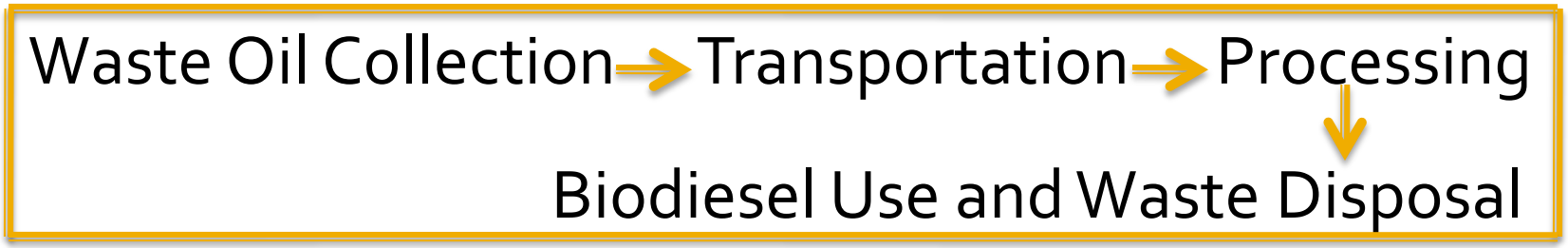
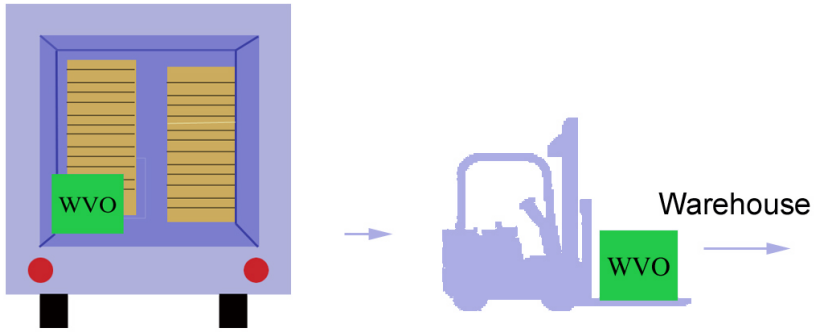
Our Tasks and Methods

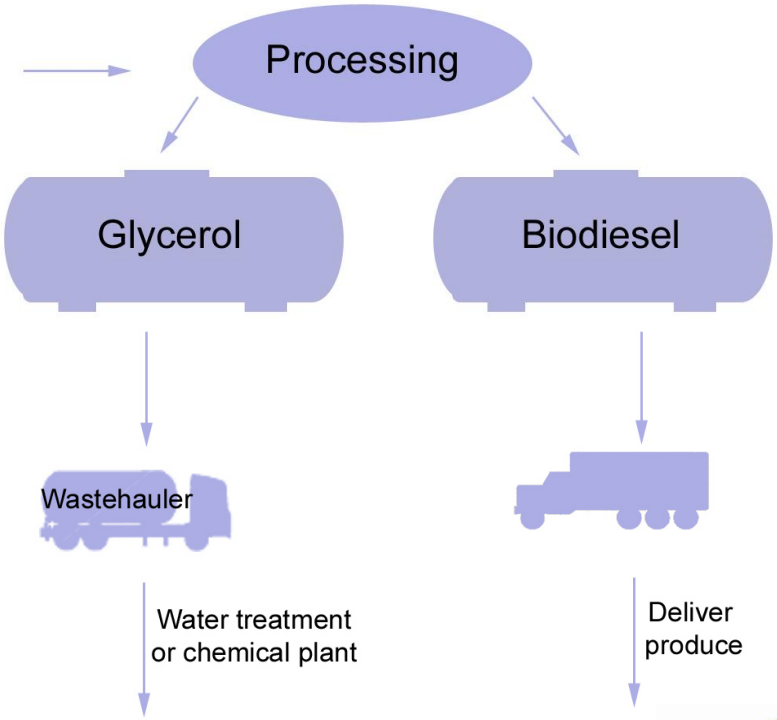
Big Picture



- Online research
  - Including preliminary research comparing biodiesel and ethanol
- Communication with Testa Produce including tour of Testa Produce facility
- Email and telephone communication

Transportation Overview





Transportation of Waste Oils

- Challenge: Transport produce and waste oil in same truck
- Trucks with separated compartments are expensive
- Brainstorming
  - Containment of waste oil
  - Limited space
  - Spill prevention

Transportation

- Waste Oil Collection
  - Use containers it came in
  - Provide color-coded containers
- Hauling
  - Plastic 'tub' on a pallet, 3-4 ft tall
  - Place small 5 gallon containers into tub
- Unloading
  - Pallet with tub easily moved with forklift
  - Oils can be dumped into larger containers

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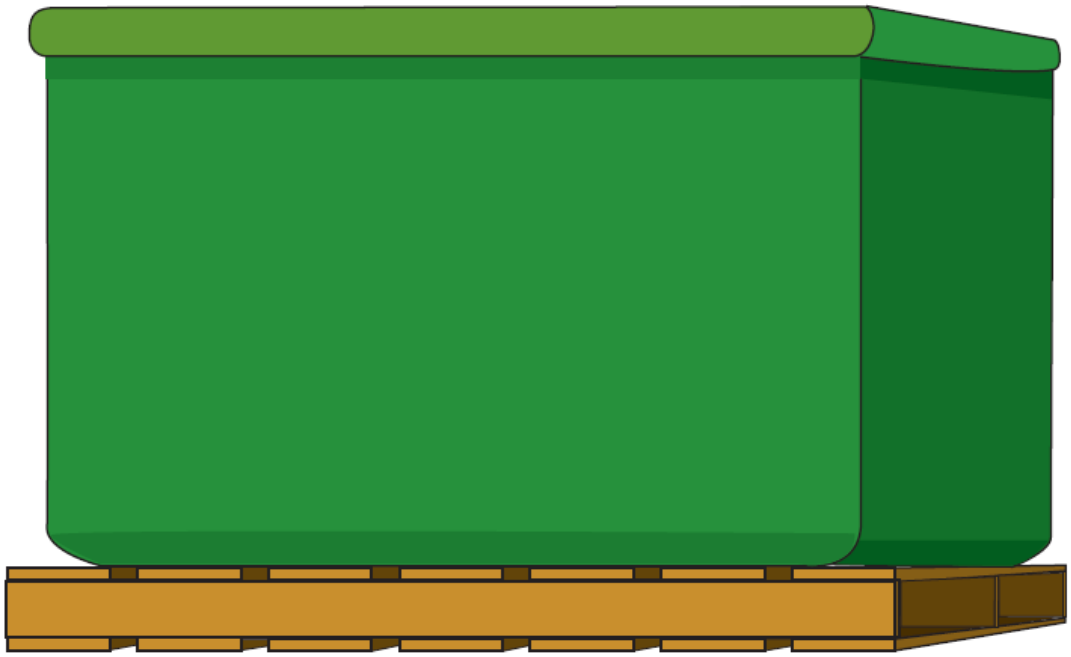
Transportation

- Attached securely to pallet
- Durable material
- Future design…collapsible container



Storage

- Waste Oil
  - Separated by types
- Methanol
  - Flammable
  - Strict storage regulations
  - No electrical equipment allowed in room
- Glycerol
  - Store on-site until bi-weekly or monthly collection

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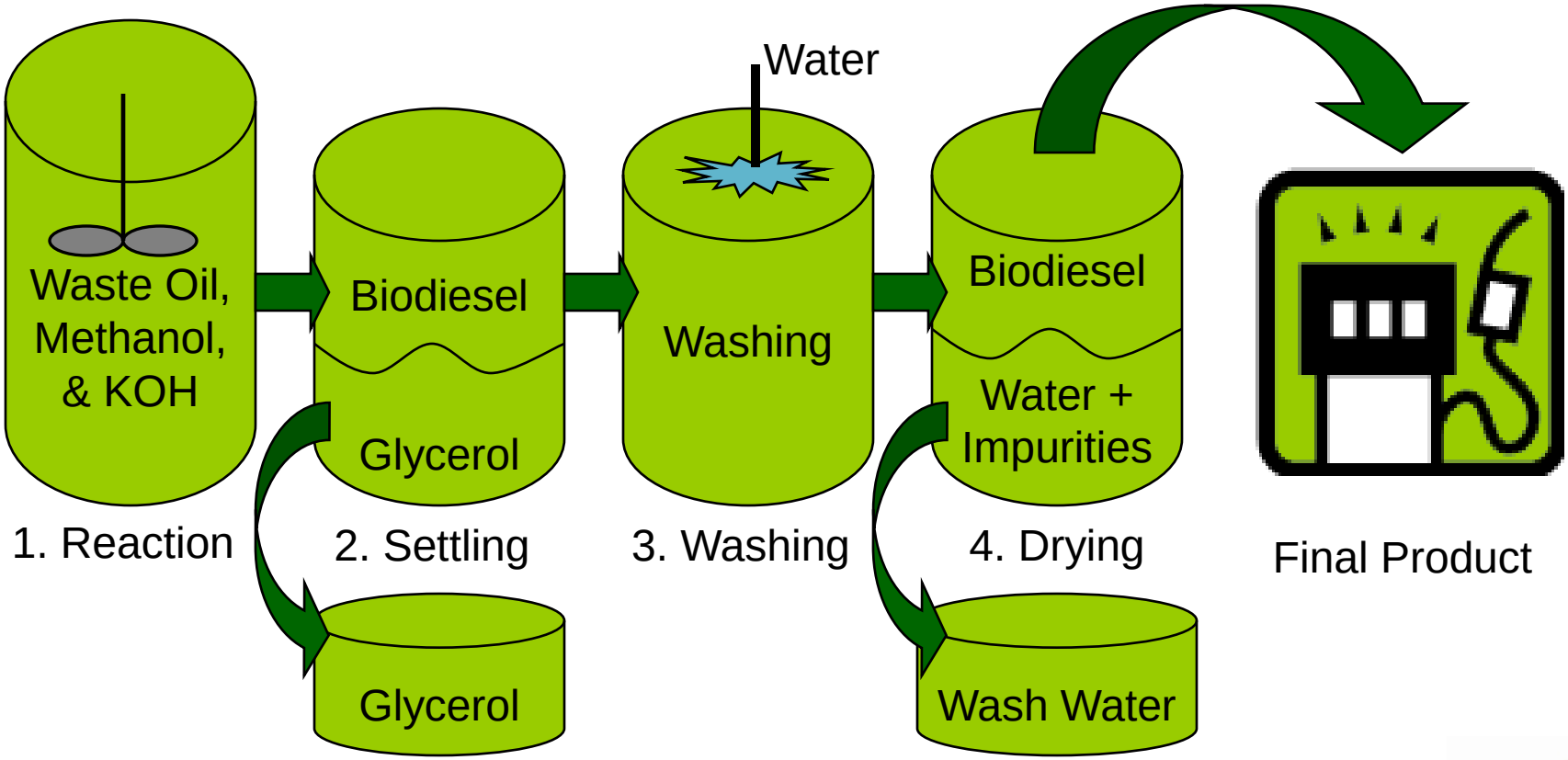
Production Process



Production

Biodiesel need	1200	gal/week
REACTANTS		
Waste oil	1470	gal/week
Methanol	367.5	gal/week
KOH(90% pure)	52	gal/week
PRODUCTS		
Glycerol	184	gal/week
Biodiesel	1654	gal/week

Calculations based on a recipe of 22 vol% Methanol, 78 vol% Waste Oil, and 36grams KOH/gal Oil.

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Production

- 500gal Biodiesel Processor

www.murphysmachines.com/

One batch per day will exceed Testa's demand.

Glycerol

- Biodiesel production byproduct
  - Current basis: ~200 gallons/week
- Contaminated with methanol & lye
- Best options
  - Transport to water treatment plant
  - Supply to chemical plant next to Testa's new facility with expertise in glycerol processing to purify and sell

Field Trip

Trucks, vegetables, and high efficiency lights

Future Steps

- Acquiring building permit
- Building the processor
- Training employees

- Experiment in mixing oils
- Conducting restaurant interviews
- Writing a training manual

If a produce company can be LEED certified, what can you do?

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Acknowledgements

- Testa Produce, Inc
- Professor Parulekar
- Murphy's Machines
- Metropolitan Water Reclamation District of Greater Chicago

Questions/Comments?