



# INTRODUCTION TO BIODIESEL

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# Whole Energy Fuels

- 2004: Plant built in NW WA
- 2005: WEF founded
- 2006: Large scale testing/distribution of biodiesel



# Whole Energy Fuels

- 2004: Plant built in NW WA
- 2005: WEF founded
- 2006: Large scale testing/distribution of biodiesel
- 2007: Awarded CARB grant for Pacifica
- 2008: 25% of WA biodiesel from WEF



# What is Biodiesel?

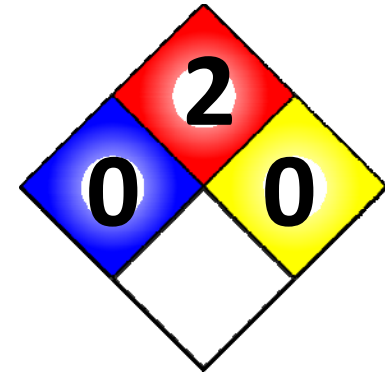
- An alternative to conventional #2 petroleum diesel
- Derived from many types of oil: canola, soy, mustard, used cooking oil, animal tallow, etc.
- Cleaner exhaust, with significant reductions in PM, SO<sub>x</sub>, CO, PAH's
- Because it comes from plants, CO<sub>2</sub> is approx 1/5<sup>th</sup> that of petroleum diesel



## BIODIESEL

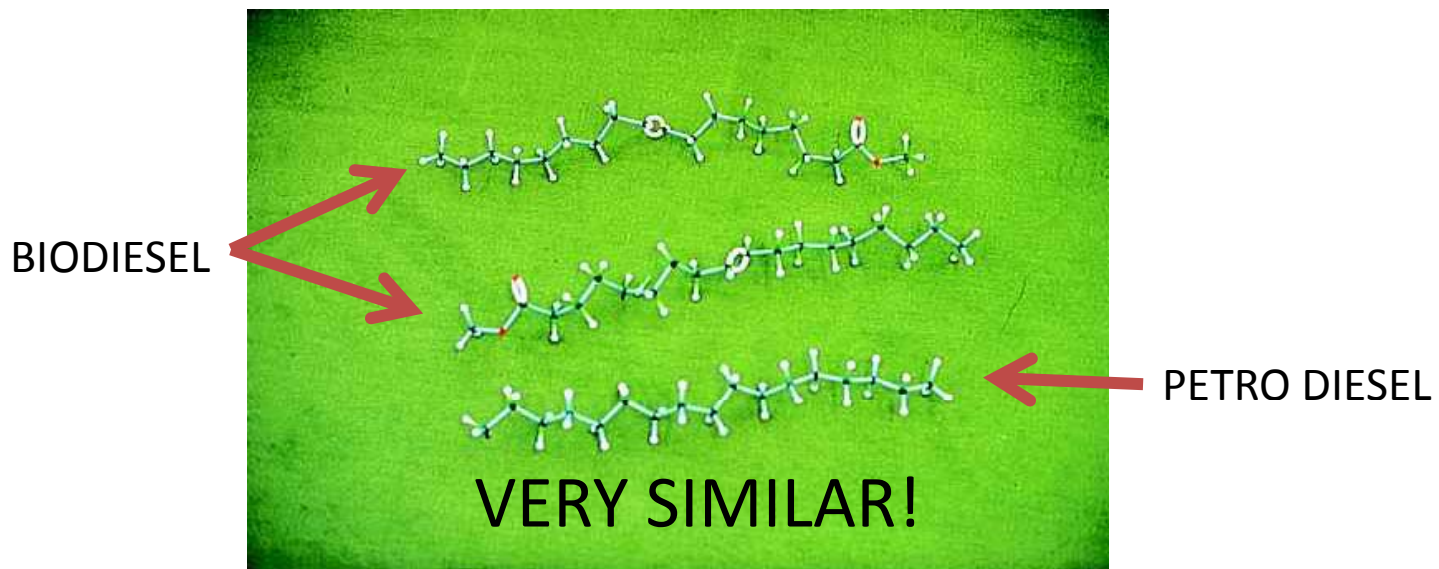
- Non-volatile
- Gels around 32 F
- Strong solvent
- Lower emissions

# Comparison

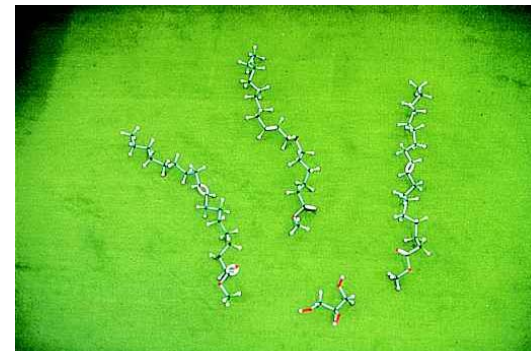
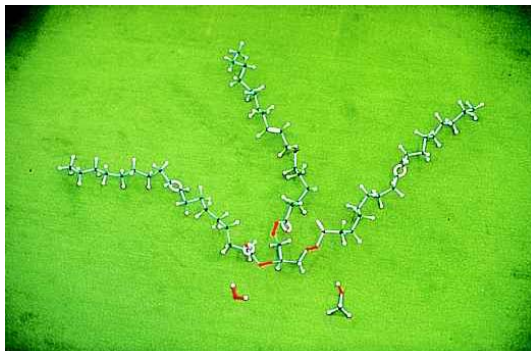


## PETROLEUM DIESEL

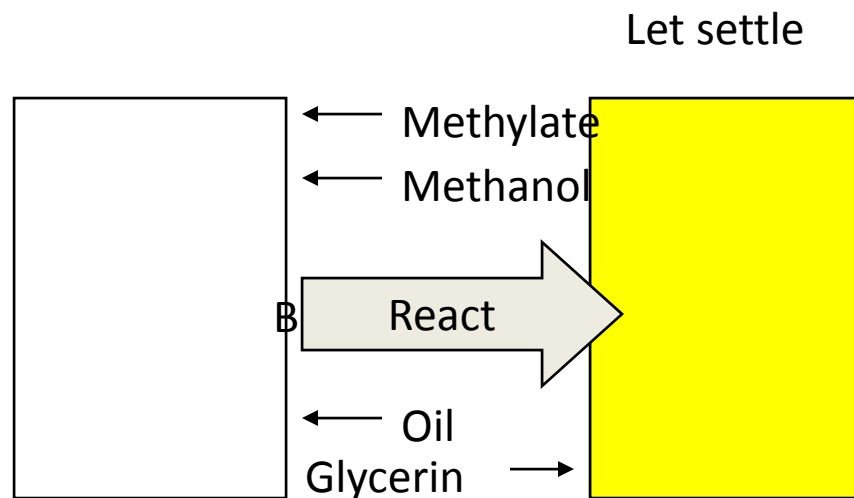
- Volatile
- Gels around 14 F
- Weak solvent
- Regular emissions



# Typical Oil to Biodiesel Reaction



# Typical Oil to Biodiesel Reaction



- Biodiesel:
  - Recover remaining methanol
  - Mix with water to dissolve remaining catalyst
  - Evaporate dissolved water
- Glycerin:
  - Recover remaining methanol

# Approx. Proportions

## Input

- 55 Gal Vegetable Oil
- 10 Gal Methanol
- 6 Lbs Sodium Hydroxide

## Output

- 55 Gal Biodiesel
- 5 Gal Glycerin
- 5 Gal Methanol

# Notes on Products

- Biodiesel must meet ASTM standard 8751 to be called biodiesel (B100)
- If biodiesel is blended with petroleum diesel, mixture is called B20 (if 20% biodiesel)
- Glycerin is a common industrial product and can be sold
- EBMUD in Oakland purchases glycerin for use in its digesters

# Typical Equipment



# How big is a biodiesel plant?



# How big is a biodiesel plant?



**MEDIUM**



# How big is a biodiesel plant?



**SMALL**



# Comparison of Production

## **Industrial**

- Spill prevention and containment plans
- Fire code analysis to determine occupancy
- Sprinkler systems
- Ventilation
- Compliance with codes and permitting agencies

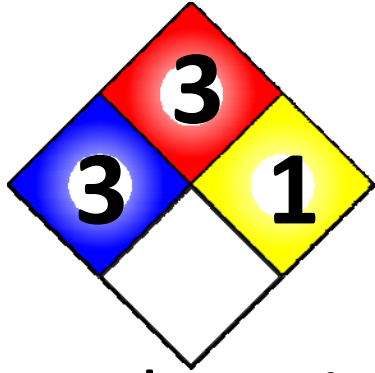
## **Home-brew**

- Under the radar – no permits
- Sometimes poor handling practices
- Methanol vapors create dangerous environment
- Access/egress issues

# Plant Fires

- Typically due to poor handling of methanol



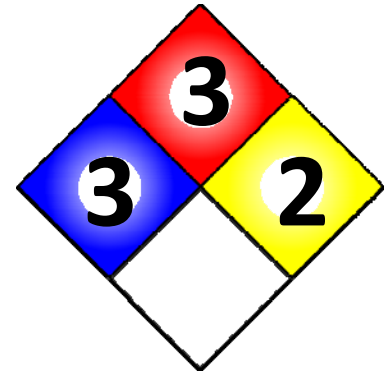


# Methanol

- The primary hazard in biodiesel production
- Liquid at room temperature, but volatile
- Flash point: 52 F
- Clear, transparent, slightly sweet odor
- Commonly used in hotrod cars, solvents, industrial applications

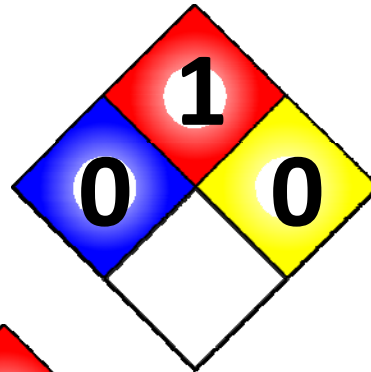
# Other HazMat

- **Sodium or potassium hydroxide**  
typical catalyst – sometimes in  
methanol solution called methylate
- **Sulfuric acid** used for preparing oil  
and neutralizing sodium or  
potassium in bio/glycerin

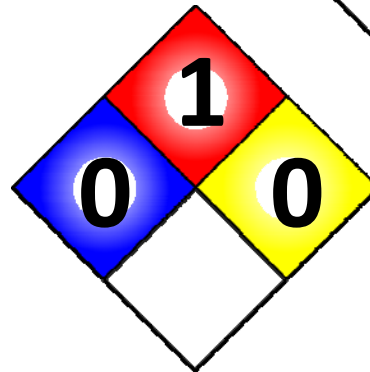


# Other Materials

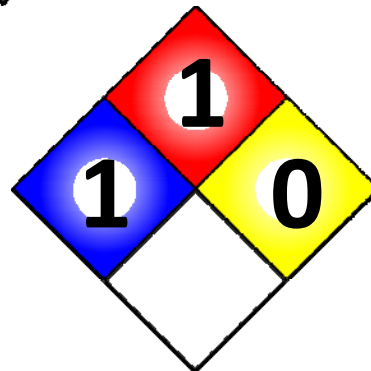
- Vegetable oil



- Biodiesel



- Glycerin



# Pre-Engineered Safety

- Double containment of Methanol and Methylate tanks and pipes
- Occupancy of process area H3, requiring Class 1 Division II electrical
- Process to take place in well ventilated space
- Sprinkler system and flammable gas detectors
- Tanks containing methanol should not be vented into the plant

# Whole Energy Pacifica Plant

- Located next to Pacifica Wastewater Plant
- Biodiesel produced from used cooking oil
- Generator runs off biodiesel
- Recycled water used in process
- Plant emissions scrubbed through an existing soil scrubber



**WASTEWATER  
TREATMENT  
PLANT**

**BIODIESEL  
PLANT**

**POLICE  
STATION**

**HWY 1**

**VALLEMAR  
NEIGHBORHOOD**

336 ft

37°36'53.94" N 122°29'14.29" W

Jul 2007

# Whole Energy Pacifica Plant

- 4000 sq ft type V-B steel building
- Analysis of Fire Code determined the building should be half F1 and half H3
- 1 hr fire barrier

# Whole Energy Pacifica Plant

- Steps to permitting:
  - 1) EIR provided to City under CEQA
    - ✓ Traffic, visual and wildlife impact assessments
  - 2) Permit issued by BAAQMD
    - ✓ Examination of plant emissions
  - 3) Permit issued by Coastal Commission
    - ✓ Spill containment, other coastal issues
  - 4) Building permit for shell
    - ✓ Structural, wind, seismic, geotech
  - 5) Building permit for interior (in process)
    - Plumbing, electrical, ventilation, site work, HazMat

# Summary

- Industrial scale operations subject to scrutiny to ensure safe handling
- Home brewers using and heating methanol: clearly dangerous

# Thank you!

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