

**Association of State and Territorial Solid Waste  
Management Officials**

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**Biodiesel and Glycerin – Missouri's Experience**

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# Main Points

- Basic Intro to Biodiesel – 2 methods
- Main Wastes from the Most Popular Process
- Regulatory Issues and Problems Relating to Biodiesel Glycerol
- Possible Strategies and Resources for Dealing with Problems

# Biodiesel

- Biodiesel –functional equivalent of No. 2 heating oil or No. 2 diesel fuel, produced from biological feedstock.
- Diesel and biodiesel are both are composed of mixtures of simple long-chain (aliphatic) hydrocarbon compounds.
- In Missouri's experience, there are 2 main methods for producing these “bio-oil” compounds on anything but a bench-scale basis.

# Biodiesel Method #1

- **Pyrolysis** – Chemical decomposition of organic material in a low-oxygen environment.
- Missouri has had horrible experiences with plants processing animal carcasses and wastes. They have all the charm of rendering plants.

# Biodiesel Method #2

- The most popular method used by commercial plants and “hobbyists” to produce biodiesel is

## **Transesterification**

- Triglycerides (biological-origin fats & oils) are reacted with methanol and an alkaline catalyst to split long-chain aliphatic methyl esters (linoleic acid, stearic acid, oleic acid, etc.) off the glycerin “hub” that held the triglyceride together.

# “Transesterification”

Triglycerides + Methanol + Sodium Hydroxide = Biodiesel + Glycerol + “stuff”

100 gal.

10 gal.

1 gal.

100 gal.

10 gal.

?

Soybean Oil

Corn Oil

Animal Fat

Waste Cooking Oil

Lye

Soaps

Salts

Whatnot

This biodiesel reaction is reversible, exothermic, and roughly corresponds to the above proportions. Note: This would be an efficient reaction, and many practitioners “flood” the reaction with methanol and catalyst to try to get the maximum production of biodiesel.

# Biodiesel Wastes

- Off-Specification Fuel
- Excess/unreacted Feedstocks
- Glycerin (glycerol)
- Reaction products and partially-reacted materials (methoxide, soaps, excess catalyst and methanol, etc.)
- Filtration media and other wastes generated from processing

# Biodiesel Glycerol Waste

Because of the way some production is handled, many producers end with 2 separated phases:

1. Their biodiesel product.
2. Crude glycerol that essentially contains all the impurities.

# Crude Glycerol

- Worldwide biodiesel production has created a glut of crude glycerol.
- To be readily salable, food-grade glycerol commonly needs to be at 99% purity or above, and pharmaceutical glycerol needs to exceed 99.9% purity.
- Crude glycerol can frequently have toxic, corrosive or ignitable hazards because of contaminants.

# Glycerol Regulatory Issues

- Contamination with methanol can make crude glycerol fail the hazardous waste characteristic of ignitability (i.e., have a flashpoint below 140° F).
- Producers can escape hazardous waste regulation by having ignitable glycerol reclaimed by themselves or others.
- Even if it is not ignitable, crude glycerol should be assumed to meet the definition of a hazardous material.

# Glycerol Regulatory Issues

- Burning Glycerol – even ignitable glycerol is a poor fuel (viscous, gummy, ashy) that produces carcinogenic acrolein gas unless burned at 1000° C and sufficient residence time.
- Burning ignitable glycerol falls under hazardous waste fuel regulation (40 CFR Part 266).
- Burning “non-hazardous” glycerol falls under solid waste and air pollution regulation.

# Possible Problems

- Waste dumping by hobbyists or commercial producers
- Illegal storage and management issues
- Failure to consider waste management as part of business plans – general failure to have a good cost structure – causing stressed finances

# Dumping glycerol on the ground



# Dumping glycerol in or near waters of the state



# Possible Strategies

- Active outreach to local officials to try to deal with hobbyist production problems
- Aggressive outreach and education involving state and federal agricultural and economic development grant programs aimed at commercial producers.

# Reclamation as a business niche/opportunity

- All commercial plants that I've seen already do some methanol reclamation as part of their standard operations.
- Other smaller operators have realized better profits by converting their operations from producing biodiesel to reclaiming crude glycerol, with little or no equipment changes.

# Other Options?

- Burning hazardous or “non-hazardous” glycerol remains an option, if regulatory requirements are met.
- Animal Feed
- Biodigestors
- Composting “non-hazardous” glycerol may be possible, but a water permit for direct land-application would be a problem

# Resources

- EPA biodiesel manual:  
[http://www.epa.gov/region07/priorities/agriculture/biodiesel\\_manual.pdf](http://www.epa.gov/region07/priorities/agriculture/biodiesel_manual.pdf)
- EPA ethanol manual:  
[http://www.epa.gov/region07/priorities/agriculture/ethanol\\_plants\\_manual.pdf](http://www.epa.gov/region07/priorities/agriculture/ethanol_plants_manual.pdf)
- Biodiesel Basics and Beyond: A Comprehensive Guide to Production and Use for the Home and Farm – by William H. Kemp (**ISBN-10:** 0973323337; **ISBN-13:** 978-0973323337)

# In Summary

- We have:
  - briefly described the primary biodiesel production process.
  - identified some primary wastes generated from biodiesel production – especially glycerol
  - discussed aspects of glycerol regulation – both problems and options.
  - identified resources and approaches to deal with biodiesel production in your jurisdiction.

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