Biofuel Manufacturing: Wastewater Permitting Considerations

Erika Felix
U.S. EPA - Office of Water
Office of Wastewater Management, Water Permits Division
November 15, 2007
Forces influencing the Biofuel Industry

- Desire for energy independence
- Environmental benefits
  - Reduction of air pollution, in particular CO$_2$ and motor vehicle emissions
- Federal and State policies and regulations:
  - i.e. MTBE ban in California, New York, and other states
  - Renewable fuels standards (20 in 10)
- Federal and State tax incentives:
  - $.50 to up $1.0 per gallon tax credit for biofuel blenders
  - $0.10 per gallon of biofuel for producers
  - 30% credit for the cost installing clean-fuel refueling equipment
The Role of Water in the Biofuel Industry

- **Water Quantity:** Water is needed for growing and processing biomass to biofuels.
  - i.e. the industrial corn-ethanol process alone uses from 3.5 to 6 gallons of water for every gallon of ethanol

- **Water Quality:** concerns are starting to emerge both in terms of:
  - Impacts from increase agricultural activities, i.e. higher rate of fertilizer applications, sedimentation, etc.
  - management of industrial wastewater, i.e. for every gallon of ethanol that is produced about 12 gallons of sewage like effluent is co-produced
The Biofuel Supply Chain

Point sources: Industrial wastewater

Non-point source: Agriculture

I will focus on this
Industrial Wastewater from Biofuels

- **Wastewater effluents** characteristics, treatment, and practices vary with the size, type, and location of the manufacturing processes and unit operations.

- **Wastewater disposal practices**: include direct (to water of the United States); indirect discharges to POTWs, septic tanks or CWT; and land application.

- **Concerns** have been raised on biofuel plants meeting sewage pollution limits:
  - conventional pollutants in particular, BOD, TSS, oil and grease
  - Small towns capacity to treat high concentrations of conventional pollutants.
Regulation of the Biofuel Sector

Ongoing Activities at EPA:

- Review of existing Effluent Guidelines and Standards (ELGs) to assess applicability to biodiesel sector
- Characterize existing biodiesel/ethanol operations: waste streams, wastewater characterization, wastewater management options
- Develop Technical Guidelines
- Collaboration with EPA regions
Flow Diagram: Biodiesel production

Refined Vegetable oils

if not, stays in glycerin and wastewater

Methanol + NaOH → Transesterification

Crude Glycerin

Glycerin refining

Glycerin:
Approx. 10% based on reactants weight

Crude biodiesel

Methanol Wash water Contaminants

Glycerin
Soaps
Spent catalysts
Water
Methyl esters
Triglycerides

Washing step

Biodiesel

Refining
Biodiesel Site Visits: Preliminary General Observations

- **Processing:**
  - Facilities overwhelmingly use the water-based washing process for making biodiesel (11 out of 15)
  - Most operate in batch vs. continuous processes (14)

- **Feedstock:**
  - Most use exclusively soybean oil as feedstock
  - Only 2 facilities pre-treat feedstock all the time

- **Water Usage**
  - All facilities use city water
  - Most facilities used about 1gal of water per gallon of biodiesel produced (exception waterless facilities)
  - 1/3 of the facilities report treating water prior to use
Wastewater Discharges Permits:

- *Storm water:* 1/3 have NPDES, 2 have pre-treatment permit
- *Processed water:* 1 NPDES, 8 pre-treatment permits, 1 off-site disposal, 1 hauling to CWT, 1 land application and remaining 3 waterless operations
- About ½ perform some wastewater treatment prior to discharge

Glycerin:

- 3 facilities report using it as energy source in their furnace
- 6 facilities sell it “as is”. i.e. for use as animal feed supplement
- 1 facility sends it to landfill

Methanol:

- About ½ facilities recycle and reuse methanol in their process
- 1 facility indicate that no-excess methanol is used
- 1 facility is considering updating to recycle methanol
Biodiesel: Wastewater Characteristics

Characteristics of raw process wastewater from limited data:

- BOD: 4,500 - 37,000 mg/l
- TSS: 156- 2130 mg/l
- Oil and Grease: from 152 up to 1090 mg/L Total*
  (HEM)

*we are interested in obtaining more data if available!
How to Permit Biodiesel Indirect Discharges:

- Initial concepts for setting wastewater limits:
  - Apply general pretreatment standards, including a prohibition on discharges causing “pass through” or “interference”
  - Apply local limits.

- Other Issues to consider:
  - Spill Protection
  - Chemical and wastewater compatibility, flammability, etc.
Next Steps

- **Characterization of Biofuel Sector:**
  - Continue with site visits to biodiesel facilities (Regions 5&7)
  - Initiate site visits to ethanol facilities

- **Perform analysis** of collected information on wastewater effluent

- **Develop technical guidance** for permit writers and for POTWs
  - BMPs
  - Establishing Local Limits

*Need more effluent data to determine the levels of pollutants that are produced from this industry!!!
Questions

Contact Information:

Erika R. Felix
Email: felix.erika@epa.gov
Tel: (202) 564-3067