Biodiesel Project at Lane Community College

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Green Chemistry at LCC

- Started Using Green Chemistry Labs in Fall 2000 – Well Received
- Green Chemistry Included in the Classroom Beginning Fall 2001
- Students Form Green Chemistry Club Winter 2003

Student Interest: From Green Chemistry to Biodiesel

- Student Project Explores Biodiesel: Proposes Lab – Spring 2002
- Student Project Completes Biodiesel Lab Development – Spring 2004
- Biodiesel Lab Run for the First Time Spring 2005
- Biodiesel Plant Project Initiated Spring 2005
- Biodiesel Plant Completed Spring 2006
- First Biodiesel Batch Produced Summer 2006

Biodiesel and Sustainability

- Sustainability is a Core Value at Lane Community College
 - "Integrate practices that... sustain life"
 - "Provide an interdisciplinary learning environment that builds understanding of sustainable ecological, social, and economic systems..."
 - "Equip and encourage all... sustainable society..."
- Design and Build a Biodiesel Plant Using Sustainable Materials – Other People's Trash
- Practice Sustainability in the Production of Biodiesel – Ex: Waste Kitchen Oil

Waste Cooking Oil Source



Planning Our Biodiesel Plant

Determine Our Needs

 Analysis of Source Vegetable Oil
 Bench Scale Testing of Biodiesel Synthesis

 Research & Develop a Plant Design

 Many Internet Resources Available
 www.journeytoforever.org

Select/Modify an Available Plan

Schematic of Plant Design



www.journeytoforever.com

LCC's Biodiesel Plant



Student Engagement

Campus Development Team
 Student Leadership
 Academic Advisor



Producing Biodiesel

Production Team

- Student Plant Manager
- Student Teams
 - 4 Students per Team
 - One Chemistry Student Minimum
 - Diverse Team

Several Teams – Not too much work / team!

 Strong Commitment to Producing Biodiesel

Producing Biodiesel

One Week Process

- Filter Waste Oil & Transfer into Reactor (~ 1 hr)
- Synthesize Base & Transfer to Reactor (< 1 hr)</p>
- React at Room Temperature (~ 4 hours)
 - Mix for 4 to 6 hours
 - Sit for 24+ Hours
- Mix & Transfer to Wash Stage (~ 1hr)
- Washing
 - Allow Separation Remove Glycerin Layer (< 1 hr)</p>
 - Bubble Wash and Remove Water Layer ~ 3 Times (< 1 hr)</p>
- Collect Final Product

Planning Our Biodiesel Plant

Campus Services - Sustainability Coordinator Develop a Budget – Sustainability Grant Find a Suitable Location Accessibility & Safety Ventilation Work Space & Storage Secure Build Biodiesel Plant

Plant Development Costs

Used 55 Gallon Drums, Mixing Tank, Central Reactor: **Free** Pumps and Plumbing Fixtures: \$900 Electrical Wire and Parts: \$600 Student Labor & Enthusiasm: **Free** <u>Campus Trades: Project Not Billed</u> Total: **\$1500**

 LCC Expenses Before Biodiesel
 Waste Oil Disposal for 450 gallons/year
 Purchasing Diesel Fuel for 450 gallons/year
 Total Costs:
 \$1461.00/year

 Biodiesel Production Costs Per Batch
 20 L MeOH 1kg KOH <u>Shipping</u> \$12.60
 Costs Per Gallon* \$0.70
 *Bulk Purchasing Costs
 Note: Ethanol Substantially More Expensive

Fuel Cost Reduction Using Biodiesel Before Biodiesel Diesel Fuel \$2.50 / gallon \$0.75 / gallon Waste Oil Disposal Costs Annualized Costs (450 Gallons): \$1462.50 Biodiesel Production Costs Materials & Shipping <u>\$0.70 / gallon</u> Annualized Costs (450 Gallons): \$315.00 Overall Saving: 1462.50 - 315.00 = 1147.50

\$1147.50 is > 75% Savings Savings Can: Covers Chemical Supply Costs Covers Plant Development Costs Hire a Student Plant Manager Cover Future Improvements & Expansions Savings Will Increase As Fuel Costs Rise...

Opportunities of Biodiese

Excellent Student Opportunity
Energy efficiency
Good Public Relations – Media Exposure
Building a sustainability program
Community involvement

Our Experience

Successes

- Working Biodiesel Plant!
- Student Involvement/Commitment
- Diverse Team
- Good Public Relations
- Challenges
 - Coordinating Between Academic & Service Side of Institution
 - Closing Permit Fire Marshall Approval
 - Location

Recommendations

Start Small

- Keep steps small and costs low
- Build with recycled materials Demonstrate sustainability

Build a good team

- Student volunteers bring a lot of energy
- Good coordination improves likelihood of success

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