Environmental Effects

Implementation
- Engine: Rubber seals will need to be replaced
- Gelling at low temperature: Install a tank heater or anti-gel additive
- Fuel Economy: Biodiesel has 5-8% less energy

http://www.organicfuels.com

Acknowledgments

Professor: Satish Parulekar
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Market Analysis

<table>
<thead>
<tr>
<th>Year</th>
<th>Biodiesel Production (Million Gallons)</th>
<th>Average Price (B20)</th>
<th>Average Price (B100)</th>
<th>Average Price (Petro Diesel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>246</td>
<td>$2.53</td>
<td>$3.31</td>
<td>$2.93</td>
</tr>
<tr>
<td>2007</td>
<td>512</td>
<td>$3.08</td>
<td>$3.38</td>
<td>$3.06</td>
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<tr>
<td>2008</td>
<td>711</td>
<td>$3.98</td>
<td>$4.31</td>
<td>$3.72</td>
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<tr>
<td>2009</td>
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<td>$2.69</td>
<td>$3.08</td>
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<tr>
<td>2010</td>
<td>n/a</td>
<td>$2.96</td>
<td>$3.59</td>
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</table>
To research and design an efficient and economically feasible process for the production of biodiesel from vegetable oil.

Objectives

- Determine reactor and product separation flow design
- Develop catalyst recovery system
- Perform a capital cost analysis
- Determine environmental effect of using biodiesel
- Perform a market analysis

Background

The conversion of vegetable oil to biodiesel through transesterification was first researched in 1853 by E Duffy and J. Patrick and was successfully tested in Rudolf Diesel’s engine in 1893. However, petroleum was chosen as the fuel feedstock due to its lower cost.

In response to global warming, government have begun mandating the “mixing” of petro and bio diesel in order to reduce CO₂ emissions. Tax breaks and other incentives have been instituted to encourage companies to move towards biodiesel production.

Below is the process options that were considered (* denotes selected option)

**Scale**

*Fuel 20 trucks for 1 year (300,000 gal)

**Reactions**

Supercritical
- Uses supercritical methanol (No catalyst)
- Very fast reaction
- Requires high temperature and pressure

Acid-Catalyzed
- Moderate tolerance for impurities
- High yield
- High methanol to oil ratio (30:1)
- Difficulties in separation process

*Base-Catalyzed
- Fast Reaction
- Low methanol to oil ratio (6:1)
- Well studied
- Low tolerance for impurities

**Product Separation**

*Settling Tank
- Batch process
- Simplest and cheapest method

Centrifuge
- Rapid process
- High capital cost
- Requires significant maintenance

**Methanol Recovery**

*Distillation
- Separates species based on difference in relative volatility