Biodiesel at UC Irvine

By
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Goal

- To find alternative fuels to reduce the campus dependence on fossil fuels
  - Various blends of biodiesel (B20 & B100)
## Current Biodiesel Regulations

<table>
<thead>
<tr>
<th></th>
<th>EPA</th>
<th>CARB</th>
</tr>
</thead>
<tbody>
<tr>
<td>B20</td>
<td>Recognized as an alternative fuel</td>
<td>SB975 allows public solid waste collection vehicles to use B20</td>
</tr>
<tr>
<td>B100</td>
<td>Recognized as an alternative fuel</td>
<td>Not recognized</td>
</tr>
</tbody>
</table>
Current Biodiesel Regulations (cont.)

- CARB’s suggested policy would consider B20 and below as a CA Diesel Fuel
Where Are We?

- B20 used in fleet vehicles (including shuttles).
- Tried B20 in stationary sources (e.g., emergency generators), with poor results.

*
What Are We Doing Now?

- Conduct baseline testing on a 5.9L Cummins Engine.
- Using Diesel #2, B20 and B100.

### Diesel #2 Baseline

<table>
<thead>
<tr>
<th>Time</th>
<th>CO (ppm)</th>
<th>NOx (ppm)</th>
<th>T Gas (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>0</td>
<td>600</td>
</tr>
<tr>
<td>0:01:10</td>
<td>200</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>0:02:10</td>
<td>300</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>0:03:10</td>
<td>400</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>0:04:10</td>
<td>500</td>
<td>400</td>
<td>200</td>
</tr>
<tr>
<td>0:05:10</td>
<td>600</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>0:06:10</td>
<td>700</td>
<td>600</td>
<td>0</td>
</tr>
<tr>
<td>0:07:10</td>
<td>800</td>
<td>700</td>
<td>-100</td>
</tr>
<tr>
<td>0:08:10</td>
<td>900</td>
<td>800</td>
<td>-200</td>
</tr>
<tr>
<td>0:09:10</td>
<td>1000</td>
<td>900</td>
<td>-300</td>
</tr>
</tbody>
</table>

**Linear (NOx (ppm))**

**Linear (CO (ppm))**

- NOx ppm Avg = 481
- CO ppm Avg = 195
What Are We Doing Now?

![B20 Baseline Graph]

- NOx ppm Avg = 513
- CO ppm Avg = 227
What Are We Doing Now?

![B100 Baseline Graph](image)

- **NOx Avg ppm = 575**
- **CO Avg ppm = 187**
Baseline Results

Based on previous biodiesel studies PM, CO, HC and SO2 emissions decreased, and NOx increased¹

<table>
<thead>
<tr>
<th></th>
<th>Diesel #2</th>
<th>B20</th>
<th>B100</th>
<th>Reduction/Increase (B20, B100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>481</td>
<td>513</td>
<td>575</td>
<td>6.7%, 19.5%</td>
</tr>
<tr>
<td>CO</td>
<td>195</td>
<td>187</td>
<td>227</td>
<td>4.1%, 16.4%</td>
</tr>
</tbody>
</table>

¹ Based on biodiesel emissions compared to conventional petroleum diesel from EPA
Next Phase

- Installed calibrated cat-back urea NOx reduction system from KleenAir Systems.
The overall system was pre-calibrated to achieve maximum NOx reduction.
Next Phase Testing Results

- Performed testing using B100.
- NOx emissions decreased by 26.8%.
What’s Next?

- Continue to monitor system over the next year.
- Retrofit other shuttle buses.
- Locate reputable vendor for B100.
What’s Next (cont.)?

- Purchase 3 alternative fueled shuttle buses.
Resources

- KleenAir Systems, Inc. – 949-831-1045
- Urea - HazMat Services – 714-491-1222
Comments/Questions