**Volume Reduction Technologies for Transporting Poultry Litter**

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**What is Poultry Litter...**
- Combination of accumulated manure, feather, spilled food and bedding materials, which is typically wood shavings, sawdust, wheat straw, peanut hulls, or rice hulls  
- Historically used as fertilizer on croplands near poultry farms - low density  
- Environmental issues mostly due to high P levels in soils, ground water and surface water due to prolonged use

**Motivation**
- More economical and efficient way to transport large amounts of poultry litter.  
- On- and Off-Site usage (or Storage).  
- Energy production and land application  
- Densification improves transportation costs (economics).  
- Decrease soil N and P buildup in heavy poultry populated areas.

**Why Volume Reduction??**
- Economics - light density  
- Dusty - biosecurity  
- Close to 2 million tonnes produced in Alabama annually

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**Volume Reduction In Agroprocessing**

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Bulk Density (lb/ft³)</th>
<th>Particle Density (lb/ft³)</th>
<th>Average Size</th>
<th>Examples of material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelleting</td>
<td>&gt; 1200 kg/m³ (75 lb/ft³)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cubing</td>
<td>870 kg/m³ (54 lb/ft³)</td>
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<tr>
<td>Baling</td>
<td>161 kg/m³ (10 lb/ft³)</td>
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</table>
**Objectives**

- Determine the effect of moisture content and the minimum pressure required to compact poultry litter.
- Determine the energy requirement to compact poultry litter.

**Materials And Methods**

- Poultry litter (wood shavings as bedding) obtained from poultry farm
- Adjusted to MCs of 16.5%, 24.2%, 26.1% and 29.0%, Initial MC = 21.7%
- Texture analyzer used to produce compacts in a 1” die
- Pressure used varied from 5.1 to 8.5 MPa
- Density of compacts measured 1) directly after test and 2) after 2 months of storage.
- Experimentation in duplicate

**Results**

- Density values increased with the increase of pressure and moisture content.
  - Water acts as a binder
- Minimum of 5.1 MPa is required
- Minimum of 26% MC (prior to compaction) is required
- Specific Energy of producing compacts is less than pelleting
  - < 4.68 kJ/kg compared to 32 to 80 kJ/kg

<table>
<thead>
<tr>
<th>Applied pressure (MPa)</th>
<th>16.5%</th>
<th>24.2%</th>
<th>26.1%</th>
<th>29.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>2.76</td>
<td>2.54</td>
<td>2.61</td>
<td>2.77</td>
</tr>
<tr>
<td>6.0</td>
<td>3.41</td>
<td>3.08</td>
<td>3.41</td>
<td>3.09</td>
</tr>
<tr>
<td>6.8</td>
<td>3.65</td>
<td>3.39</td>
<td>3.59</td>
<td>3.67</td>
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<tr>
<td>7.7</td>
<td>4.06</td>
<td>3.89</td>
<td>4.25</td>
<td>4.16</td>
</tr>
<tr>
<td>8.5</td>
<td>4.62</td>
<td>4.54</td>
<td>4.57</td>
<td>4.68</td>
</tr>
</tbody>
</table>

*Note that specific energy to produce poultry litter pellets varies from 32 to 80 kJ/kg (Colley et al., 2005).*

**Compacts to Blocks**

- 200,000 lb capacity hydraulic press
- Pressure: 1.4 MPa

| 12 X 12 X 8 inch |
What we are learning...

- Must compact to > 1000 kg/m³ (1.4 MPa)
- Must bring MC of litter to between 35-40%.
- Near 2:1 volume reduction
- Internal heating
  - 14 degree C difference during daytime
  - Start seeing differences within 15 minutes

Where we are heading...

- Attempt to increase size of compacted blocks
  - Energy requirements and economics
- Determine any chemical and biological changes in compacted litter
- Match results to possible commercial compaction equipment.

QUESTIONS

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