Soybean Meal-Extended Plywood Adhesive

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Face2Face Meeting with Global Midwest Alliance
October 19, 2010    Peoria, IL
Background: Soybean Glues

- Considered as natural glue
- Used extensively during World War II
- Replaced by petroleum-derived synthetic resin glues after the War
Soybean Glues Research: Problems Addressed

- Minimize the impact of disruption caused by petrochemical crises to wood products industry
- Environmental concerns about formaldehyde resins
- More value-added uses of soybean protein co-products
Soybean Glues Research at NCAUR

- Current focus on soybean meal
- Contain ca. 50% protein
- Abundant: 39.3 million tons of soybean meal (2009)
- Inexpensive: $0.28/kg
Soybean Glues Research at NCAUR

Soybean Meal-Based Plywood Adhesive

- Formulation is for sprayline coaters
- Soybean meal replaced wheat flour as extender
- Replacement is on protein content basis
- Compared mixing behaviors and bond strengths
## Soybean Meal-Based Plywood Adhesive

### Formulations: Protein Content-based Replacement

<table>
<thead>
<tr>
<th><strong>Standard Glue</strong></th>
<th><strong>New Glue</strong></th>
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</thead>
<tbody>
<tr>
<td>(wheat-based)</td>
<td>(soybean-based)</td>
</tr>
<tr>
<td>Water 136 g</td>
<td>Water 156 g</td>
</tr>
<tr>
<td>Wheat flour 61 g</td>
<td>Soy meal 32 g</td>
</tr>
<tr>
<td>(Protein content=13.1%)</td>
<td>(Protein content=51.5%)</td>
</tr>
<tr>
<td>Glu-X filler 70 g</td>
<td>Glu-X filler 96 g</td>
</tr>
<tr>
<td>P-F resin 698 g</td>
<td>P-F resin 681 g</td>
</tr>
<tr>
<td>Caustic 30 g</td>
<td>Caustic 30 g</td>
</tr>
</tbody>
</table>
Laboratory Plywood Processing

1. Glue application
2. Veneer Lay-up
3. Cold-pressing
4. Hot-pressing
5. Water-soaking
6. Tensile strength testing
Our Key Results

► Soybean meal-extended glue had acceptable mixing properties and viscosity.

► Soybean meal-extended glue bonded as strongly (209 psi) as the wheat-based industry adhesive (211 psi).

Published in J. Amer. Oil Chem. Soc. (2010) 87 (9): 1047-1052
Benefits of Soybean Meal-Extended Plywood Adhesive

► **Cheaper** than the industry standard adhesive by nearly $1 per 100 kg glue mix. (Annual savings of $50,000+)

► **Ease of adoption:** drop-in substitution

► **Value-added income to soybean farmers in the U.S.**

(160,000 bu soybeans/year will provide the 3 million kg soybean meal needed for this type of plywood adhesive)
Next Steps for Technology Transfer

► Optimization studies
  ▪ Improve dispersion of the meal
  ▪ Increase the amount of soybean meal
  ▪ Combine soybean meal with other protein sources (sorghum, corn germ)

► Shelf-stability evaluation

► Pilot-scale testing (industry partner)

► Full-scale mill trials (industry partner)