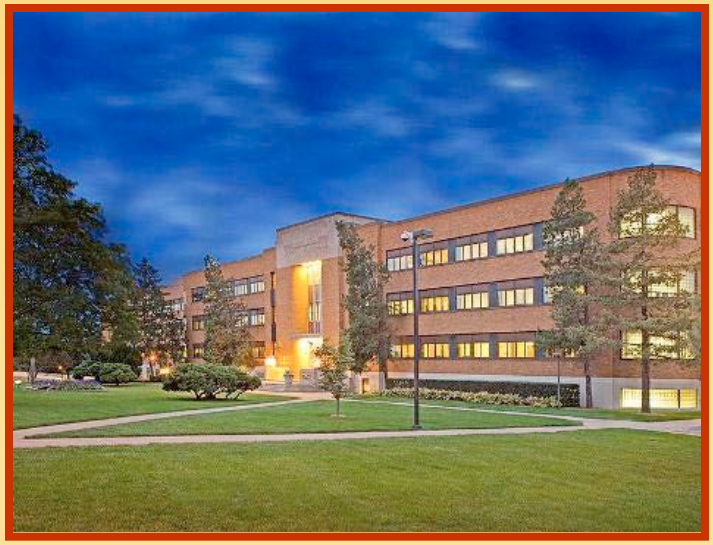
United States Department of Agriculture

Agricultural Research Service

Soybean Meal-Extended Plywood Adhesive



Mila P. Hojilla-Evangelista

Plant Polymer Research

National Center for Agricultural Utilization Research

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

USDA ARS NCAUR Where the future is Created

Soybean Glues Research at NCAUR

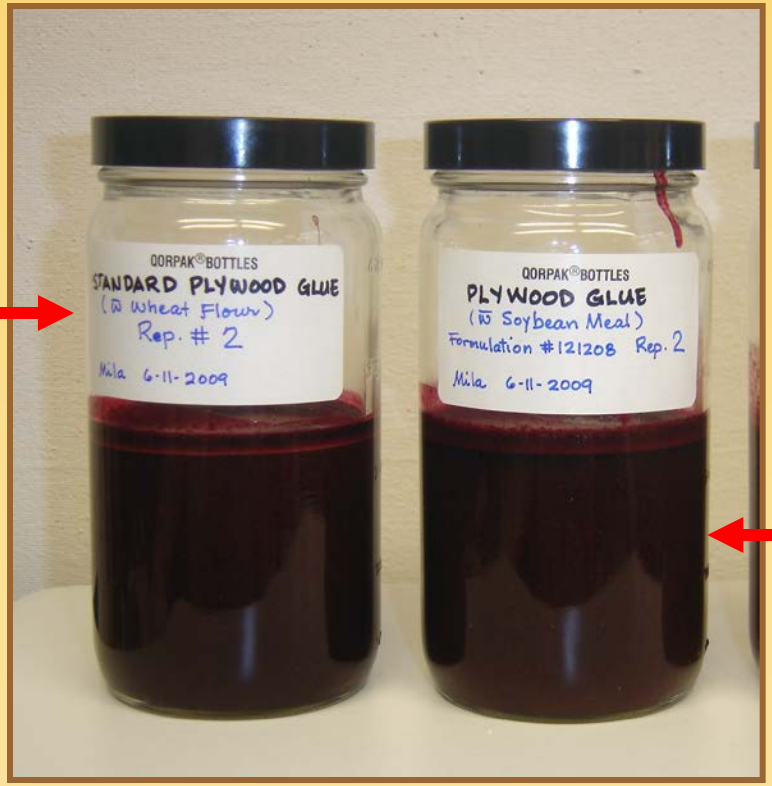
- Current focus on **soybean meal**
- Contain ca. **50% protein**
- **Abundant:** 39.3 million tons of soybean meal (2009)
- **Inexpensive:** $0.28/kg

Soybean 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**

Formulations: Protein Content-based Replacement

Standard Glue (wheat-based)	
Water	136 g
Wheat flour *(Protein content=13.1%)*	61 g
Glu-X filler	70 g
P-F resin	698 g
Caustic	30 g



New Glue (soybean-based)	
Water	156 g
Soy meal *(Protein content=51.5%)*	**32 g**
Glu-X filler	**96 g**
P-F resin	681 g
Caustic	30 g

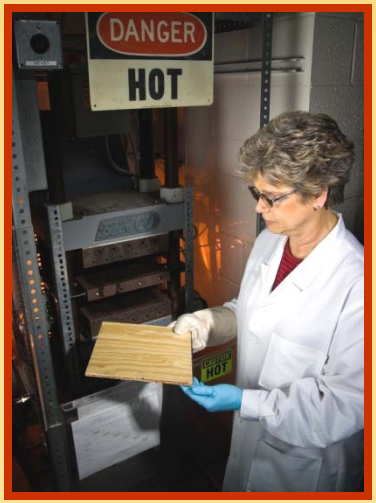
USDA ARS NCAUR Where the future is Created

Laboratory Plywood Processing

1. Glue application

2. Veneer Lay-up

3. Cold-pressing



4. Hot-pressing

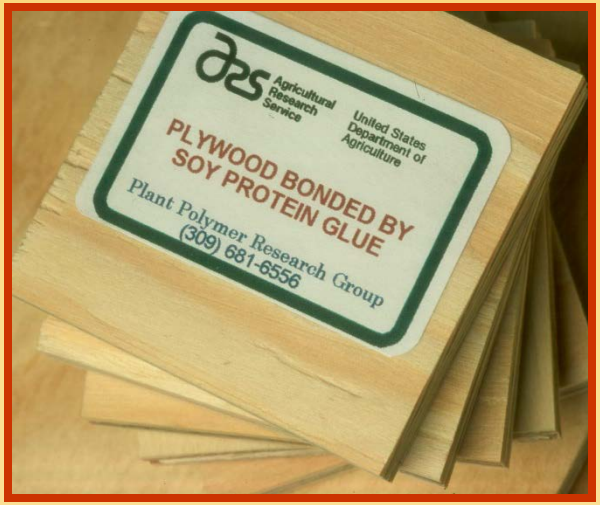
5. Water-soaking

6. Tensile strength testing

USDA ARS NCAUR Where the future is Created

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).**

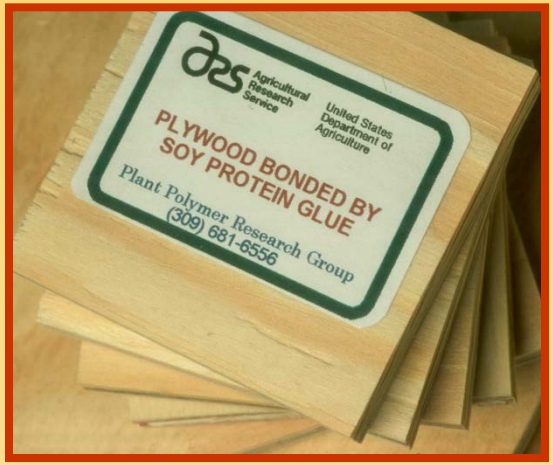


Published in J. Amer. Oil Chem. Soc. (2010) 87 (9): 1047-1052

USDA ars NCAUR Where the future is Created

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)

USDA ars NCAUR Where the future is Created

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)