CHIMAR

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ENVIRONMENTALLY-FRIENDLY ADHESIVES FOR WOOD PRODUCTS USED IN CONSTRUCTION APPLICATIONS

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Objective

- The main objective of this work was to develop environmentally-friendly, sustainable adhesive systems, capable of setting in cold pressing conditions, for the manufacture of engineered wood products (mainly glulam), to replace synthetic adhesives made from petrochemicals.

Aim

- Reduce the demand on fossil fuels and promote sustainable development by using renewable raw materials for adhesives
- Develop adhesives with the same or even enhanced bonding quality over conventional ones
- Provide safe, emission-free wood products
- Offer cost –effective solutions to the adhesive and wood panel industry

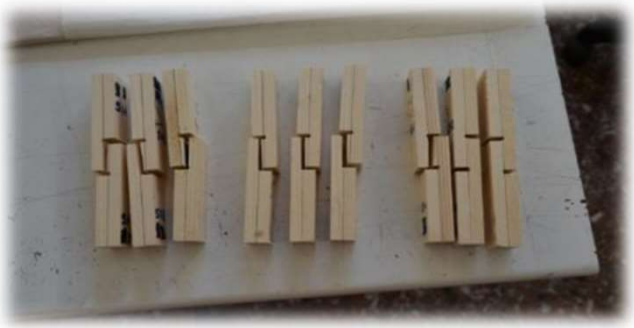
Experimental part (1/2)

Various bio-based adhesive systems, containing lignin or tannin, and hardeners, fillers and/or cross-linkers, as well, were tested in CHIMAR's lab in the production of 3-layer plywood. A phenol-formaldehyde-lignin (PFL) resin, with lignin replacing 50% of phenol, seemed to be the most promising.

Experimental part (2/2)

In continuation to this work, the types of engineered wood products, tested with the PFL resin and a hardener produced based on CHIMAR's technology, were:

- 2- and 3-lumber laminated timber (PF vs. PFL)
- 3-layer Glued laminated timber (Glulam) (MUF vs. PFL)
- 4-layer Glued laminated timber (Glulam) (PUR vs. PFL)



***Picture 1**: Laminated timber assembling*

***Picture 2**: Testing of 3-lumber specimens, 100% wood failure*

***Picture 1**: Spread PFL glue mixture on beam*

***Picture 1**: PFL-bonded glulam*

Results

***Table 1**: Pilot laminated timber testing results*

Adhesive system	PF-hardener	PFL-hardener
Shear strength, N/mm2	4.2	4.0
MOR, N/mm2	85	78
Wood failure, %	100	88
Breaking point	Wood	Wood
Formaldehyde release, mg/m2h	0.80	0.33

***Table 2**: Industrial glulam testing results (winter)*

Adhesive system	MUF-hardener	PFL-hardener
MOR, N/mm2	85	78
Wood failure, %	100	88

***Table 3**: Industrial glulam testing results (summer), Spain*

Adhesive system	MUF-hardener	PFL-hardener
MOR, N/mm2	50	61

***Table 4**: Industrial glulam testing results (summer), UK*

Adhesive system	PUR	PFL
MOR, N/mm2	50	61

Conclusions

This new lignin-based gluing system cures at room temperature within only a few hours and can be effectively used in the production of glulam beams and columns with a performance comparable to the products produced with conventional gluing systems.

Thank you!