



Chimar Hellas S.A.



BIO-RESINS FOR THE PRODUCTION OF COMPOSITE WOOD PANELS

Eleftheria Athanassiadou

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Structure of the presentation

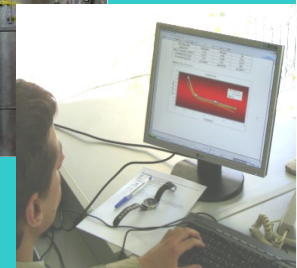
- ❖ Profile of CHIMAR activities
- ❖ Composite wood panels-definitions, applications
- ❖ Formaldehyde-based resins
- ❖ Panel and resin market data
- ❖ CHIMAR research activities in bio-derived resins (resins from renewable resources)



CHIMAR HELLAS Profile



- ❖ **Global technology provider** for the resin & panel industries
- ❖ **Formaldehyde resins, resin additives, processes:** technology licensing, manufacturing support
- ❖ **Turnkey plants:** formaldehyde, UFC, resins, additives
- ❖ **Research & Development**
- ❖ **Training**
- ❖ **Technical support** remotely & on-site

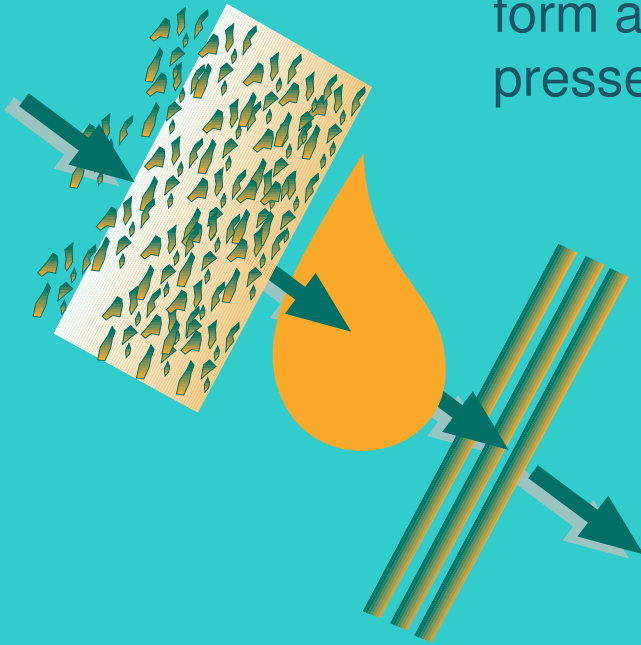




Composite wood panels

Particleboard (PB), Medium Density Fibreboard (MDF),
Oriented Strand Board (OSB), Plywood (PW)

Wood particles/fibres/strands or veneers are mixed/coated with a mix of resin and additives to form a composite mat. The composite mat is hot-pressed to form a panel.





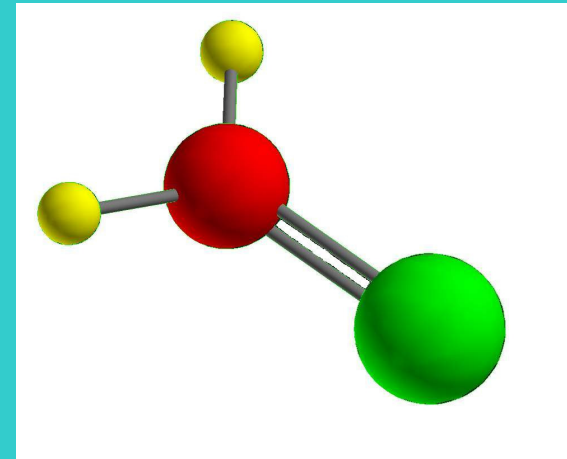
Applications of composite wood panels

The panels are employed as house construction materials or furniture elements



Formaldehyde-based resins

- ❖ An important type of wood adhesives in terms of performance, applicability and cost
- ❖ Thermosetting polymers, poly-condensation products based on:
 - Formaldehyde (F)
 - Urea (U)
 - Melamine (M)
 - Phenol (P)





Market data I

Wood-based panels market in the EU-25 (2004 data)*

Panel type	Production m ³	Imports m ³	Exports m ³
Particleboard	38,554,910	10,396,403	13,881,705
MDF	10,886,155	3,682,049	6,895,050
Plywood	4,048,702	6,210,223	3,583,400
Wood-based panels	57,322,516	25,327,610	28,329,648

*Source: FAOSTAT database





Market data II

Global wood-based panels production (2004 data)*

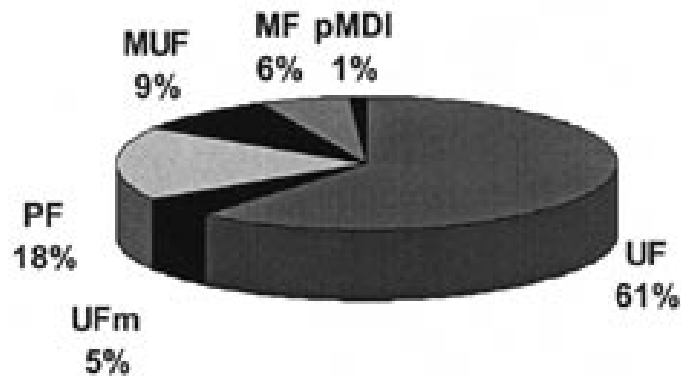
Panel type	Production m ³
Particleboard	96,267,970
MDF	38,061,075
Plywood	68,067,087
Wood-based panels	224,929,155

*Source: FAOSTAT database



Market data III

Volume:
Total 13.3 million tonnes (wood binders)



Value: Total US\$6.1 billion

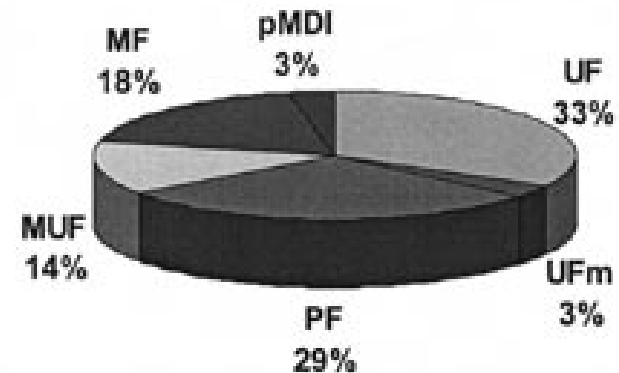


Figure 2. Global wood adhesive resin market: volume and value perspective (2001).
(UF = urea formaldehyde; MF = melamine-formaldehyde;
PF = phenol-formaldehyde; MUF = melamine-urea-formaldehyde;
pMDI = polymeric methylene diphenyl diisocyanate; UFm = <5% MF;
MUF = >10% MF).

Source: Westermeyer 2002





Market data IV

Formaldehyde-resins use in wood-based panels*

	Million tons of liquid resin
World	15.00
Europe	6.00
• UF	80%
• PF	5%
• MUF/MUPF	10%

*Source: Dunky 2005





CHIMAR Research Objectives

- Environmentally friendly adhesive resins for the wood panel industry
- Same or enhanced performance of the new resins as compared to the conventional ones
- Low cost resin products for the wood panel manufacture





Petrochemicals versus biomass chemicals

- ❖ All current resin raw materials are derived from oil or natural gas - limited long-term availability
- ❖ Resin prices highly affected by price fluctuations of oil and natural gas
- ❖ Biomass as a source of chemicals and energy reduces CO₂ emissions
- ❖ Use of resin raw materials derived from renewable biomass helps to reduce the demand on fossil fuels and to promote sustainable development



CHIMAR R&D on panel resins from renewable resources

Resins derived from natural products or by-products:

- Tannin
- Lignin
- Cellulose
- Spent pulping liquor from paper production
- Biomass pyrolysis oil (bio-oil) and its fractions
- Extraction/liquefaction products of agricultural and forestry residues (cashew nut shell liquid (CNSL), liquefied wood, liquefied olive stones, vinasse)
- Starch
- Proteins (soy)





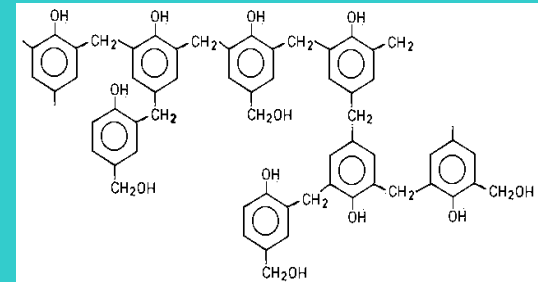
CHIMAR specific research areas

- ❖ Phenol-Formaldehyde resins with partial substitution of phenol by natural materials
- ❖ Urea-formaldehyde resins with natural products as additives
- ❖ Totally natural resins
- ❖ Achievements at the laboratory, pilot and industrial scale





PF resins with partial substitution of phenol by natural materials - I



Laboratory/experimental scale

- ❖ 75% phenol replacement by liquefied olive stone in plywood production
- ❖ 50% phenol replacement by lignin in particleboard production
- ❖ 30% phenol replacement by tannin in plywood production
- ❖ 25% phenol replacement by soy in plywood production





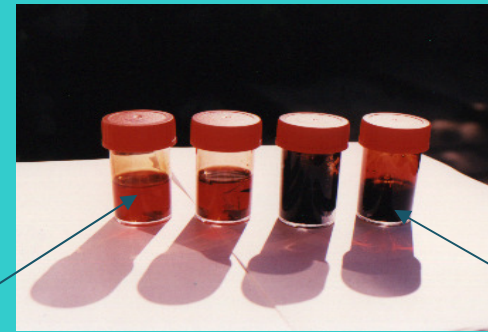
PF resins with partial substitution of phenol by natural materials - II

Pilot scale

- ❖ 50% phenol replacement by wood pyrolysis oil in Oriented Strand Board (OSB) production



Standard PF



Bio-oil-PF





PF resins with partial substitution of phenol by natural materials - III

Industry scale

- ❖ 50% phenol replacement by liquefied olive stone in plywood production
- ❖ 40% phenol replacement by wood pyrolysis oil in OSB production
- ❖ 20% phenol replacement by wood pyrolysis oil in plywood production
- ❖ 20% phenol replacement by tannin in plywood production



Industrial plywood





Urea-formaldehyde resins with natural products as additives

Laboratory/experimental scale

- ❖ Addition of soy protein in UF resin for particleboard production
- ❖ Enhanced resin performance – improved board properties

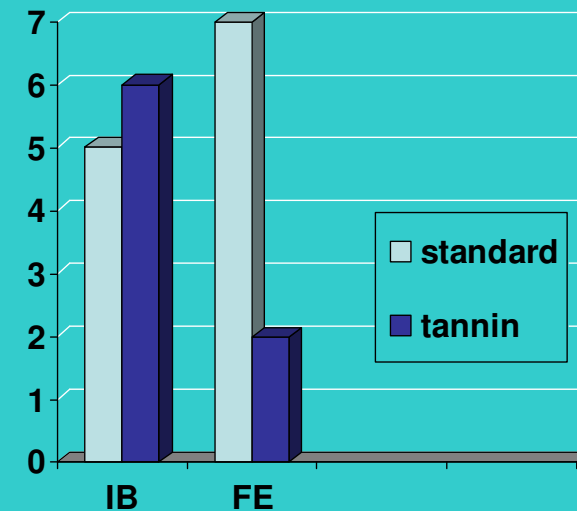




Totally natural resins

Laboratory/experimental scale

- ❖ Tannin resin with catalyst/hardener as an alternative to UF resin for particleboard production
- ❖ Enhanced resin performance – improved board properties





Ongoing R&D on resins from renewable resources

- Increase of substitution levels
- Enhancement of resin performance
- Evaluation of further natural products (e.g. with self adhesive properties like mastic gum)
- Research on additives (resin catalysts, cross-linkers, surfactants)
- Participation in collaborative RTD projects





Conclusion

- ❖ **CHIMAR HELLAS** continuously evaluates the option of “green” wood adhesives focusing either on the replacement of petrochemical raw materials by others of natural origin or on the development of totally natural binder systems.
- ❖ The aim is to provide feasible and cost effective resin solutions based on regional plant species in each continent.
- ❖ This research paves the way for the development and commercial adoption of natural resins for wood products, offering significant competitive advantage to the resin and panel industries and helping to increase the positive environmental impact.





31 years expertise in more than 36 countries





Chimar Hellas S.A.



Thank you

ELEFThERIA ATHANASSIADOU
Head of R&D Support Dept

Address: Sofouli 88, 55131 Thessaloniki, GREECE

Phone: +30-2310424167, Fax: +30-2310424149

e-mail: eathan@ari.gr, www.chimar-hellas.com