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"GREEN PRODUCTS FROM AGRICULTURAL WASTE BIOMASS FOR THE WOOD-BASED PANELS INDUSTRY"

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CHIMAR is an innovating R&D SME, located in Thessaloniki, Greece, which develops and provides competitive chemical technology, R&D and engineering services to the adhesive resin and wood-based panel industries all around the world.



CHIMAR HELLAS summary of activities

CORE Business

- **1** Development & Application of Industrial Technology for Binders & Additives
- 2 Engineering Services & Equipment Supply for resin plants
- 3 Technical Support & Training Services for resin & panel manufacturers
- 4 **R&D** Services for 3rd parties
- 5 Participation in National and EU funded research projects

Specialty SERVICES

- **1** Chemicals production upon request
- 2 Accredited testing (EN 17025)
- 3 Resin, Additives & Board testing and evaluation
- 4 Equipment Representation

Established relationship with over 10% of global WBP production



CHIMAR in figures

- <u>Since 1977</u> with presence in <u>40+ countries</u>
- Know-how applied in <u>100+ industrial sites</u>
- Over <u>1.4 Million Tons/year of resin</u> produced by customers under CHIMAR technology
- Over <u>10% of global wood panel production</u> uses CHIMAR services (PB & MDF)
- Engineering/Procurement of more than 15 turn-key formaldehyde & resin plants worldwide
- <u>Over 20 patent families in >50 countries</u>
- Participation in <u>60+ EU funded projects & scientific networks</u>
- Strong team of 32 highly motivated experts
- Customers follow CHIMAR <u>since the company's day 1</u>





CHIMAR: renewable materials portfolio

CHIMAR R&D projects for:

	Lignin	Tannin	
Extracting the binding potential of biopolymers and biomass-derived chemicals like:	Starch	Glycerin	
	Nano-/micro- fibrillated cellulose	Proteins	
	CNSL	Oils	
	Bio-based Esters	Liquefied biomass	
	Sugars/Saccharides	Biomass Pyrolysis heavy and light fractions	
	Textiles biorefinery fractions	Biomass Torrefaction liquid fractions	
Developing Novel Composites such as:	 Boards from Annual Plant Residues (Fibers or Chips) e.g. Lightweight panels, Torrefied wood Panels from Recycled Materials 		



Highlights of CHIMAR technologies with renewable raw materials

Replacement of petrochemical phenol in PF resins

	Production		
	Industrial	Pilot	Panel type
Materials	Phenol substitution level, %		
Lignin	50	50	Plywood
Wood pyrolysis bio-oil	40	50	OSB
Tannin	30		Plywood
Liquefied olive stone	50		Plywood



Nano Fibrillated Cellulose (NFC)



NFC in Formaldehyde based resins, can reduce the formaldehyde emissions of the panels and
Under specific conditions of resin synthesis, application and panel production, it can improve water resistance and mechanical properties



O.P. Competitiveness and Entrepreneurship (EPAN II), ROP Macedonia - Thrace, ROP Crete and Aegean Islands, ROP Thessaly - Mainland Greece - Epirus, ROP Attica

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The project is co-funded by the National Strategic Reference Framework (NSRF) Programme, the European Regional Development Fund and the participating enterprises.



CNSL as phenol substitute in PF resins

- <u>Cashews Nut shell liquid</u> (CNSL) → A liquid derived from the fruit of cashew tree (*Anacardium Occidentale L*.)
- CNSL has been used for phenol replacement in the synthesis of phenol-formaldehyde resins.
- CHIMAR has developed phenolic type thermosetting polymers by replacing phenol with CNSL up to 20%, suitable for the production of plywood panels

Standard/property tested	Unit	PW with PF resin	PW with PCF resin
EN 314.1 Shear strength Wood failure	MPa %	1.04 74	1.08 86
JIS A1460-desiccators' method Free formaldehyde emissions	mg/l	0.52	0.56

E. Papadopoulou, K. Chrissafis, Thermal study of phenol-formaldehyde resin modified with cashew nut shell liquid, Thermochimica Acta 512, 105–109, 2011.



Proteins

As additive in UF resins (<1%)

- Sunflower protein as an additive in UF resins (<1% w/w)
- Particleboard panels at laboratory scale
- Improvement of internal bond of boards
- Improvement of water resistance of the produced panels

Phenol substitutions up to 20% w/w

- Sunflower protein as a substitute of phenol in Phenol-Formaldehyde resins (up to 25%)
- Plywood panels at laboratory scale
- Plywood panels with properties close to the typical ones with the reference Phenol-Formaldehyde resins



The project is co-funded by the National Strategic Reference Framework (NSRF) Programme, the European Regional Development Fund and the participating enterprises.





- <u>Alkyl pentosides</u> derived from biomass
- Non-ionic surfactants ٠
- Excellent wetting and penetrating properties ٠
- CHIMAR •
 - Blend with Urea-Formaldehyde syrup for impregnation paper to improve penetration ٠
 - Introduce in proprietary wetting agent for impregnation paper to substitute petrochemical substances
 - In both cases, improvement of foaming and wetting speed

E. Papadopoulou, A. Hatjiissaak, B. Estrine, S. Marinkovic, Novel use of biomass derived alkyl-xylosides in wetting agent for paper impregnation suitable for the wood-based industry, Eur. J. Wood Prod., 2010









Liquid derived from the olive stone residue

- Liquefaction process
- Replacement of phenols
- CHIMAR
 - Replaced phenol in Phenol-Formaldehyde resin up to 50%
 - Successfully applied the synthesized resin in industrial scale plywood production

BIOLIVE QLK5-CT-2000-00766



BIOLIVE Project was funded under the 5th Framework Programme, the European Union's Research and Innovation funding programme for 1998-2002



Waste from food and biodiesel

- Formaldehyde-free bio-based polyester polyacrylate resin
- Biodiesel residues to produce monomers (polyols) and crosslinkers.
- Reactive diluents to improve rheology
- Addition of ceramic nanoparticles to enhance performance.
- CHIMAR
 - Scale-up of the production process



wood pressed products



SMEs





ECOPRESSWOOD Project was funded under the 7th Framework Program (FP7-SME – Specific Programme "Capacities": Research for the benefit of

40+ Years / 40+ Countries



Advantages and disadvantages of bio-based panels

Advantages:

- Renewable materials
- Eco & human friendly
- Use of wastes
- Promotion of sustainable industrial development

Disadvantages:

- Generally of lower performance that synthetic resins and especially PF
- Not of constant quality which affect their performance
- Higher cost than petrochemicals and more expensive methods for their use (treatments/application conditions)
- Restricted/Local availability
- Storage instability (in some cases)



CHIMAR Licensing technology – since 1977 in 40+ countries (Indicative References)

CHIMAR communicates the bio-based innovations to its network





CHIMAR.

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