

European Good Practices in Eco-creativity, natural fibres, short value chains

WOOL4BUILD - Isolation material for eco-building based on natural wool

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SUMMARY

1. ECO-CREATIVITY AND NATURAL-BASED SOLUTIONS ARE DRIVING INNOVATION IN THE VALENCIAN TEXTILE INDUSTRY.

2. THE WOOL4BUILD PROJECT. NEEDS AND REQUIREMENTS.

3. DEVELOPMENT OF THE PROJECT AND THE WOOL-BASED PRODUCT

4. CLOSING REMARKS.

1. ECO-CREATIVITY AND NATURAL-BASED SOLUTIONS ARE DRIVING INNOVATION IN THE VALENCIAN TEXTILE INDUSTRY.

Several innovations in the Valencian textile industry are driven under some added-value concepts:

- Eco-creativity, eco-design.
- Sustainability of manufacturing processes.
- New functional materials.
- Natural-based textile materials.
- Industry 4.0.
- Revalorization of wastes.
- Raw materials from a 'km 0' supplier.



These innovations are addressed to solve and minimize some lacks:

- Technification of processes and products.
- Re-industrialization needs
- Added-value focused on 'traditional' textile products
- Use (or re-use) of natural materials and textile wastes instead of synthetic materials.

1. ECO-CREATIVITY AND NATURAL-BASED SOLUTIONS ARE DRIVING INNOVATION IN THE VALENCIAN TEXTILE INDUSTRY.

Only some examples:

Eco-creativity, eco-design.



This **Interreg MED** project (lead by Municipality of Prato, Italy) seeks to **recover and valorise the design heritage** and “making” knowledge of **Mediterranean cultures** by bringing renewed creative energy to T&C clusters and industrial districts.

Pilot testing in Valencia involves:

- Manufacturing textile companies.
- Cultural entities.
- Research entities.
- Designers, creators, artists...

1. ECO-CREATIVITY AND NATURAL-BASED SOLUTIONS ARE DRIVING INNOVATION IN THE VALENCIAN TEXTILE INDUSTRY.



Sustainability of manufacturing processes



Decoration of natural leather using laser marking



Left) PES fabric finished via nanobubbles; right) PES t-shirt marked with laser

FUN2GARMENT - New functional and sustainable finishings for fabrics and garments. This AITEX's project funded by IVACE (Valencian Funding Agency) is looking for new finishing processes based on sustainable technologies:

- **Laser marking.**
- **Ozone treatment.**
- **Nanobubbles/micronization of chemicals.**

Some functionalities and sustainable benefits (less energy, water and chemicals used) **are expected on home- and sport-textiles** finished with these new processes, as an alternative to spraying, dip-coating or padding.

1. ECO-CREATIVITY AND NATURAL-BASED SOLUTIONS ARE DRIVING INNOVATION IN THE VALENCIAN TEXTILE INDUSTRY.

New functional and natural-based textile materials



ALL4RESTgo2MARKET - Validation and commercialization of improved solutions for rest systems was a FP7 project that allowed the development and validation of:

- **mattresses with thermoregulation performance and promotion of better sleep and recovery** (ECUS SLU, Murcia),
- **pyjamas manufactured with casein or chitosan fibers** that provide benefits for the skin (RAMÓN ESPÍ SL, Valencia),
- **bedclothes** (sheets sets, bedlinen...) **manufactured with bio-fibers or functional yarns** (AZNAR TEXTIL SL, Valencia).

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New functional and natural-based textile materials



IMPROVED ISOLATION MATERIAL FOR ECO-BUILDING
BASED ON NATURAL WOOL



CIP-EIP-Eco-Innovation-2013



Co-funded by the Eco-Innovation
Initiative of the European Union



Leader:



Beneficiaries:



WOOL4BUILD - Isolation material for eco-building based on natural wool (lead by INPELSA, Valencia) was a project funded by EU's CIP-Eco-Innovation programme.

The main objective was to **develop a sustainable product for buildings isolation based on the wastes and by-products of hair and wool produced in the tannery industry**, with improved performance in the acoustic and thermal isolation and able to optimize energy efficiency and indoor air quality.

A sustainable alternative vs synthetic isolation materials available in the market.

2. THE WOOL4BUILD PROJECT. NEEDS AND REQUIREMENTS

Some **natural wastes** coming from the **processing of natural leather** were identified as a raw material 'potentially' suitable to develop nonwovens. **Valorization of tannery wastes as the main objective.**

Who **was producing** these wool-based wastes and in **which stage** of the manufacturing process?



- 40 years experience with lamb leather
- Exported around of 85% of the production
- 100 workers.
- Producing 1M pieces of leather / year

- Standard productive process

Buy raw leather



Cleaning, soaking and degreasing



Machining process



2. THE WOOL4BUILD PROJECT. NEEDS AND REQUIREMENTS

Main requirements and needs were established with the background coming from technical data of common isolation materials available in the market.

Insulation material	Thermal conductivity [W/m K]
Cork	0.045
Coco	0.045
Wood fibre boards	0.045
Cellulose	0.040
Foam glas	0.040 – 0.055
Rock wool	0.035 – 0.040
Fibre glas	0.035 – 0.040
Extruded polystyrene	0.035 – 0.040
Expanded polystyrene	0.035 – 0.040
Polyurethane boards	0.025 – 0.035
Perlite	0.055 – 0.070

Material	Thickness (mm)	Density (Kg/m ³)	Acoustic abs. (α_w)
Polyester wool	40	11	0.35
Polyester wool	20	20	0.30
Light foam	16		0.35
Plastic foam	25		0.30
Mineral wool	50	80	0.85
Glass wool	50	40	0.50
Rock wool	30	100	0.70

Processing needs:

- Study physical characteristics of wool waste.
- Prepare wool waste (washing and drying).
- Carding + consolidation of the NW.
- Wool-based nonwoven to be treated for moth and flame resistance.
- Study thermal/acoustic properties.
- Study how to cut and packing it.

Wool waste



Wool Insulating material



3. DEVELOPMENT OF THE PROJECT AND THE WOOL-BASED PRODUCT.

From the wide analysis of current solutions available in the market, the R&D partnership defined the desirable features of the new WOOL4BUILD material.

WOOL 4 BUILD PROPERTIES (50mm)						
THERMAL	ACOUSTICS		MOISTURE			FIRE
Conductivity (w/mk)	Air flow resistance (Kpa s/m ²)	Acoustic absorption α_w	Humidity absorption (kg/m ²)	Humidity absorption immersion (%VOL)	Moisture transmission m	Fire reaction classification
< 0,035	>5	>0,7	<1	<3	>2	E

Size of panels (for wall covering purposes) should be:

- 400 – 600 mm (width).
- 1200 – 1350 mm (high).
- Around 50 mm (thickness).

3. DEVELOPMENT OF THE PROJECT AND THE WOOL-BASED PRODUCT.

The **tannery wool-based waste**, coming from mechanical processes of the manufacturing leather section of INPELSA was, then, **soaked and washed properly** in order to achieve an optimal cleaning level of the wool waste for further processing steps (carding / needlepunching and application of moth- and flameproof chemicals).

Different types of soaking baths using bactericides, fungicides, degreasing agents, etc. were considered for cleaning wool.



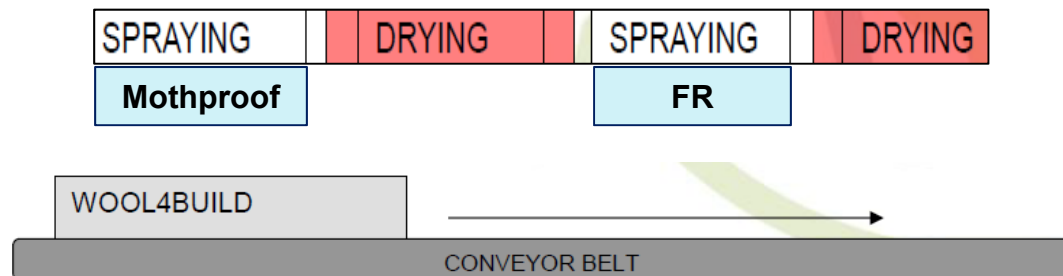
Raw material for nonwoven development (needlepunch), using a small quantity of PES fibers for thermobonding.



- High production speed (up to 150 m/min).
- It allows the use of recycled material.
- Fiber count ranging from 1 - 200 dtex.
- Products could be developed in the range of 30 - 3000 g/m².

3. DEVELOPMENT OF THE PROJECT AND THE WOOL-BASED PRODUCT.

The **wool-based nonwoven was functionalized** in order to protect it against moths/insects and fire risks. The selected system was the **application of both mothproof and fireproof (FR) products** in the same process, using 2 different spraying cabins and 2 drying ovens.



Moth and insect finishes:

Products based on permethrin are very effective against moth larvae, dust-mites and some insects (incl. mosquitoes)

FR finishes:

Wool has an intrinsic flame retardant performance, but the addition of FRs enhances this property. N+P inorganic salts could provide good protection against flames.

3. DEVELOPMENT OF THE PROJECT AND THE WOOL-BASED PRODUCT.

Last steps were not only the **validation** of the isolation properties, but also the installation and testing of the wool-based panels in a **real environment**.



3. DEVELOPMENT OF THE PROJECT AND THE WOOL-BASED PRODUCT.

The **validation of the W4B product** was done in comparison with a **mineral wool, MW** (common isolation material). Thermal flow/conductivity was monitored in several pilots (North of Spain, Basque Country) using heat sensors, and acoustic isolation properties were also assessed.



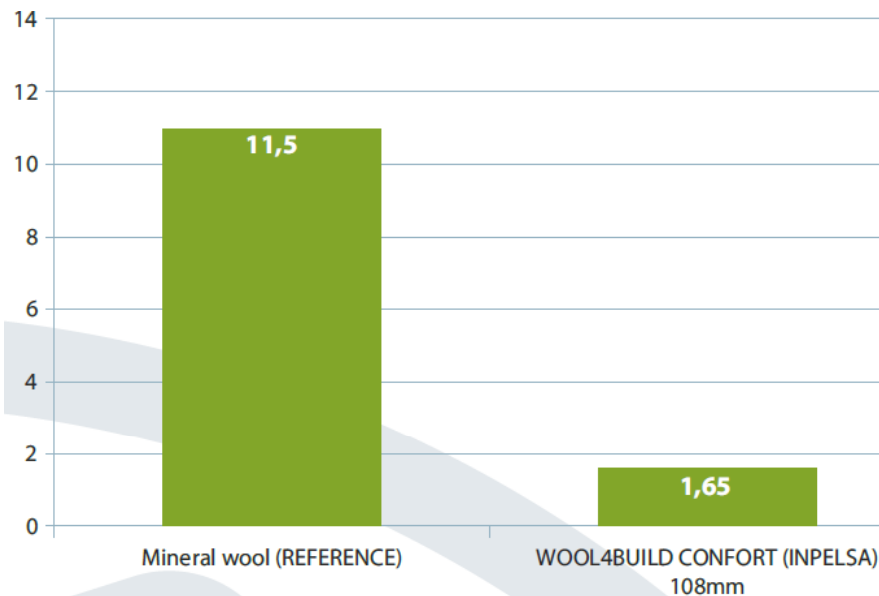
	Thermal conductivity (units: W/m2.K)	
	W4B	MW
PAMPLONA - SARRIGUREN	0,033	0,05
VITORIA	0,037	0,06
BILBAO	0,017	0,032

TEST	STANDARD	WOOL4BUILD CONFORT	WOOL4BUILD PREMIUM
Measurement of Acoustic Flow Resistance	Method of Ingard-Deary	9,3 kPa·s/m ²	8,3kPa·s/m ²
Weighted acoustic absorption coefficient	EN ISO 11654:1998 European Standard	α_w 0,65 Class C	α_w 0,75 Class C
	DB-HR (CTE) Spanish normative	α_{medio} 0,75	α_{medio} 0,88

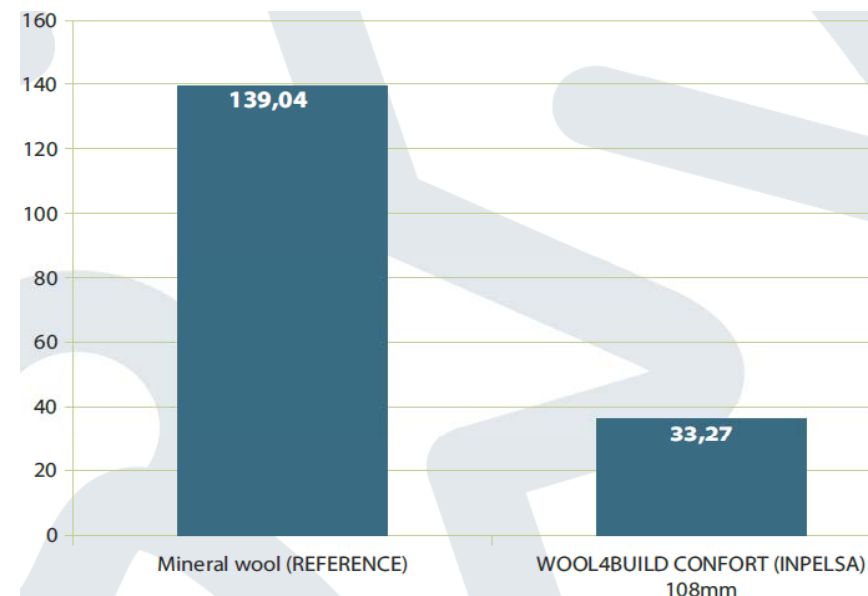
3. DEVELOPMENT OF THE PROJECT AND THE WOOL-BASED PRODUCT.

And... what about **sustainability issues**?

WOOL4BUILD product was also assessed in terms of 'global warming' and primary energy demand, through a Life Cycle Analysis: **positive balance**.



GWP 100yr of W4B product vs mineral wool (kg CO2eq/F.U)



Primary energy demand of W4B product vs mineral wool (MJ/F.U)

4. CLOSING REMARKS.

- WOOL4BUILD is a **natural wool insulation material** with high thermal and acoustic isolation performance.
- The sheep wool used to manufacture WOOL4BUILD product is **100% recycled wool** and, even, after its life-cycle **can be reclaimed** from the demolition of a building where it had been installed-in **and reused to make new panels**. This also reduces wastes coming from buildings.
- The **high performance of the thermal & acoustic properties** of these insulation product increases the comfort at home and reduces the energy consumption. Thermal and acoustic properties were **improved up to 10% in comparison with similar isolation products**.

4. CLOSING REMARKS.

- The manufacture of WOOL4BUILD panels **reduces no less than 80% the global warming potential** at 100yrs, and **only require 25% of the energy used to manufacture other synthetic insulation materials** such as rockwool or glass fibre.
- The successful completion of the project has produced the **valorization of the wool waste** generated in the tannery company **up to 60%.**
- Being a 100% natural product, sheep wool represents **no health risk during installation or over the course of time.**
- In according to these satisfactory results, the coordinator of the project (INPELSA) has decided to introduced **WOOL4BUILD products in the Spanish market** of insulation materials for building constructions.

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