WET-LAIĐ TECHNOLOGY IMPLEMENTATION IN REVALORIZATION OF SOLID WASTES GENERATED IN URBAN OR INDUSTRIAL ENVIRONMENTS.
- ATHENS 2014 -

Research Group on Materials and Sustainability
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AITEX – A non-profit Technological Institute created in 1985, whose main objective is to improve competitiveness of companies, encouraging modernization measures, the introduction of new technologies and improving the quality of the companies and their products.

Aitex Headquarters, Alcoy (Spain)

2008: Aitex technical offices located in 3 countries
2012: Aitex technical offices located in 9 countries

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Transfer of knowledge and technologies for textile solutions in the following spheres of application:

- Textile Architecture
- Geotextiles
- Aeronautical Industry
- Medical and Hospital Products
- Public Transport
- Telemedicine and Domotics
- Clothing
- Protective Clothing
- Sports Surfaces
- Hygiene and Cosmetics
- Fashion
- Habitat
- Civil Engineering
- Sport and Leisure
- Automotive Industry
- Textile Value Chain
R & D – WET-LAID TECHNOLOGY

1. BASIS OF WET-LAID TECHNOLOGY

2. EXPERTISE IN BIOCOMPOSITES DEVELOPMENT

3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

4. CONCLUSIONS

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Wet-laid technology is based on a nonwoven production process in which the textile fibres are suspended in an aqueous medium, and are then deposited on a conveyor belt that carries the nonwoven sheet to the consolidation station.
1. BASIS OF WET-LAIĐ TECHNOLOGY

FIBRES PREPARATION

FIBRE PRE-DISPERSION

FEEDING TANK

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1. BASIS OF WET-LAID TECHNOLOGY
1. BASIS OF WET-LAI D TECHNOLOGY

NONWOVEN CONSOLIDATION

THERMAL CONSOLIDATION

The bonds between the fibers of the nonwoven are generated by the action of the temperature inside the drying module, through the fusion of the thermo-melting fibres in the veil.
1. BASIS OF WET-LAID TECHNOLOGY

FINISHING OF NONWOVEN: CALENDERING

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1. BASIS OF WET-LAIĐ TECHNOLOGY

NATURAL FIBRES
- COCONUT
- FLAX
- HEMP
- COTTON

TECHNICAL FIBRES
- CARBON
- ARAMID
- BASALT
- METALLIC
- FIBERGLASS

ORGANIC WASTES
- SEAWeed
- RICE HULLS

TEXTILE WASTES

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2. EXPERTISE IN BIOCOMPOSITES DEVELOPMENT

WET-LAID + COMPRESSION MOULDING

WET-LAID + INJECTION MOULDING

PRESSURE

TEMPERATURE

PRESSURE

TEMPERATURE

WET-LAID NONWOVEN

FOAM

WET-LAID NONWOVEN

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3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

This work is part of the project 2011 LIFE11 ENV/E/000600: SEAMATTER—“Revalorization of coastal algae wastes in textile nonwoven industry with applications in building noise isolation” funded by the LIFE+ programme.

CLEANING, DRYING AND CRUSHING

DEVELOPMENT OF NONWOVENS

WET LAID TECHNOLOGY

CHARACTERIZATION OF NONWOVENS

DEVELOPMENT OF BIOCOMPOSITES

PRESS MOULDING TECHNOLOGY

INJECTION MOULDING TECHNOLOGY

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3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

WET-LAIĐ NONWOVEN BASED ON POSIDONIA ALGAE WASTES

POSIDONIA ALGAE WASTES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
<th>Average length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Fine grain Posidonia</td>
<td>1 mm</td>
</tr>
<tr>
<td>G2</td>
<td>Medium-grain Posidonia</td>
<td>1,4 mm</td>
</tr>
<tr>
<td>G3</td>
<td>Coarse-grain Posidonia</td>
<td>4,40 mm</td>
</tr>
</tbody>
</table>

FIBRES

<table>
<thead>
<tr>
<th>Property</th>
<th>Lyocell Fibre</th>
<th>PLA Fibre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut length (mm)</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Fibre coarseness</td>
<td>1,7 dtex</td>
<td>1,3 dpf</td>
</tr>
<tr>
<td>Melting point (°C)</td>
<td>---</td>
<td>168/170</td>
</tr>
<tr>
<td>Degradation point (°C)</td>
<td>190</td>
<td>---</td>
</tr>
</tbody>
</table>

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3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

WET-LAID NONWOVEN BASED ON POSIDONIA ALGAE WASTES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Material</th>
<th>Composition % (p/p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSWS-G1</td>
<td>Posidonia oceanica waste fibre G1</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Lyocell fibre</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>PLA fibre</td>
<td>10</td>
</tr>
<tr>
<td>POSWS-G2</td>
<td>Posidonia oceanica waste fibre G2</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Lyocell fibre</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>PLA fibre</td>
<td>10</td>
</tr>
<tr>
<td>POSWS-G3</td>
<td>Posidonia oceanica waste fibre G3</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Lyocell fibre</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>PLA fibre</td>
<td>10</td>
</tr>
</tbody>
</table>

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3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

CHARACTERIZATION OF WET LAID NONWOVENS

MECHANICAL PROPERTIES

ISO 29073-3:1993


Dynamometer
3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

CHARACTERIZATION OF WET LAID NONWOVENS

MECHANICAL PROPERTIES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Direction</th>
<th>Tensile Strength (N)</th>
<th>Elongation at break (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSWS-G1</td>
<td>Lengthwise</td>
<td>63</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Crosswise</td>
<td>30</td>
<td>2.8</td>
</tr>
<tr>
<td>POSWS-G2</td>
<td>Lengthwise</td>
<td>79</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>Crosswise</td>
<td>51</td>
<td>5.4</td>
</tr>
<tr>
<td>POSWS-G3</td>
<td>Lengthwise</td>
<td>30</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>Crosswise</td>
<td>27</td>
<td>3.2</td>
</tr>
</tbody>
</table>

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CHARACTERIZATION OF WET LAID NONWOVENS

ACOUSTIC PROPERTIES

UNE-EN ISO 10534-2:2002

Sound Absorption coefficient in normal incidence ($\alpha$)

$$\alpha = \frac{E_{absorbed}}{E_{incident}}$$

$0 \leq \alpha \leq 1$

$\alpha$ close to 0 = worse sound absorbent material

$\alpha$ close to 1 = better sound absorbent material

Impedance Tube (Kundt Tube)

Low Frequencies
50 Hz to 1,6 kHz

High Frequencies
500 Hz to 6,4 kHz

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CHARACTERIZATION OF WET LAID NONWOVENS

ACOUSTIC PROPERTIES

![Graph showing normal incidence sound absorption coefficient vs. frequency](image)

**Normal incidence sound absorption coefficient vs. frequency**

- POSW5-G1 (1 LAYER)
- POSW5-G2 (1 LAYER)
- POSW5-G3 (1 LAYER)

**Graph Details**
- Y-axis: Normal incidence sound absorption coefficient ($\alpha$)
- X-axis: Frequency (Hz)

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CHARACTERIZATION OF WET LAID NONWOVENS

ACOUSTIC PROPERTIES

Normal incidence sound absorption coefficient vs. frequency

![Graph showing normal incidence sound absorption coefficient vs. frequency for different samples.

- POSWS-G1 (10 LAYERS)
- POSWS-G2 (10 LAYERS)
- POSWS-G3 (10 LAYERS)

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BIOCOMPOSITE BASED ON POSIDONIA ALGAE WASTES

PRESS MOULDING TECHNOLOGY

<table>
<thead>
<tr>
<th>Pressure</th>
<th>8 Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>165°C</td>
</tr>
<tr>
<td>Time</td>
<td>10 min</td>
</tr>
</tbody>
</table>
3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

BIOCOMPOSITE BASED ON POSIDONIA ALGAE WASTES

PRESS MOULDING TECHNOLOGY

POSWS-G1  POSWS-G2  POSWS-G3

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3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

BIOCOMPOSITE BASED ON POSIDONIA ALGAE WASTES

INJECTION MOULDING TECHNOLOGY

<table>
<thead>
<tr>
<th>Cure time</th>
<th>10 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cure Temperature</td>
<td>Ambient Temperature</td>
</tr>
</tbody>
</table>

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3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

BIOCOMPOSITE BASED ON POSIDONIA ALGAE WASTES

INJECTION MOULDING TECHNOLOGY

POSWS-G1

POSWS-G2

POSWS-G3
3. BIOCOMPOSITES BASED ON POSIDONIA ALGAE WASTES

AGROINDUSTRIAL & NATURAL WASTES PROJECTS

- Posidonia Algae WASTES
- Textile WASTES
- Rice husks WASTES

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4. CONCLUSIONS

1. Wet-laid technology allows to obtain technical non-wovens suitable to be implemented in composites manufacturing by means of compression and injection moulding techniques.

2. Very short fibres or even powder materials can be processed using wet-laid technology in order to obtain technical non-wovens.

3. Natural wastes find a huge variety of applications in technical non-wovens development. It is important to identify the optimum binder agent (thermoplastic material to improve the mechanical properties of the non-woven). In addition, chemical treatments with compatibilizing agents could enhance the mechanical properties of non-wovens and subsequent composites obtained based on them.

4. Non-wovens and composites based on natural wastes can be successfully applied as acoustic insulation systems. Anyway, fire retardant treatments should be implemented in these ecological building products.
Centre for research, innovation and advanced technical services for textile, clothing and technical textiles sectors.

THANKS FOR YOUR ATTENTION

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