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European Good Practices in New materials and new applications

Use of algae wastes to develop nonwovens and composite materials

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"New materials and new applications"
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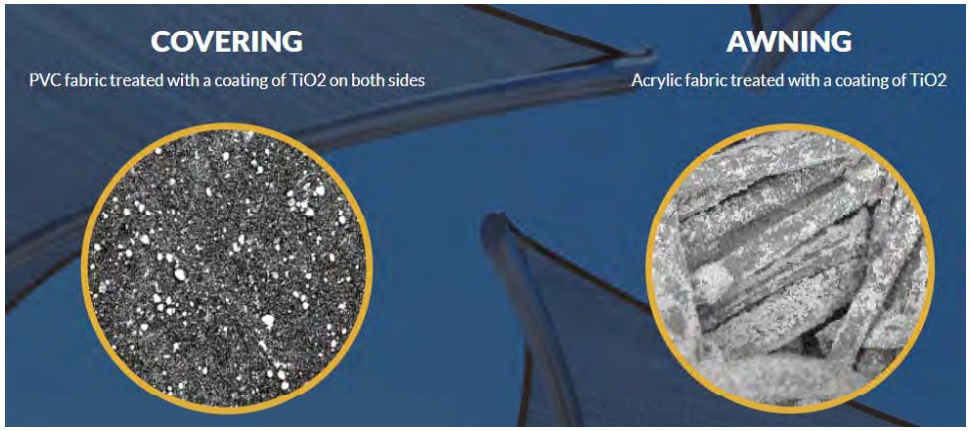
SUMMARY

1. INTRODUCTION: SOME EXAMPLES OF THE RESEARCH ON NEW MATERIALS CARRIED OUT BY VALENCIAN TEXTILE COMPANIES

- Additives and new functionalities on end-products (e.g. TiO2).
- Use of new/functional bio- and synthetic fibers.
- Metallic yarns for heating purposes.
- Minerals for textile finishing.
- Sustainable chemicals for textile finishing.
- Hotmelt adhesives for textile bonding.
- RFID tags/antennas for tracking of goods.



Fabrics with photocatalytic activity help decontamination of urban environments (Photocitytex project)

1. INTRODUCTION: SOME EXAMPLES OF THE RESEARCH ON NEW MATERIALS CARRIED OUT BY VALENCIAN TEXTILE COMPANIES

Mineral-based finishing for odour reduction on garments

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.

Zeolites are included as a part of a finishing recipe for functionalization of garments. This textile finishing is **applied by micronization** (water + chemical savings). **Less odour perceived (artificial sweat) on treated garments: up to 80%.**

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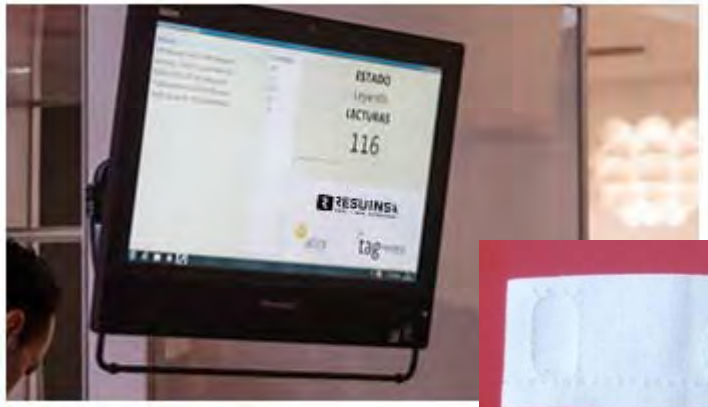
RFID tags/antennas for tracking of goods.



Radio Frequency Identification **(RFID) tags** were **implemented on hotel linen goods, in order to improve tracking and industrial laundry procedures**: automatize data collection, avoid errors, reduce costs and ultimately facilitate cooperation and information exchange.

Not easy to implement in the hotel linen industry, since the textile items are subjected to extreme washing conditions at industrial laundries, making RFID implantation and label conservation more difficult.

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2. PROBLEM TO BE SOLVED AND POTENTIAL OF ALGAE WASTES AS NEW 'RAW MATERIAL' FOR TEXTILE PRODUCTS

Algae and seaweed accumulations on beaches and along coasts (mainly Mediterranean but also from other EU zones) are an **environmental problem**; this biomass releases unpleasant odours, promotes mosquitoes and their rotting contribute to increase the mortality of some species living in the sea/coast, as they turn into rubbish.

Sand is also removed when algae wastes are collected so, year by year, the beach goes back and must be regenerated releasing new sand.

The most widely adopted practice is to leave the algae wastes in the coasts in winter and collect them before summer.

The marine accumulations are managed as urban solid wastes and are deposited in a landfill and/or incinerated.

2. PROBLEM TO BE SOLVED AND POTENTIAL OF ALGAE WASTES AS NEW 'RAW MATERIAL' FOR TEXTILE PRODUCTS

Anyway, **some aquatic plants** like Posidonia **are like terrestrial plants**. And **can be processed** in order **to fiberize** and take profit from them.

This GP (developed through the LIFE+ SEAMATTER project) **intends to solve the environmental problem** of the vegetal, algae and seaweed accumulation in the coastal while validating the best collection and transport management method for these natural wastes. They find **application in non-woven textile industry as 'raw materials'** derived from marine biomass, for a further use on **sustainable textile reinforcement and composite goods**, specifically as acoustic panels in buildings.

Who are the **main stakeholders and beneficiaries of the practice**?
Public institutions responsible of management of public places (beaches), City councils, textile recycling and emerging companies, people/tourists.

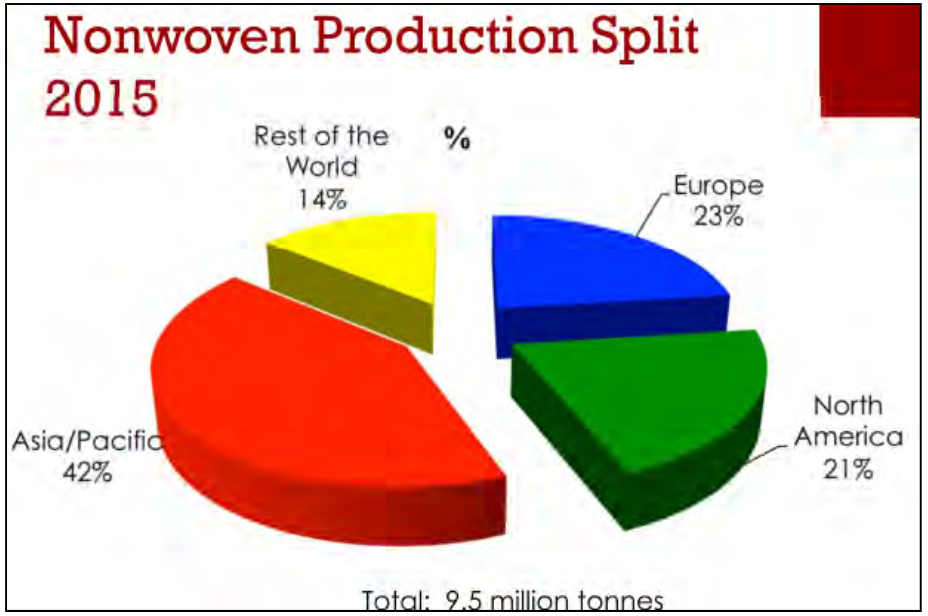
3. NONWOVEN MANUFACTURING TECHNOLOGIES: WET-LAID

Nonwoven manufacturing is a growing worldwide market due to the different end-applications they are involved. Growth in Europe is mainly driven by:

- Nonwoven production, growth rate of 60% over the past decade.
- Composites applications, growth rate of 75% over the past decade.

The key processes to manufacture nonwovens are:

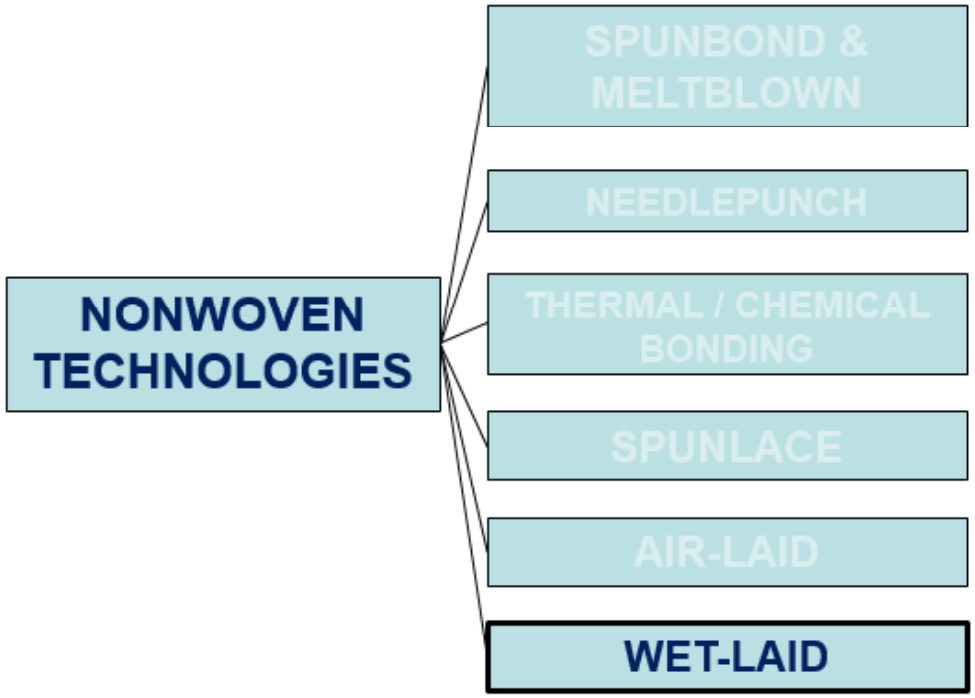
- Spunbond + meltblown.
- Needlepunch.
- Thermal or chemical bond.
- Spunlace / hydroentanglement.
- Air-laid.
- **Wet-laid.**

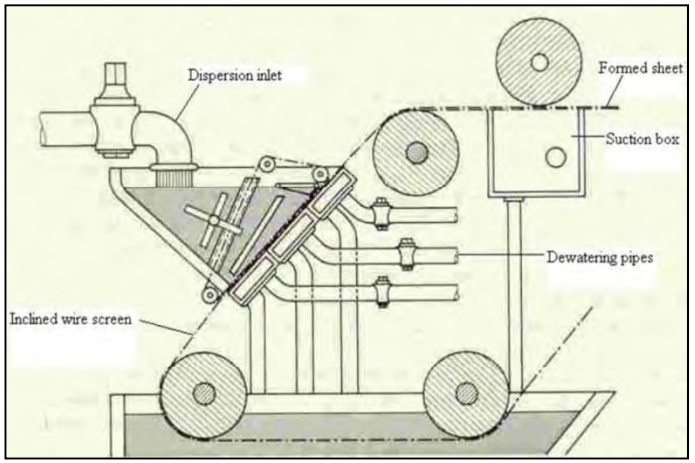


Data taken from KELLIE SOLUTIONS.

3. NONWOVEN MANUFACTURING TECHNOLOGIES: WET-LAID

It's **a modified paper-making process**. Main steps: 1) **Swelling and dispersion of the fiber** in water and transport of the suspension on a conveyor belt; 2) Continuous **web formation** on the belt as a result of water filtration; 3) **Drying/bonding of the web.** Water is re-circulated along the system.





- **Innovative technology (5 - 10% of NWs).**
- **Usually 2 - 30 mm fibers are used.**
- **Bonding by hot calender or chemicals.**
- **Composites, reinforcement materials…**
- **Roofing felts, filters, insulating uses…**
- **Sanitary and hygiene applications.**

4. DEVELOPMENT OF THE GOOD PRACTICE

Partners involved:

- AITEX – Textile Research Institute.
- IEL (Instituto de Ecología Litoral).
- Perugia University (Università degli Studi di Perugia Dipartimento di Ingegneria Civile ed Ambientale).
- ATEVAL (Association of Valencian Textile Companies).

Main stages of the project:

- Optimization of the method of management/deposition of algae wastes.
- Fiberizing and characterization of properties of coastal vegetal wastes.
- Development of nonwovens by wet-laid technique.
- Composites obtained through different technologies with the nonwovens.

4. DEVELOPMENT OF THE GOOD PRACTICE

Optimization of the method of management/deposition of algae wastes.

In order to define the best solution for collecting the marine wastes from the coast and to suggest techniques for transport and storage of the coastal vegetal wastes some entities which work on the management and collection of Posidonia were contacted. Methodology performed was:

- Collection from El Campello beach (Alicante).
- Washing, drying, sieving (separation of non-profitable materials).



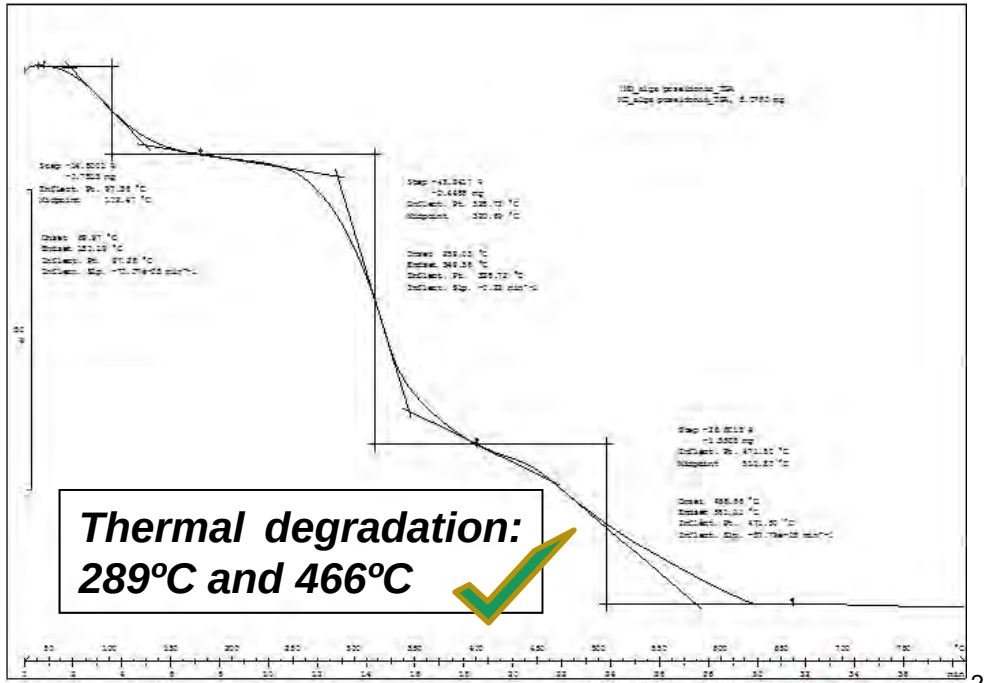
4. DEVELOPMENT OF THE GOOD PRACTICE

Fiberizing and characterization of properties of coastal vegetal wastes.

The algae wastes were fiberized and characterized to be used as raw material for wet-laid process.

Cutting device Retsch SM100. 2.5 mm length.

Different fiber sizes obtained:
<1.5 mm, 1.5 – 3 mm, 3 – 7 mm.



Thermal degradation:
289ºC and 466ºC

Lab: METTLER METTLER TOLEDO STAR^{e} System

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4. DEVELOPMENT OF THE GOOD PRACTICE

Development of nonwovens by wet-laid technique.

Algae wastes were mixed with other fibers to develop the nonwoven by wet-laid technique. PLA fibers were used for thermobonding purposes.

80% POSIDONIA OCEANICA WASTE + 10% PLA + 10% LYOCELL. 100-300 g/m2
70% POSIDONIA OCEANICA WASTE + 10% PLA + 20% P-ARAMID. 300 g/m2






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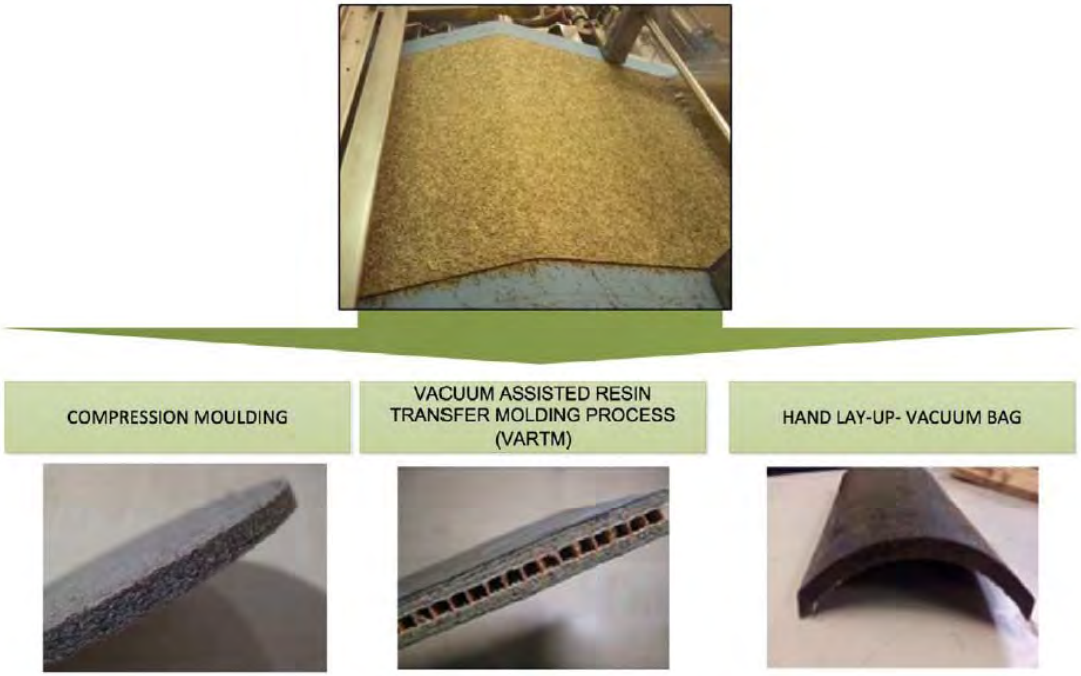
4. DEVELOPMENT OF THE GOOD PRACTICE

Composites obtained through different technologies with the nonwovens.

The wet-laid nonwovens were used as reinforcement in thermoplastic and thermosetting composites developed by:

- thermocompression moulding,
- resin infusion (VARTM) and
- manual laminating (HAND LAY-UP and VACUUM BAG).



4 different types of demonstrators were obtained after the end of SEAMATTER:

- ***a wall covering end-product based on a nonwoven structure,***
- ***a tile (composite material with fibers coming from algae wastes acting as a reinforcement material),***
- ***a decorative rafter (composite material),***
- ***a moulding-manufactured end product.***

5. CLOSING REMARKS

- This GP demonstrates the feasibility to use wastes coming from oceans as a fiber-based 'raw material' for industrial purposes.

- Nonwovens based on algae wastes mixed with other fibers can be developed and further manufactured as composite materials.

- The possibility of using this algae/seaweed waste in textile and composite/engineering industries opens a new environmental and attractive option to design green composites.

- This GP could be replicated/implemented at EU level, as involvement of public + private partners is required and problems on coasts coming from algae wastes are so common around Europe. Entities beyond RESET partnership could also find some benefits from this GP. Strength collaboration between industrial/private entities, public bodies and even research/academic partners could be promoted.

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THANK YOU FOR YOUR ATTENTION!!!

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