

# POLITECNICO DI TORINO

**DISAT - Department of Applied Science and Technology**

**L.A.T.T. - Laboratory of High Textile Technology Città Studi, Biella**

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The research group, starting from process engineering and textile engineering competences, is capable to conceive new materials at laboratories scale, define and test new processes in pilot units and in prototype equipments.

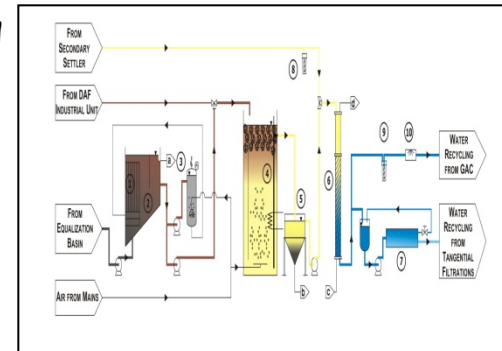
The research work and technological transfer is carried out in cooperation with other Universities, Research centers and Industries.

# ACTIVITIES

- Teaching
- 1st year of Engineering at Città Studi
  - MSc in Textile Engineering in Torino
  - student practical activities in LATT at Città Studi
  - AUTEX European Master E-Team
  - International Doctorate program SMDTex



- Research
- development of experimental research and modelling in the laboratories of Città Studi and the main Politecnico site of and, as well as by research platforms at industrial premises
  - sharing research projects with Companies and external Institutions.



- Technological transfer
- support to manufacture industries for solving specific problems and design new processes and products in view of competitiveness and environmental sustainability of productions.



# DYEING PROCESSES

## Aims

Studying new environmental friendly dyeing for new technical products

## Projects

Supercritical  $\text{CO}_2$  dyeing, dyeing with treated wastewater, wool fabric continuous dyeing, aramid fibre dyeing

## Methods

To define hydrodynamic, physical and physico-chemical parameters of kinetics as well as dye-bath and textile substrate equilibria

## Instruments

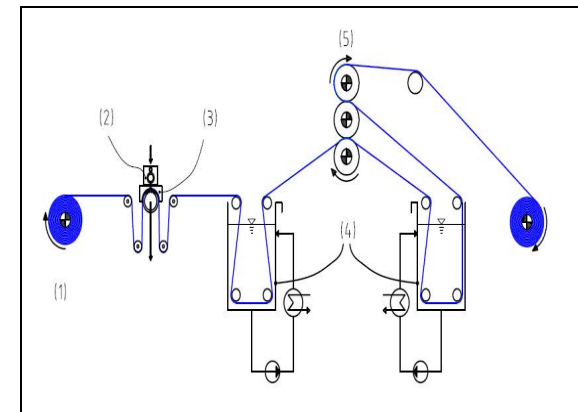
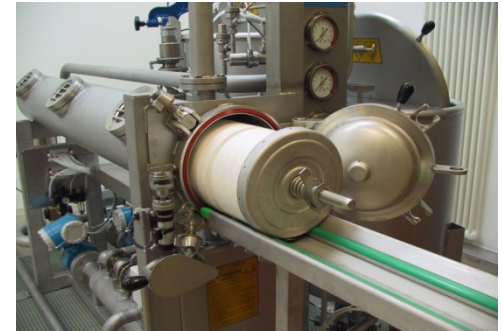
Dyeing Apparatuses: Teintolab, Mathis  
Pilot units: medium and high pressure tubular equipment by OBEM and atmospheric pressure units by TMT

## Industrial collaborations

OBEM, Tintoria & Finissaggio Tonella, FILIDEA, Marchi & Fildi

## Results

Assessment of noticeable freshwater need, process patents, qualitative enhancement of dyed products



# FINISHING

## Aims

Physicochemical phenomena rationalization of finishing treatments according to a scientific approach

## Project

PhD with industrial collaborations to define the physical and kinetic parameters to reach dimensional stability of animal fiber fabrics (fine wool and cashmere)

## Methods

Definition of moisture regain kinetics for wool fabrics as a function of temperature and pressure through modeling and experimentation

## Instruments

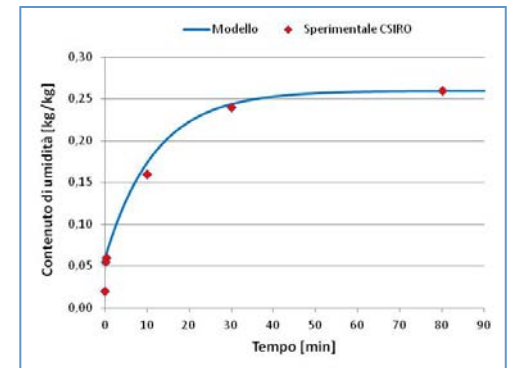
Pilot plant design for continuous finishing processes (work in progress)

## Industrial and institutional collaboration

PhD granted by C.C.I.A.A. of Biella, Guabello (Marzotto Group), TMT Manenti

## Expected results

Codification of fabric finishing. Continuous KD design.





# WASTEWATER RECYCLING

## Aims

Primary, secondary and tertiary treatment optimization through input-output process correlations.

## Projects

Wastewater recycling. PhD projects in textile wet upgrading by industrial collaboration. Construction of wastewater platforms for FILIDEA e CORDAR

## Methods

Experimentation on the designed pilot units.  
Finishing and dyeing by wastewater recycling.

## Instruments

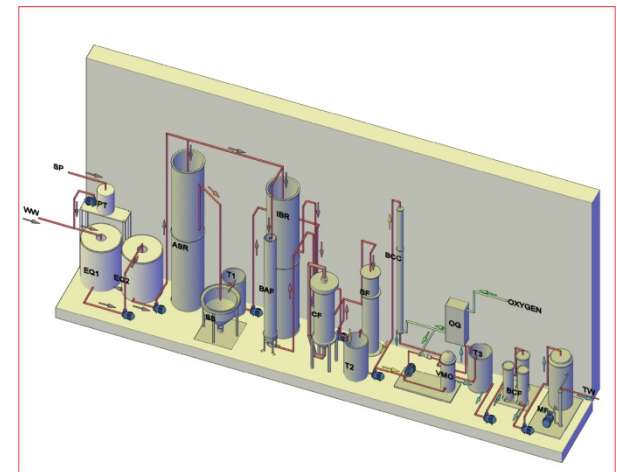
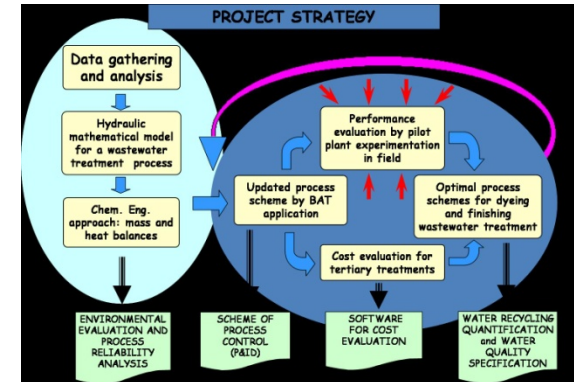
Pilot units for industrial wastewater treatments.

## Industrial collaborations

20 textile industries, 10 technology providers , FILIDEA  
Italy/Turkey settlement contract, CORDAR Biella

## Results

Definition of quality parameters for treated water . About 70% reduction of freshwater intake.



# PROCESS SUSTAINABILITY

## 1) Energy valorization of textile waste and cigarette butts

**Aims and expected results:** gasification of textile waste products in spouted beds; new process development for waste treatment and electrical energy production.

**Projects:** VALENTEX e VALENTEX2 in POINTEX

**Method:** waste pelletization and chemical disruption in reducing conditions at  $800\div 900\text{ }^{\circ}\text{C}$ .

**Industrial collaborations:** Tecnomeccanica Biellese, Marchi & Fildi

**Instruments:** design and constructing a continuously operating  $20\text{ kW}_t$  pilot plant connected to an internal combustion engine.



## 2) "Green" raw wool hydrolysis

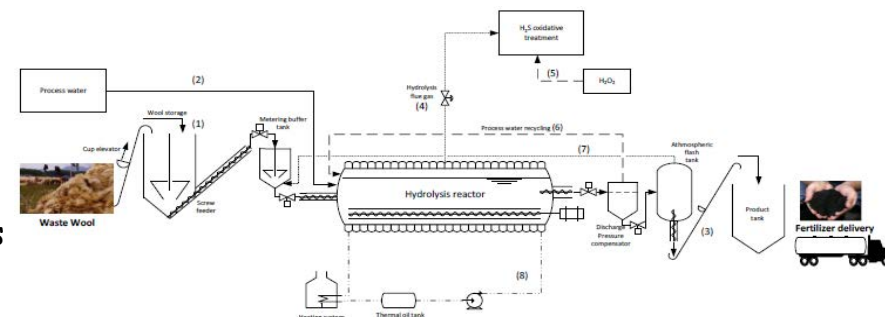
**Aims and expected results:** chemical modification of waste wool to produce a large class of chemicals (from biological scaffold tissues to nitrogen controlled release fertilizers).

**Project:** LIFE+ European project

**Method:** treatment at  $\approx 150\text{ }^{\circ}\text{C}$  without any chemical reagent

**Collaborations** CNR-Ismac Institute, OBEM company.

**Instruments:** mobile demonstration unit in different EU sites



# PLASMA TREATMENTS

## Aims

Definitions of gas-to-solid reactions on textile substrates to modify surface affinity and reactivity (nanotechnology).

## Projects

To increase process kinetics (dyeing at low temperatures), to confere hydrophilicity or coat with compounds of molecular thickness able to modify the properties of textile substrates (dirt repellant, flame resistance, UV protection, etc.).

## Methods

Modification of wet processes to sustainable dry processes. Operating with products of industrial interest. Investigating on fundamental phenomena to define their application.

## Instruments

Continuously operating atmospheric pressure pilot plants (jet type and "in situ" plasma generation)

## Industrial collaborations

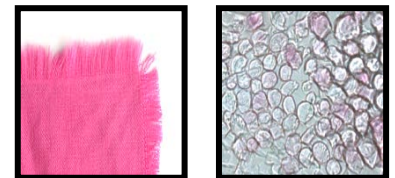
Italy/Turkey FILIDEA settlement contract, De Martini, Tintoria Finissaggio Tonella

## Results

Patent on continuous dyeing of wool fabrics (85% water saving, 92% energy saving). "customized" dyeing.



*untreated*



*treated*



# UV RADIATION TREATMENTS

## Aims

Defining the UV-irradiation potential for textile finishing and dyeing

## Projects

Double-face dyeing effect and low temperature dyeing as results

of the UV—irradiation. Fluorocarbon resins deposition through UV grafting, without high temperature polymerization to obtain washing fastness and hydro/oil repellent. Durable antibacterial finishing based on chitosan (a natural biocompatible polymer) UV-grafting, as an alternative to silver and poor eco-friendly treatments.



No UV

UV treated

## Instruments and methods

Studying of continuous fabrics/garments treatment at laboratory scale, followed by scale-up.

## Industrial collaborations

Italy/Turkey FILIDEA settlement contract, Nearchimica, Stamperia Emiliana, TMT Manenti.

## Results

Low temperature, eco-friendly processes with negligible fiber damage and energy saving. Easy applicable UV lamps on existing industrial scale apparatuses.





# ULTRASOUND APPLICATIONS

## Aims

Defining the US conditions applicable in dyeing and continuous washing processes. Sorting the effect of cavitation, sonication and hydraulic localized dirt removal.

## Projects

INTEXUSA: defining the US application in dyeing processes;  
CIMI contract: improvement of washing efficiency, decreased water consumption.

## Methods

Pilot plant design and utilization to quantify the fundamental phenomena involved in view of industrial applications

## Instruments

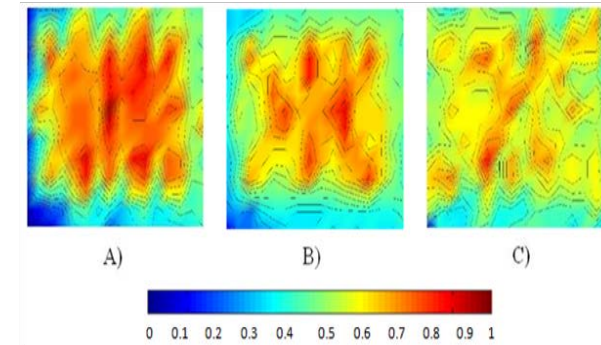
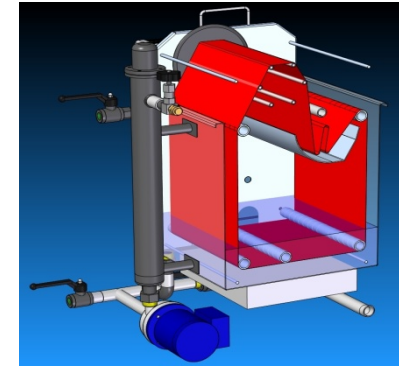
Continuous and discontinuous pilot units for dyeing and washing. US transducers working at different frequencies.

## Industrial collaborations

ENEA, OBEM, TMT Manenti, CIMI, FLAINOX

## Preliminary results

Definition of US working conditions. Mapping of US field intensity.



# TEXTILE COMFORT



Associazione Tessile e Salute



## Aims

Definition of textile properties and correlation with the thermo-physiological comfort. Mathematical modeling of cloths effect on heat and mass transfer mechanisms between the body and the surrounding environment.

## Projects

Federazione Italiana Vela Pechino 2008 T-shirt, Pella Sport cycling outfit, Solar Res clothes, Mico skiing socks, Chicco baby car seat

## Methods

In vivo physiological and sensorial parameter analysis.  
Characterization of textile physical properties (thermal resistance, water vapor permeability, wetability, etc..).

## Instruments

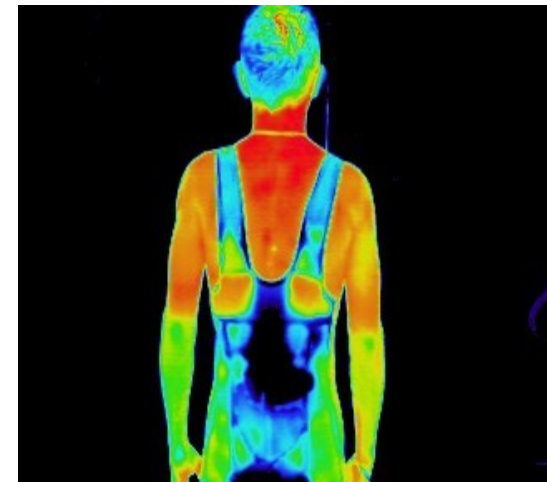
Environmental chamber, Cyclo-ergometer, moisture and temperature sensors, thermo-camera, tensiometer, moisture management tester, air and water vapor permeability meters

## Industrial collaborations

SLAM, Pella Sport, Mico, Artsana, Stamperia Alicese, companies...

## Results

High performance cloth design.



# TEXTILE FUNCTIONALIZATION

## Aims

Cosmetic and para-pharmaceutical textile functionalization.  
Evaluation of the performances of the prepared textiles.

## Projects

Durable antibacterial finishing on cotton fabrics, preparation of elasto-compressive socks with refreshing effect (in collaboration with CNR), controlled release of anticellulite active principles from nanoparticles treated textiles.

## Methods

Evaluation of skin parameters through patch-test before and after contact with the treated cloth, sensorial evaluation and analysis of in-vitro active principle kinetics release

## Instruments

Cutometer , Franz Cells, HPLC.

## Industrial collaboration

FILIDEA

## Results

Functionalized cloth design for human comfort.

