



MERMAIDS

LIFE13 ENV/IT/001069

Problemática de los tejidos sintéticos.
Hacia la producción de tejidos más
sostenibles

1/12/2016

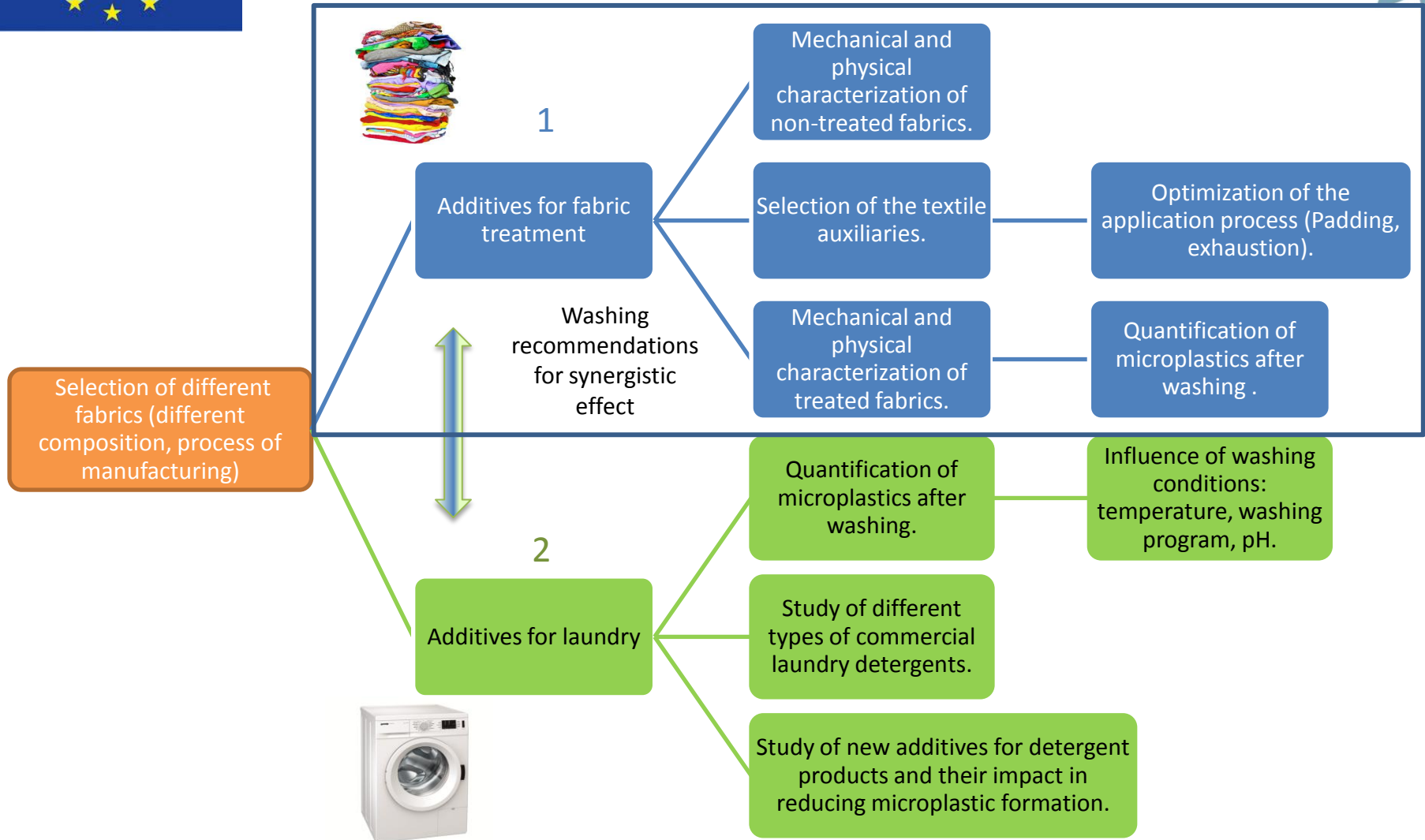
LEITAT, Terrassa

Àngels Rovira, Marolda Brouta-Agnés, Rosa Escudero, Laura Gelabert, Laia Puigmal, Raquel Villalba, Émilie Mespoulhes.





Experimental work plan





Objective



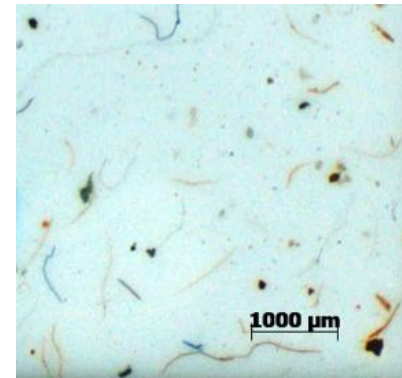
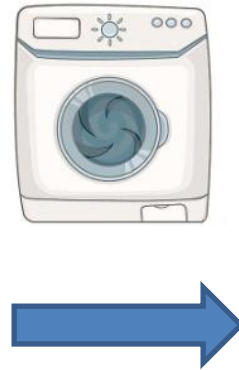
Objective

Select and study different types of commercial textile auxiliaries with potential to reduce the fibre breakage and avoid the loss of microfibres during the domestic washing.



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Textile auxiliaries



Reduction in the fibre release





Introduction



Main parameters that could affect the microfibrils breakage

PHYSICAL

- Fibre length
- Linear density (yarn)
- Yarn twist
- Fabric density

	Influence on the microfibrils release	
Fibre length	High length	Low length
Linear density	Low linear density	High linear density
Yarn twist	High twist	Low twist
Fabric density	High density ✓	Low density ✗

MECHANICAL

- Abrasion during the spinning/weaving process
- Degradation under use conditions (pilling)
- Domestic washing process

Others: fibre fineness, resistance, dyeing method, etc.





Introduction



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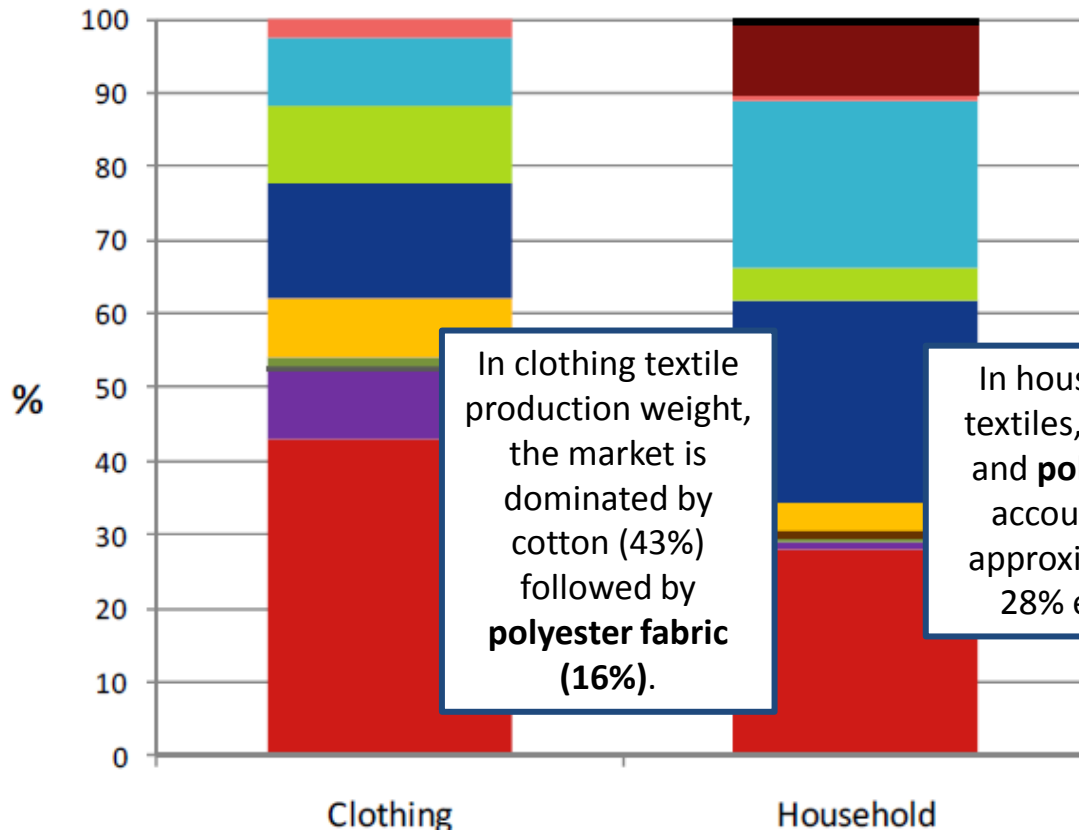


Fabric pilling





Selection of textiles



In clothing textile production weight, the market is dominated by cotton (43%) followed by polyester fabric (16%).

In household textiles, cotton and polyester account for approximately 28% each.

SYNTHETIC	■ PVC
	■ Polypropylene
	■ Polyurethane/Polypropylene
	■ Polyamide
	■ Acrylic
	■ Polyester
	■ Viscose
NATURAL	■ Feather
	■ Flax
	■ Silk
	■ Wool or other animal hair
	■ Cotton

Percentage breakdown of consumption by material for clothing and household textiles (Source: Environmental Improvement Potential of Textiles IMPRO-Textiles, EU-27).





Selection of textile auxiliaries



- **The textile auxiliaries will:**
 1. Provide a physical barrier to protect the fibres.
 2. Bind and collect microplastics.
- **General requirements:**
 1. Do not change the fabric touch
 2. Water based emulsions



Polyurethane

Polyacrylate

Polysiloxane

Textile auxiliary	AUX1	AUX2	AUX3	AUX4	AUX5
Chemical description	PU resin	PU /Acrylic resin	Acrylic resin	Acrylic resin	Silicone emulsion
Ionic character	Anionic	Anionic	No-Ionic	Anionic	Cationic / Non-ionic





Application process



	Padding	Exhaustion
Auxiliary concentration	10-20-30 (g/L)	1-5 (g product /g fibre)
Speed (m/min)	3-6	-
Pressure (Kg/cm ²)	3	-
Temperature (°C)	-	55-60
Time (min)	-	35



	Drying	Curing
Temperature (°C)	110	160
Time	1'	1'30''



- Application has been carried out in controlled conditions for both methods.





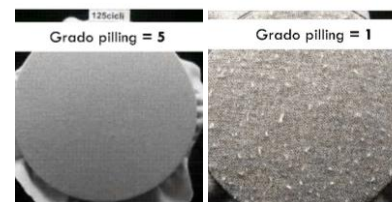
Results



Fabric degradation under use conditions

Martindale method

- **Abrasion and pilling testing:** Determination of fabric propensity to surface fuzzing and pilling.
- **Martindale Method:** EN ISO 12945/2. Cycles: 2000/5000. Friction against wool fabric (higher abrasion).



Degradation templates for the pilling resistance test
(left: pilling index number 5;
right: pilling index number 1).





Results



Fabric degradation under use conditions

Martindale method

Textile auxiliary	AUX 1	AUX 2	AUX 3	AUX 4	AUX 5
Chemical description	PU resin	PU /Acrylic resin	Acrylic resin	Acrylic resin	Silicone emulsion

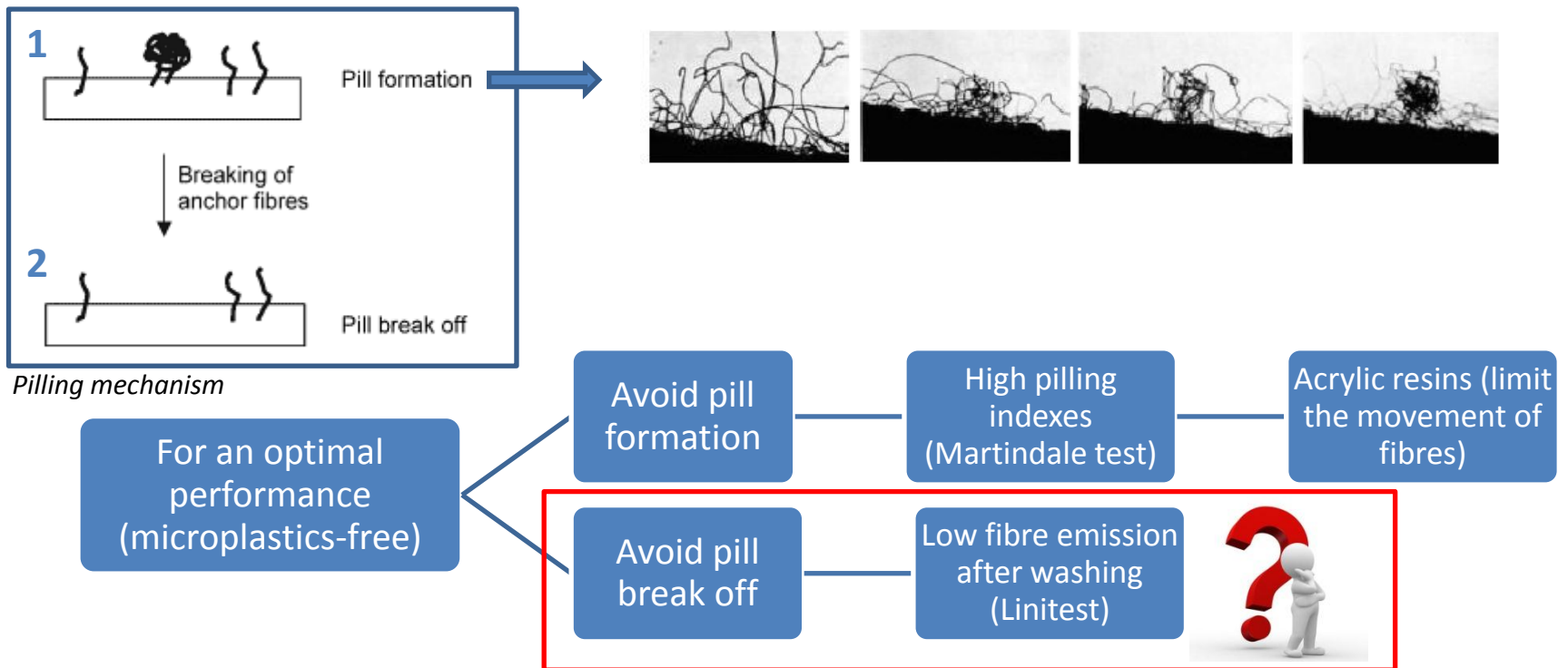
Best pilling index (highlighted in green)

Worst pilling index (highlighted in red)

- Acrylic resins (AUX3/AUX4) provide a clear improvement in the pilling effect.



Fabric degradation under use conditions





Results



Washing, filtration and quantification

Study the influence of the laundry process on the fibre release:

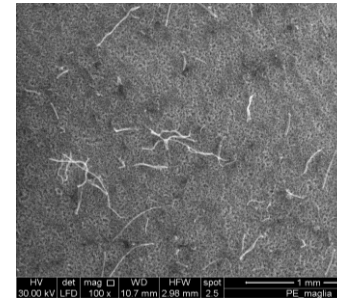
1. Washing cycles comparing different **washing conditions**.
2. Washing water **filtration**
3. Fibre **quantification**



Lini-test washing device :
based on ISO 105-C06:2010.



Filtration



SEM micrograph containing PES
microfibres

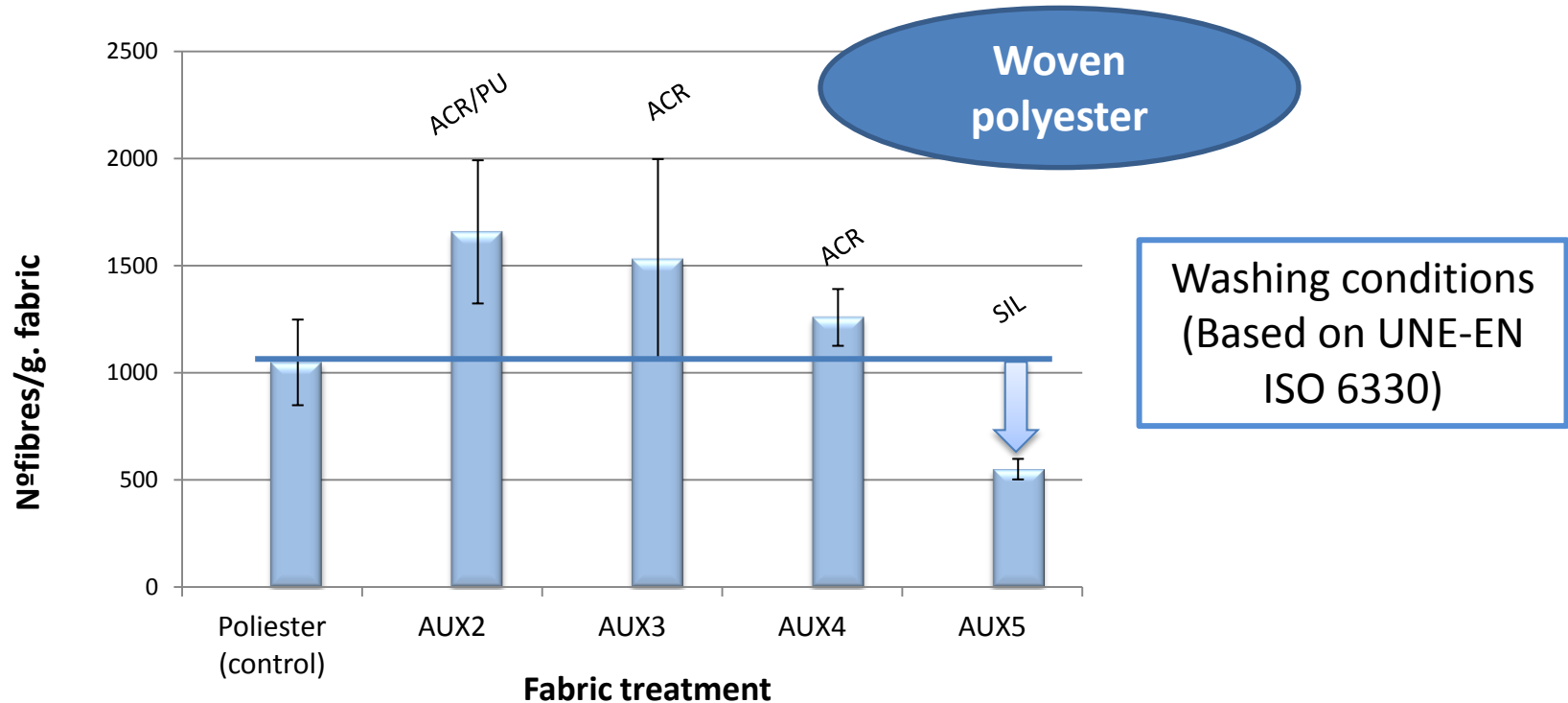




Results



Quantification of microfibrils released



- AUX 5 (silicone emulsion) has shown a trend of reducing the fibre release during washing.





Conclusions



- The emission of microfibres can be prevented or reduced by *i)* **appropriate yarn and/or fabric construction** or *ii)* by applying a **suitable finishing**.
- The quantification of fibres after the washing process (at lab scale) results in **better values** for the **silicone emulsion (AUX5)**.
- AUX5 reduced the fibre release with the conditions set in the lab due to a softening effect between fibres and washing medium.
- Softening agents reduce the friction between the fibres and **decrease their probability to break** during the wash.





Thank you for your attention!

Àngels Rovira Cort
arovira@leitat.org

LEITAT – Technological Center
C/ de la Innovació, 2
08 225 Terrassa (Barcelona) Spain