

MARTINA MURONI

# Wool & Flow



# Booklet

Credit: Marie Tregoat,  
Le Textile Lab

# Material and context

Lyon Lab is a key partner of the EU project Woolshed, which aims to revitalize Alpine wool value chain through design, innovation and small-scale technologies.

The material used is **Thônes et Marthod wool**, a rustic French fiber with a strong territorial and cultural identity, yet limited applications in fashion.

Its coarse texture, combined with the high water demand of conventional treatments, often leads to it being undervalued.

Each year 8 tons are discarded, with only 350 kg are recovered by the wool association Defrise ton mouton. This project uses part of the recovered wool.



**Thônes et Marthod**

# Project focus

Traditional wool processing requires a considerable amount of resources, especially water. For rustic wool, which has a low market value, the investment is often economically unsustainable.

In this project, water is rethought within the processing of rustic wool.

Initially seen as a resource to be reduced, it gradually becomes a transformative element, shaping texture, color and structure. Like a river and its tributaries, this shift unfolds through multiple paths, all contributing to the same flow.

**BIOLOGICAL  
MEDIUM**

**CHROMATIC  
CARRIER**

**FIBER  
ACTIVATOR**

**MATERIAL  
MEDIUM**

**Washing**

**Dyeing**

**Felting**

**Biocomposite**

**BIOLOGICAL  
MEDIUM**

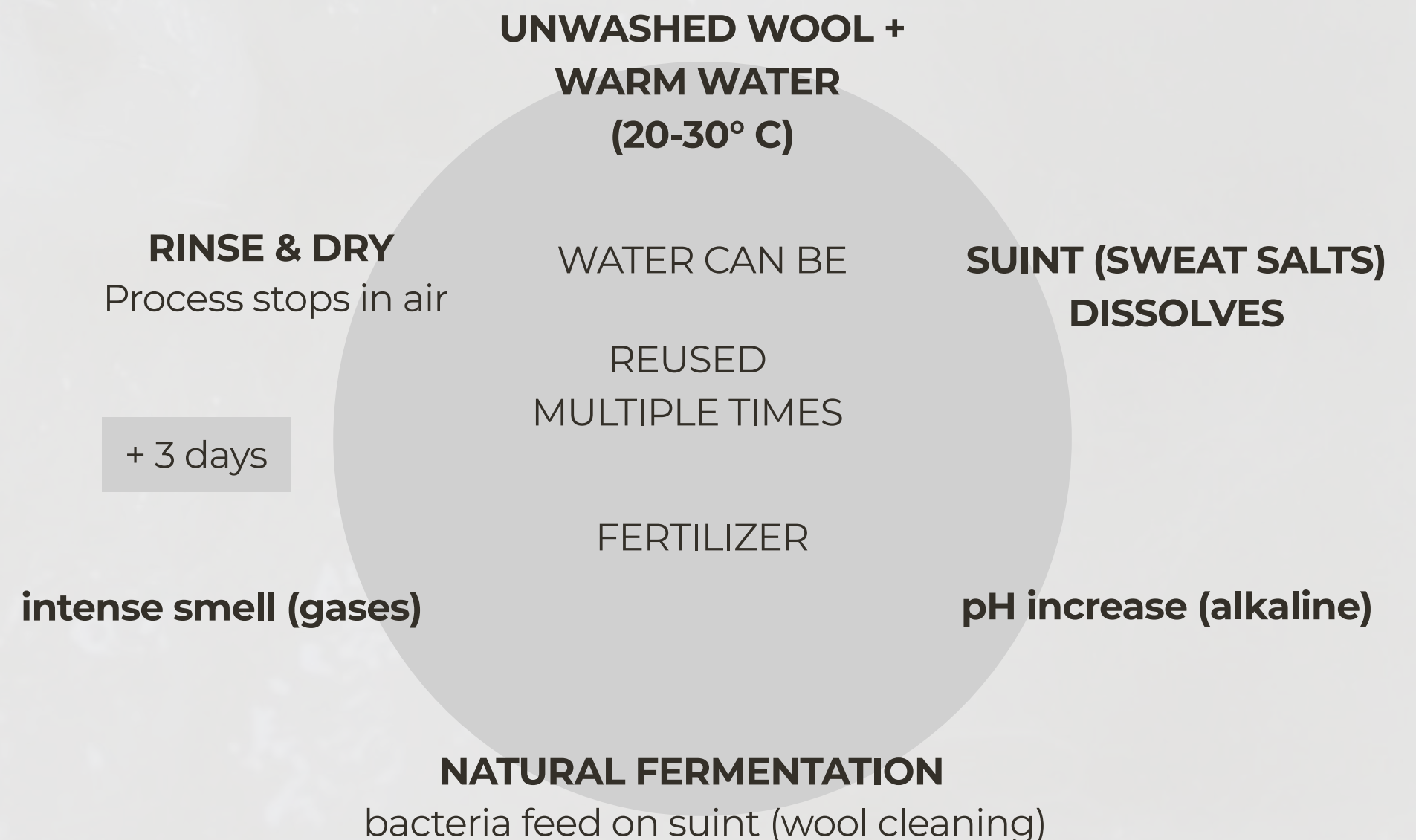
**Washing**

# Suint Fermentation

It is a pre-industrial wool scouring method that relies solely on rainwater and the natural suint contained in raw wool. Suint, composed of water-soluble salts from sheep sweat, gradually dissolves in warm water, creating a naturally alkaline bath without the need for added soap

At temperatures between 20–30°C, a biological fermentation process begins: naturally occurring bacteria feed on the suint, breaking it down and effectively cleaning the wool.

Because it depends on stable warm temperatures, suint fermentation is traditionally carried out in spring and summer.



**My goal was to create a laboratory setup to run the process even in winter and all year round.**

Below you can find the system now available in Le Textile Lab to wash up to 10 kg of wool

200L tank  
with lid



rolling cart

drain tap

SYSTEM FROM INSIDE



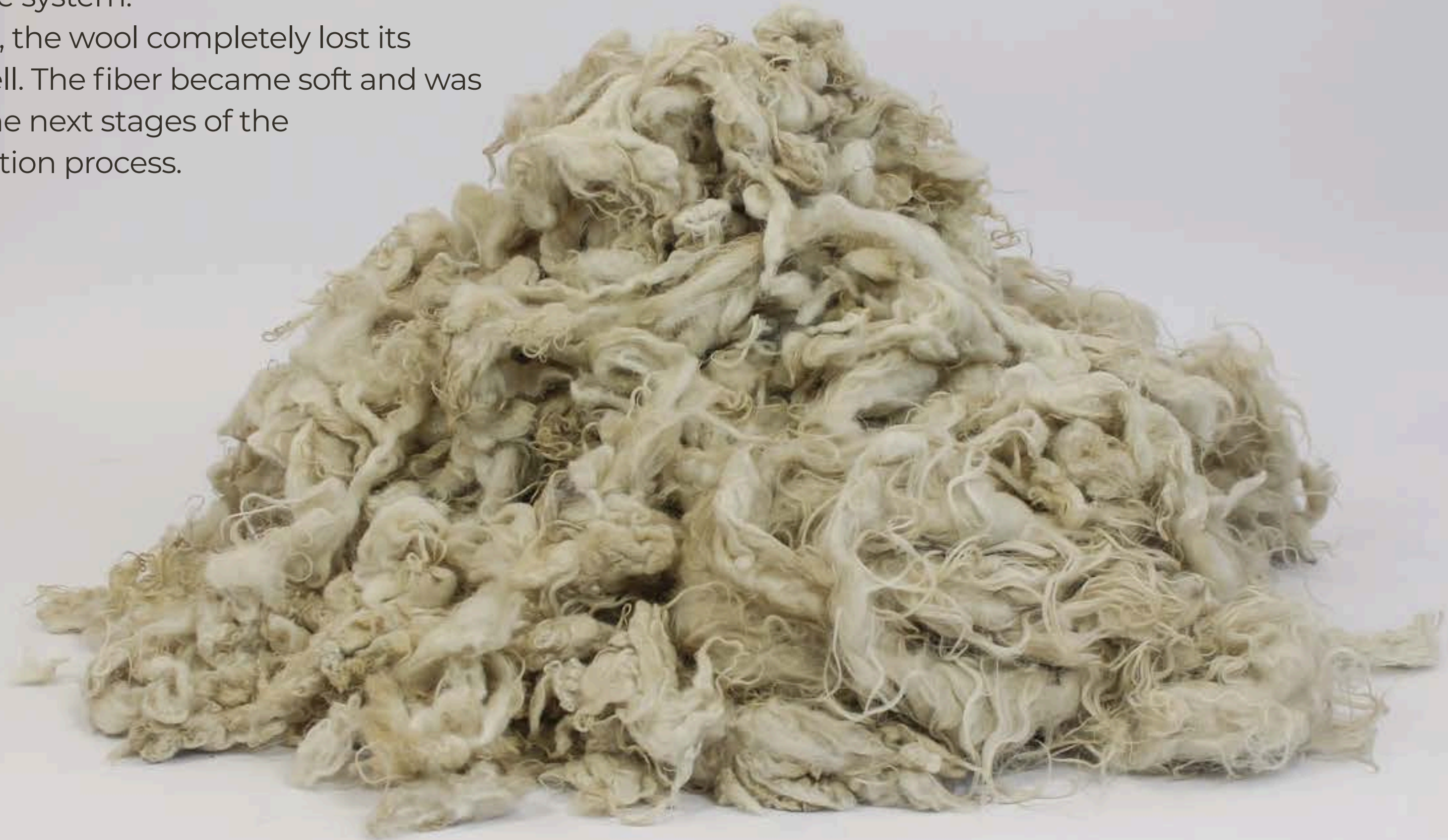
Wool inside bags

aquarium thermostat

aquarium pump

5 kg of Thônes et Marthod wool washed through the system.

Once dried, the wool completely lost its strong smell. The fiber became soft and was ready for the next stages of the transformation process.



## Washing systems comparison

Compared to conventional washing methods, suint fermentation enables reductions across several environmental indicators.

Indicator	Fermentation	Industrial*	Micro-Scouring**
Water Use (L/kg)	10 L/Kg	15 L/kg	50 L/kg
Temperature	20-30°C	60-70°C	50-80°C
Synthetic Chemicals	None	Yes (alkali + detergents)	Soap / detergent
Effluent Outcome	Regenerative water (reused)	Industrial wastewater	Sewage system
Energy level required	Low	High	Medium

\*Industrial scouring, as described in textile processing literature (e.g., multi-bowl washing systems).

\*\*Micro-scouring plant from "[Laver la Laine](#)", [Atelier Laine d'Europe](#).



CHROMATIC  
CARRIER

Dyeing

# Natural Dyeing

Alternative to chemical colors

The work is structured around three main directions:

## Local resources

Territorial water and plant dyes

Focus on Alpine dye plants, typical of the five countries participating in the Woolshed project, and on local water sources, comparing rainwater (pH:5) and tap water (pH:8).

While pH variations do not always produce significant differences, in some cases they influence tone and colour development, contributing to context-specific results.

## Process simplification

No scouring and separate mordanting

Tannin colours are observed without a mordanting step, alongside simultaneous mordanting during dyeing, reducing the number of steps while maintaining effective results.

## Circular Colour

Dye bath reuse and pigment extraction

Extension of dye material life through reuse and transformation. Dye baths are reused across multiple cycles, producing softer tonal variations, while pigment extraction enables further applications, such as on paper or for additional dyeing processes.

## Local dyeing material linked to Woolshed countries



**Chamomile**  
(Anthemis spp.)

COLOUR

Yellow

COUNTRY

**Slovenia**



**Madder**  
(Rubia tinctorum)

Red

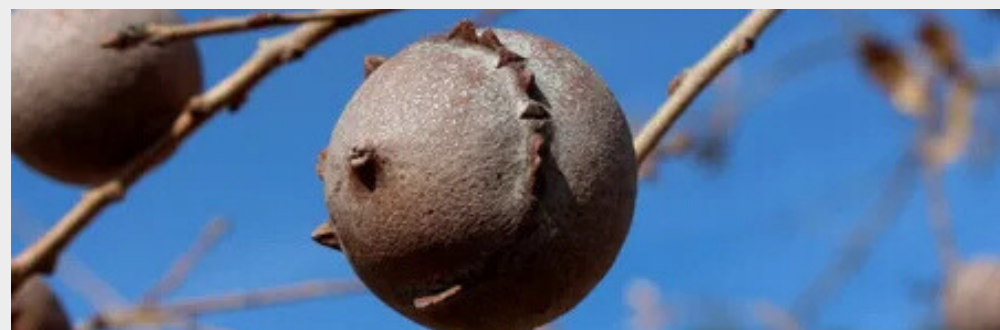
**Italy**



**Nettle**  
(Urtica dioica)

Beige

**Switzerland**



**Oak galls**  
(Quercus spp.)

Beige/Pink

**Austria**



**Walnut husks**  
(Juglans regia)

Brown

**France**

[credits](#)

# Dyeing tests

Tap water (TAP) ph: 8 - Rain water (RAIN) ph: 5.  
 Low-concentration iron, tested with a lower-impact method.

## Chamomile (*Anthemis spp.*)

MORDANT IN DYE BATH

## Nettle (*Urtica dioica*)

MORDANT IN DYE BATH

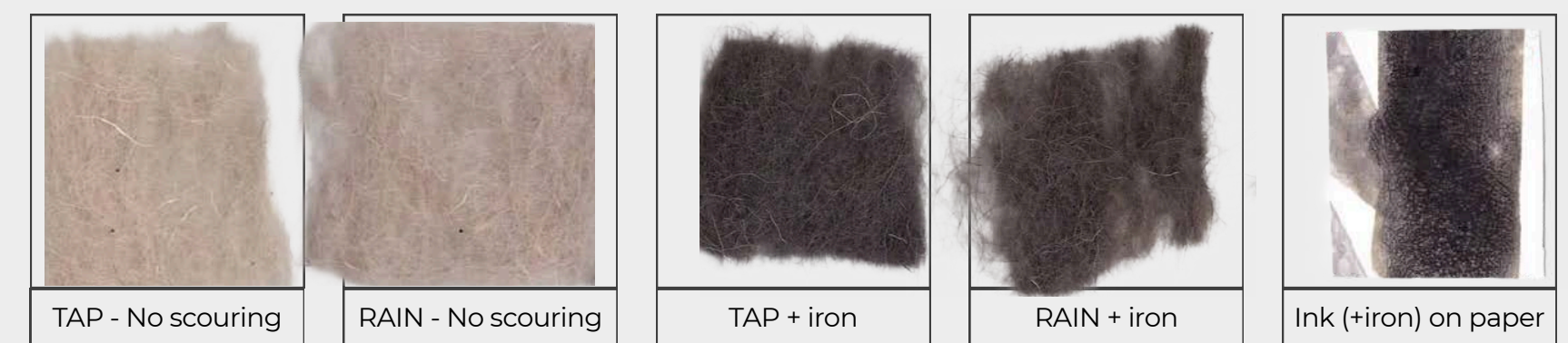


## Madder (*Rubia tinctorum*)

MORDANT IN DYE BATH

## Oak galls (*Quercus spp.*)

NO MORDANT



## Madder (*Rubia tinctorum*) - Second bath

MORDANT IN DYE BATH

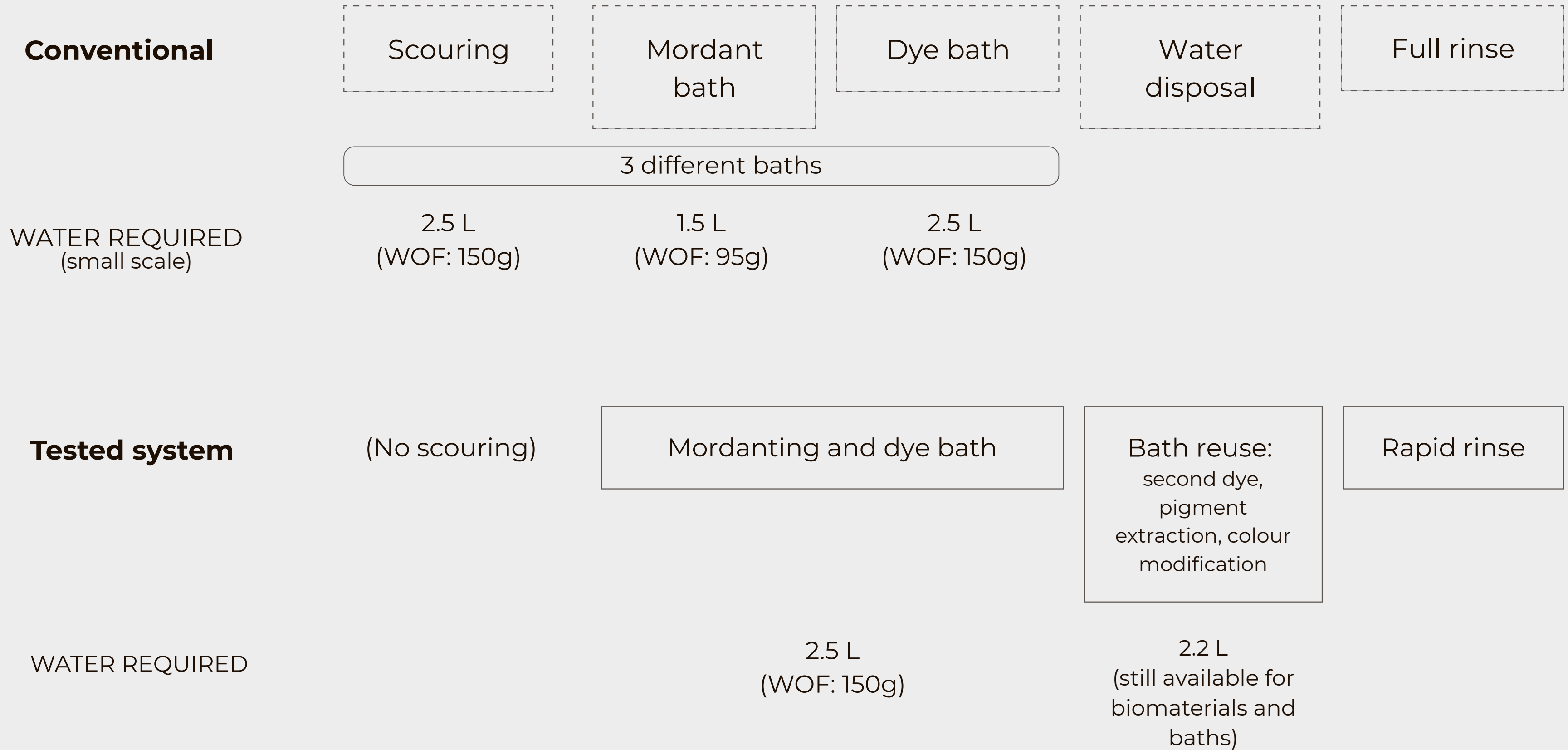
## Walnut husks (*Juglans regia*)

NO MORDANT



Local water is recommended whenever possible, as its mineral composition and pH help shape unique dye results.

## Water use: coloring comparison



**FIBER  
ACTIVATOR**

**Felting**

# Felting

One of the oldest textile techniques is wet felting, in which water, soap, and friction interlock fibers to create a dense fabric without machines.



Later, needle felting emerged, interlocking fibers mechanically and reducing the need for water.

Today, technology can support these techniques, reducing manual effort while expanding creative possibilities.

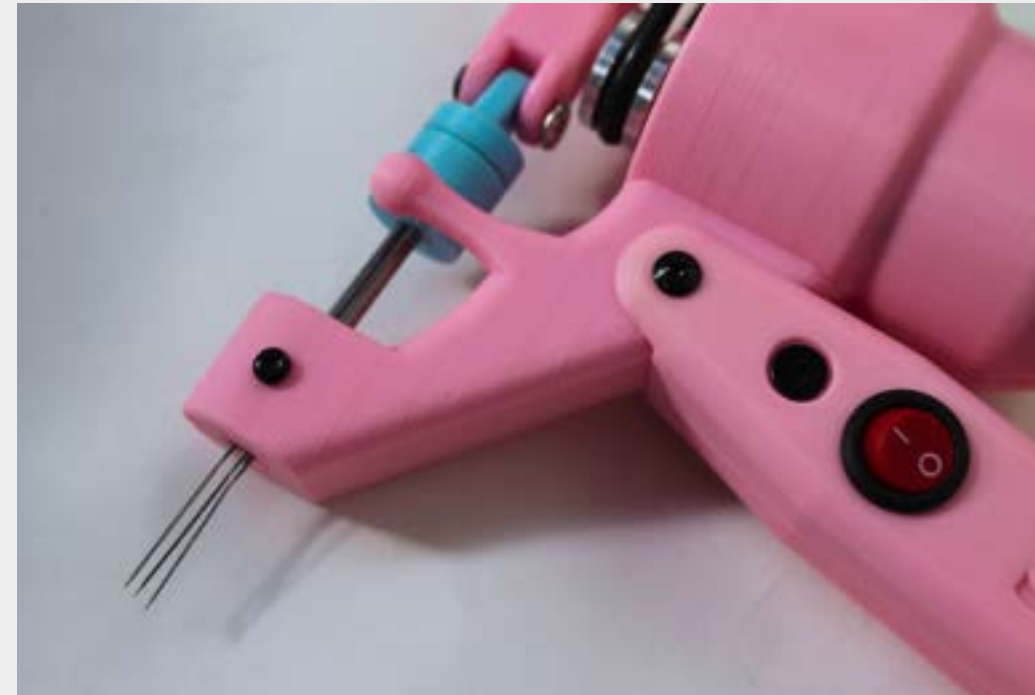
My research focused on the interaction between water-based and dry techniques and technological support.

## Supporting tools (low-, medium-, high-tech)

A selection of tools and systems (see examples below) was tested through shared parameters to evaluate performance and produce comparative felt panels as outcomes.



**ROLLING PIN** (Wet felting)  
Low-tech



**FELTING GUN** (Needle felting)  
High-tech



**FELTLOOM** (Needle felting)  
High-tech

## Parameters

Observation time	Sample weight	Sample size	Layer structure
10 minutes	50g	25x25	4 layers cross-laid

## Technology interventions: some results



TOOL

**FeltLOOM**

**Felting gun**

**Rolling pin**

**Sanding machine**

TECH  
LEVEL

High

Medium

Low

Medium

MANUAL  
EFFORT

Low

Medium

High

Low

Comparison with all tools and more details available [here](#)

## Experimenting pieces

I combined tools and techniques to create experimental pieces, including garments where rustic wool is usually not used.



**Bag**

wet felting, details with needle felting  
rolling pin and felting gun



**Vest**

wet felting  
sanding and washing machine

**MATERIAL  
MEDIUM**

**Biocomposite**

# Wool biocomposite

In combination with Alginate (algae-based binder)

Water is used in the recipe and can be locally sourced, I tested with rainwater, and also reused from the dyeing bath.

My goal was to design a replicable workshop setup for collective learning, where participants could experiment and reflect on possible applications. On top of building a material archive.

The workshop setup includes guidelines outlining roles and recipes ([printable version](#)).

WOOL-ALGINATE WORKSHOP	RECIPE	<p><b>MATERIALS</b></p> <ul style="list-style-type: none"> <li>- 12 g Alginate</li> <li>- 20 g Glycerin</li> <li>- 400 ml</li> <li>- 10 g seed oil</li> <li>- Calcium Chloride solution (10 g calcium chloride per 100 ml water)</li> </ul> <p>Note: double/triple the dose based on the number of participants.</p> <ul style="list-style-type: none"> <li>- Food-waste powder ingredients (e.g. orange peels, banana peels, coffee grounds)</li> <li>- Wool fibres (washed and carded, optional test with unwashed wool)</li> </ul> <p><b>TOOLS</b></p> <ul style="list-style-type: none"> <li>- Containers or mixing bowls</li> <li>- Digital balance</li> <li>- Spatula</li> <li>- Mixer</li> <li>- Paper towels</li> <li>- Spray bottle</li> <li>- Embroidery hoops and texture dense fabric</li> <li>- Dehydrator (optional)</li> <li>- Grinder (fine powders)</li> <li>- Camera/smartphone for documentation</li> <li>- Printer, papers and markers for sample tracking</li> </ul> <p><b>INSTRUCTIONS</b></p> <p><b>Step 1: Prepare the sodium alginate mix</b></p> <ul style="list-style-type: none"> <li>• Add the sodium alginate to the water.</li> <li>• Blend the mix until it becomes homogeneous.</li> <li>• Add the glycerine and blend again.</li> </ul> <p><b>Step 2: Prepare the calcium chloride mix</b></p> <ul style="list-style-type: none"> <li>• Mix 100ml of water with 10 grams of calcium chloride.</li> <li>• Stir until completely dissolved.</li> <li>• Place the mix in the sprayer bottle and shake the bottle before use.</li> </ul> <p><b>Step 3: Prepare and spray the mold</b></p> <ul style="list-style-type: none"> <li>• Take the waterproof texture dense fabric, place and fix it in the embroidery hoop.</li> <li>• Spray the textile mold with calcium chloride.</li> <li>• Remove excess with a paper towel.</li> </ul> <p><b>Step 4: Pour and spray the mix</b></p> <ul style="list-style-type: none"> <li>• Pour the mix onto the textile mold.</li> <li>• Tap the mold so the mix distributes evenly over the surface.</li> <li>• Spray the surface of the mix with calcium chloride.</li> <li>• Remove excess with a paper towel.</li> </ul> <p><b>Step 5: Dry</b></p> <p>Let dry over a radiator or in a food dehydrator (40°C for 24 hrs)</p> <p><b>Step 6: Remove from the mold</b></p> <ul style="list-style-type: none"> <li>• Take out of the frame.</li> <li>• Pull slowly from the border of the bioplastic until completely detached.</li> </ul>	ROLES	<p><b>FACILITATOR</b></p> <p><b>BEFORE THE WORKSHOP:</b></p> <ul style="list-style-type: none"> <li>- Prepare and label powder ingredients in jars</li> <li>- Prepare calcium chloride solution and alginate mixture (step 1 and 2)</li> <li>- Cut wool fibres into smaller pieces (washed and unwashed)</li> <li>- Prepare sample documentation sheets</li> <li>- Prepare sample storage area</li> </ul> <p><b>DURING THE WORKSHOP:</b></p> <ul style="list-style-type: none"> <li>- Introduces workshop concept and materials</li> <li>- Guides participants through process</li> <li>- Supports safe and inclusive participation</li> </ul> <p><b>AFTER THE WORKSHOP:</b></p> <ul style="list-style-type: none"> <li>- Checks drying process in the lab</li> <li>- Ensures each sample sheet is associated to the material sample</li> <li>- During second meeting with participant (if planned), shares dried materials and collects reflections on possible applications and future experimentation.</li> </ul> <p><b>PARTICIPANTS</b></p> <ul style="list-style-type: none"> <li>- Select the wool and powder ingredients and record your choices in the sample sheet</li> <li>- Prepare the mold: first spray the calcium solution, add the ingredients, then pour in the alginate mixture. Spray again with calcium chloride and let it dry</li> <li>- Share feedback on the experience and material observations</li> <li>- Enjoy the session!</li> </ul> <p><b>DOCUMENTATION LEAD (Facilitator/assigned person)</b></p> <ul style="list-style-type: none"> <li>- Collects participants' consent for photos and videos</li> <li>- Documents the process through photos and videos</li> <li>- Archives results for open knowledge sharing and gathers participant feedback</li> </ul>
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BIOCOMPOSITE	BIOCOMPOSITE	<p><b>DATE:</b> _____ <b>PARTICIPANT:</b> _____</p> <p><b>FIBRE INFORMATION</b> Wool type / breed (if known): _____ <input type="checkbox"/> Washed <input type="checkbox"/> Unwashed <input type="checkbox"/> Carded <input type="checkbox"/> Other: _____ Approximate fibre weight (if measurable): _____</p> <p><b>COMPOSITE RECIPE</b> Food-waste fillers used: _____ Powder granulometry (fine/coarse/mixed): _____ Quantity of fillers: <input type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High <input type="checkbox"/> Weight: _____</p> <p><b>WATER TYPE (TAP, RAIN, DYE BATH):</b> _____</p> <p><b>OBSERVATIONS (TEXTURE, FLEXIBILITY, ETC):</b></p> <p><b>REFLECTIONS/APPLICATIONS:</b></p>	BIOCOMPOSITE
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## Workshop session (test)

A first session was held at Le Textile Lab on February to explore how different combinations of wool and natural binders could support collective experimentation, allowing participants to influence texture and material behaviour through their material choices.

Different water sources were introduced to test their influence on the composite behaviour but no significant differences were observed between the water sources, as all produced stable and consistent results.



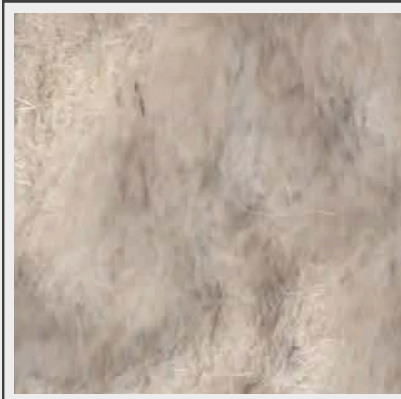
## Workshop results

During the session, participants created around 15 samples and explored additional recipes.



# Biocomposites Archive

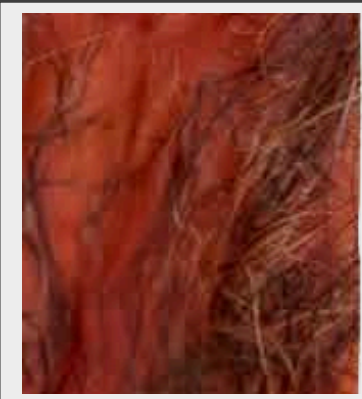
\*Alginate refers to the full mixture (incl. additives)



Rain water  
Alginat: 98g  
Washed wool



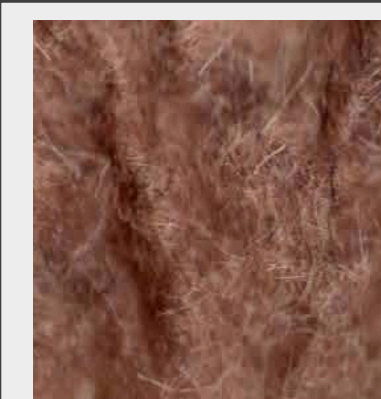
Madder dye bath  
Alginat: 105g  
Washed wool: 4.8g



Madder dye bath  
Alginat: 119g  
Washed wool: 3g



Madder dye bath  
Alginat: 130g  
Washed wool: 1.5g



Walnut dye bath  
Alginat: 235g  
Wool: 5.4g



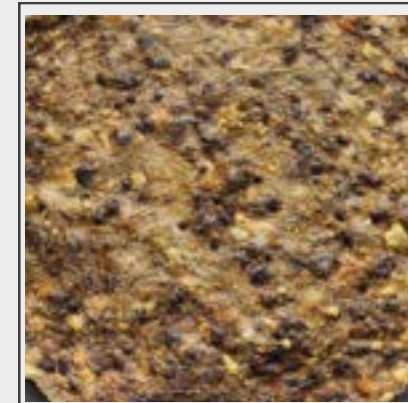
Tap water  
Alginat: 100g  
Unw. wool: 10g



Rain water  
Alginat: 211g  
Washed wool: 6g  
Orange filler: 6.20g



Rain water  
Alginat: 81g  
Washed wool: 2.4g  
Orange filler: 1.5g



Rain water  
Alginat: 85g  
Washed wool: 2g  
Orange filler: 15g



Tap water  
Paper pulp  
Unwashed wool: 1g



Tap water  
Alginat: 70g  
Washed wool: 5g



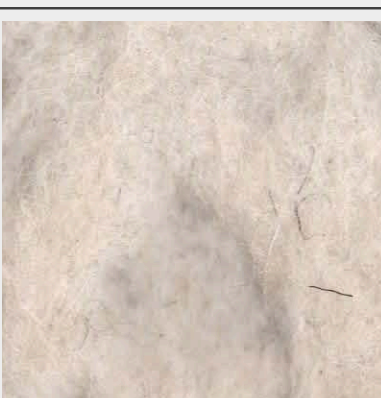
Tap water  
Alginat: 70g  
Washed wool: 1g



Tap water  
Alginat: 70g  
Washed wool: 8g



Tap water  
Alginat: 70g  
Washed wool: 10g



Tap water  
Agar: 1g  
Washed wool: 2g

# WHAT'S NEXT: expanding the research

I tested suint fermentation on several Alpine sheep breeds, all with promising results. Ongoing research will extend to Italian wool breeds and involve knowledge-sharing with farmers to foster collaborative testing and locally rooted practices.



Next: material behavior study



I am currently investigating wool biocomposite applications through experimentation and dialogue with designers, farmers, and Woolshed partners, intending to develop a scientific analysis of the materials.

I also take part in events and exchanges to deepen my knowledge, connect with producers and explore ongoing initiatives.

**Interreg**



Co-funded by  
the European Union

Woolshed

**Alpine Space**

LE  
TEXTILE  
LAB



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**Wool & Flow**

**MARTINA MURONI**