# TINKERING WITH AND FOR BIO AND SMART TEXTILES: PRODUCE AND EXPLORE A BIO-YARN

OER: TINKERING WITH AND FOR ADVANCED TEXTILES. MATERIAL TINKERING AS A SOURCE FOR THE CREATIVE PRACTICE

**Objective & Scope**

Material tinkering is an informal way of learning based on creative and experimental manipulation of material ingredients and processes. It aims to explore (novel) materials from a performative and expressive-sensorial standpoint (tinkering with materials) and understand design opportunities developing further versions of the material (tinkering for materials).

The proposed exercise aims to experiment with and develop a Do-It-Yourself bio-based yarn made of sodium alginate and calcium chloride, as an alternative organic and biodegradable material for textile in clothing or other applications coming from renewable resources. Smart and conductive materials can be added in the process. In addition, the activity focuses on acquiring sensory sensitivity by exploring the qualities and characteristics of the resulting resources through senses, e.g., visual and tactile exploration.

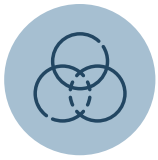
**Activity Question**

**Which qualities can we obtain applying experimental and low-tech material tinkering to basic bio-based ingredients for a more sustainable textile design?**

**Learning Goals**

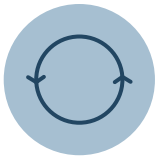
- Learn how to put in practice Material Tinkering for textiles and fibres' exploration and development
- Be able to practice sensorial and performative understanding and description of material qualities
- Learn alternative and creative approaches to materials exploration and development (Material Tinkering) allowing to discover and valorise unconventional bio-based and smart resources for textile.

**Categories**



**Design Process**

**Smart Textiles**



**Sustainability**

**References**


- Parisi, S., Rognoli, V., Sonneveld, M.H. (2017). Material Tinkering. An inspirational approach for experiential learning and envisioning in product design education. The Design Journal, 20:sup1, S1167-S1184.
- Rognoli, V., Parisi, S. (2021). Material Tinkering and Creativity. In: Cleries, L., Rognoli, V., Solanki S., Llorach P. (eds.). Material Designers. Boosting talent towards circular economies. http://materialdesigners.org/book
- Create Bio-yarn. (n.d.). Instructables Craft. Retrieved 2021, from https://www.instructables.com/Create-Bio-yarn/
- Bogers, L. (2020). ALGINATE STRINGS. Textile Academy. Retrieved 2021, from https://class.textile-academy.org/2020/loes.bogers/files/recipes/alginatestring/


**Support material**

- Step by step instruction and recipes + references for inspiration
- Canvas as a support for sensorial exploration (see visual below, inspired by Elvin Karana's sensory scale, 2009)
- Tangible logbook and stationery (owned by the students) or virtual logbook on student's laptop
- **OER**
- **Summary presentation**

**Equipment**

- Ingredients: sodium alginate, calcium chloride, chitosan (optional), active charcoal (optional) or smart pigments (e.g., thermochromic) (optional), pigments (spirulina, turmeric, etc.) (optional). Quantity of the ingredients to define.
- Equipment: syringes, bowls or glass jars, knitting needles, scales, spoons.
- About quantities: we will prepare indication for individual experimentation, small group (5 students) in the case of satellite summer school, and big group (20 students) for full on-site summer school.
- Facilities for the presentation and exercise: a projector, teaching staff laptop, university space equipped with tables, seats, wi-fi, electrical outlets.

## A.

## Tinkering with and for bio and smart textiles: produce and explore a bio-yarn

**1.**
Introduction: the activity is introduced by teaching staff using a short presentation (summary presentation) (10 minutes)

**2.**
Tutorial: the teaching staff presents the starting ingredients and demonstrates the process using equipment and ingredients (20 minutes)

**3.**
Collect tools and ingredients): each group of students (small group 4 students) is given ingredients and equipment: sodium alginate, calcium chloride, chitosan (optional), a syringe, water, bowls or glass jars, knitting needles, active charcoal (optional) or smart pigments (e.g. thermochromic) (optional), pigments (spirulina, turmeric, etc.) (optional), scale, spoon; recipes and references are provided to each team. Students decide how to plan the next step experimentation, e.g. which ingredients to use (15 minutes).

**4.**
First experiments: iterative approach): 1) Preparation: weight ingredients according to the recipe; mix the ingredients in water to create a solution; 2) Extrude: use the syringe to extrude the solution; 3) Knit: use the knitting needles to create a textile from your bio-yarn. 4) Cure: leave it dry for a few days to cure it and stabilize it. In this phase, the teaching staff is available for feedback and support. Besides curing, one iteration will take approx. 20 minutes.

**5.**
Document: during the process, document everything about the ingredients, processes, results' qualities and characteristics. Use a logbook, a diary, an abacus, videos, and pictures. Teaching staff will be available to support students struggling with the documentation.

**6.**
After the first iterations: Use your senses to explore the results from a sensorial and performative standpoint. Do tactile exploration to understand the mechanical characteristics and touch qualities of the resource (e.g., flexibility, weight, tensile strength, texture, etc.). Do visual exploration to understand the visual qualities of the resource (e.g., translucency, colours, patterns, etc.). Explore the materials even with other senses, e.g. olfactory qualities. A 'scale' tool can be used to support the activity. Ask: What is their potentials for the textile sector? This activity can be performed anytime to explore results of the following activities. Teaching staff will be available to facilitate this activity.

**7.**
Experiment and Tinker (iterative approach): in any phase, experiment with the ingredients or the process and create different variation starting from a basic recipe. In this phase, the teaching staff is available for feedback and support.

**8.**
Search for other resources (Optional):
1) make field research: explore your proximate surrounding environment (your home, your school, your district), searching for potential alternative resources (focusing on fibres, powders and inks) to be used or re-used in combination with the bio-yarn. They can be organic or synthetic material resources coming from waste, vegetables and fruits peels, etc.
2) Collect those resources and tinker with them adding them to the bio-yarn

**9.**
Discussion. Discussion about the results to share ideas and opinions and see the different variations and experimenta-tions. This phase can be done at the end or in intermediate phases (for example right after 5). Teaching staff will facilitate the discussion.

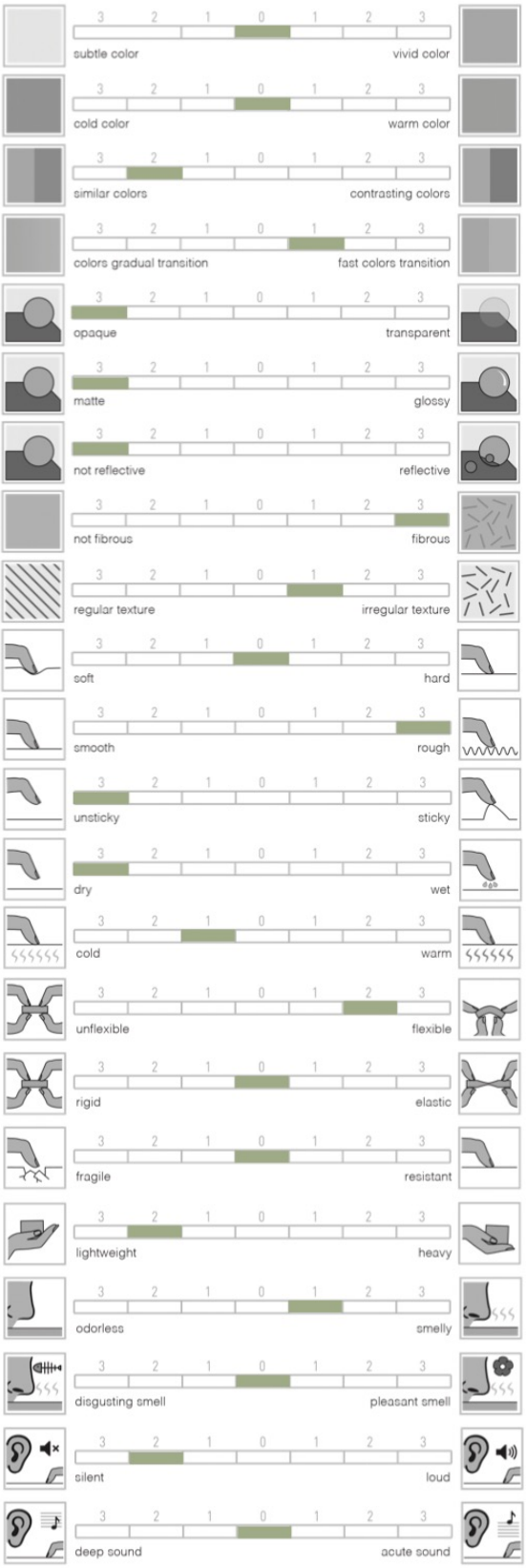
**10.**
As a further step of the activity, you can observe how the material vary change time

**Around half a day**
**A day or more than a day**

**Small group**
**Discussion**

**Discover, Define**
**& Develop**

## SUPPORT FOR SENSORIAL EXPLORATION (AFTER KARANA'S SENSORY SCALE, 2009)



**GLASS NOODLE**
15% Sodium Alginate
$NaC_6H_7O_6$
20% Calcium Chloride
CACl

Ø 3mm, l. 3.60m, w. 40gr

**THERMOCROMIC INK NOODLE**
20% Sodium Alginate $NaC_6H_7O_6$
20% Calcium Chloride $CACl_2$
1,5g Sweet Paprika Powder

Ø 5mm, l. 1.90m, w. 35gr

**RIBES TEA & PAPRIKA NOODLE**
15% Sodium Alginate $NaC_6H_7O_6$
20% Calcium Chloride $CACl_2$
1,5g Sweet Paprika Powder

Ø 3mm, l. 3.07m, w. 54gr

**CONDUCTIVE NOODLE**
15% Sodium Alginate $NaC_6H_7O_6$
20% Calcium Chloride $CACl_2$
15g Active Carbon

Ø 3mm, l. 3.30m, w. 40gr, r. 150-200 Ω