



STUDY REPORT ON NATURAL PIGMENTS FOR DYEING YARNS AND FABRICS



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Introduction

About the Study

This study was conducted during the school year 2025/26 by Daugavpils secondary school of arts and design SAULES SKOLA within the framework of the EU Erasmus+ KA2 project “Natural Paints for Sustainable Art and Crafts” (Plant&Paint) Nr. 2024-1-LV01-KA220-VET-000252528. It explores the educational, artistic, and technological aspects of using natural pigments derived from plants in fashion and textile design. The research focuses on how traditional knowledge of natural dyeing can be integrated into contemporary creative education, promoting sustainability, material awareness, and ecological responsibility. By combining artistic experimentation with environmental consciousness, the study highlights new pathways for developing eco-friendly design practices that respect both cultural heritage and the natural environment.

Participants

Students of the **Product Design – Textile programme (Year 2)** explored the use of plant-based dyes on natural textile materials, researching possibilities for colouring fabrics and yarns with natural pigments and various mordants. The core idea of the project was to apply traditional techniques and technologies in material processing to create a new, contemporary design product. Natural materials, natural colours, environmentally friendly approaches, eco-design, experimentation, nature, and creativity formed the foundation of the entire process.

During the development of the project concept, students acquired theoretical knowledge about plants and mordants, as well as practical skills in dyeing yarn with plant-based pigments. They dyed small samples, experimented with different mordants, and tested how the shades changed depending on the chosen methods.

Within the Plant&Paint project framework, the **Fashion Design Programme (Year 2)** students focused on the artistic and technological exploration of natural pigments as a sustainable alternative in fashion design. The project offered an opportunity to integrate creative experimentation with eco-conscious thinking, encouraging students to investigate how naturally derived dyes can enrich both the aesthetic and conceptual dimensions of contemporary fashion.

1. Discovering Local Plant-Based Colors

1.2. Historical & Cultural Insights

The traditional use of plants for textile dyeing in Latvia reflects a deep connection between natural resources, craftsmanship, and local identity. Historical evidence and ethnographic sources indicate that Latvian artisans relied primarily on locally available dye plants, many of which were gathered seasonally from meadows, forests, and household gardens.

Among the most common sources of colorants:

Plants	Colors
Birch leaves	greenish, green-grey tones.
Walnut leaves	brownish, greyish tones.
St. John's wort	yellowish, greenish-yellow tones.
Nettle	greyish, greenish tones.
Greater celandine	yellowish, green-yellow tones.
Aronia	purplish, pinkish, greyish tones.
Pokeweed (Phytolacca)	pink-violet tones.
Marigold	yellowish tones from flowers; greenish-brown tones from stems.
Onion skins	yellow, orange, and brownish tones.
Tomato plant	greenish-grey tones.
Blackcurrant	violet and violet-bluish tones.
Grapes	violet-bluish tones, violet-grey tones.

The choice of dyeing plants was influenced by regional flora, seasonal cycles, and the availability of mordants.

In Latvian traditional dyeing practices, as in most Northern European regions, mordants played a crucial role in achieving durable and vibrant colors.

The most commonly used mordants were:

Alum (potassium aluminum sulfate) – the most widespread and gentle mordant, producing clear and bright tones, especially with yellow and red dyes.

Iron (ferrous sulfate) – used to darken colors, turning yellows into olive or browns; sometimes obtained by soaking rusty nails in vinegar.

Copper (copper sulfate or natural verdigris) – deepened greenish and bluish shades.

Tannin-rich natural materials, such as oak bark, sumac, or willow leaves, acted as mild organic mordants, especially for linen fibers.

Urine and whey – occasionally used historically as protein-based fixatives before industrial mordants became common.

Traditional Latvian textile artisans applied these dyes mainly to wool and linen, fibers typical of domestic production. The resulting color palette was naturally subdued yet harmonious, reflecting the tones of the local landscape. Today, the revival of plant-based dyeing connects contemporary sustainable design with Latvia’s intangible cultural heritage, demonstrating how ecological awareness and historical practices can merge within modern creative education.



1.3. Sustainable Aspects

Natural pigments are eco-friendly because they are biodegradable, non-toxic, and renewable, unlike synthetic dyes derived from petrochemicals. Their production uses less energy and fewer harmful chemicals, reducing water and soil pollution. Additionally, many are sourced from locally grown or waste plant materials, supporting sustainable and circular design practices.

2. Experimenting with Natural Pigments

2.2. Exploring Regional Plants

Over the course of one year, students conducted extensive experiments with natural dyes extracted from locally available plants. Using onion skins, blackcurrants, grapes, chokeberries, and oak leaves, they explored a wide range of natural colour outcomes and tested how different mordants influenced tonal variations. The hands-on investigations provided valuable insight into the dyeing potential of regional plant resources.

2.3. Methods of Extraction

Both fresh plants and berries, as well as pressed juice and dried leaves, were used for pigment extraction. For dyeing, the students prepared decoctions from dried plants, berry infusions, and diluted juice concentrates, allowing them to test how different extraction methods influence colour intensity and shade variation.

2.4. Testing on Different Materials

Cotton fabric was used for batik and dyeing experiments, while **wool yarn** was prepared and dyed using natural pigments. **Vinegar, salt, and iron sulfate** served as mordants, helping the fibres absorb and fix the colour more effectively.

The tie-dye (batik) technique is a traditional method of resist dyeing, used to create decorative patterns on fabric by preventing dye from penetrating certain areas. The design is formed through binding, folding, twisting, or stitching parts of the textile before immersing it in dye. When the bindings are removed after dyeing, the reserved areas remain undyed, revealing distinctive, often organic patterns. In Latvian and European craft education, the technique is valued for its expressive spontaneity and the ability to



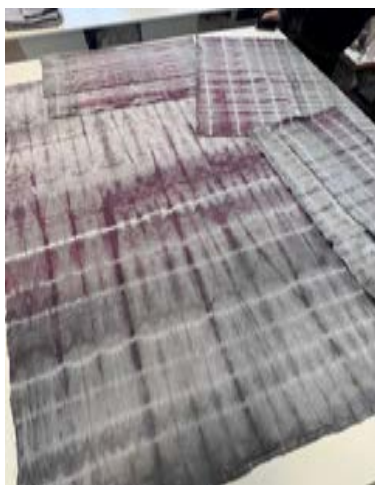
experiment with color gradients and textures. Within the Plant&Paint project, students adapted tie-dye to work with plant-based pigments, exploring how natural dyes behave when absorbed into different fibers such as cotton or linen.

2.5. Challenges Faced & Solutions Found

Previous experience of working with synthetic dyes proved useful during the experimentation process, although preparing natural dyes required significantly more time. The temperature of the dye bath played a crucial role in determining the final colour, meaning that the process demanded constant attention and careful monitoring. Because natural dyes are less saturated than synthetic ones, students had to consider that the resulting shades would be softer and less vivid. In many cases, the natural colour of fresh plants or berries differed from both the prepared dye and the final colour on the material — a characteristic that distinguishes natural dyes from artificial alternatives. After drying the material often became noticeably lighter or even shifted in tone.



Throughout the project, students experimented with mixing colours from different plants. The more tones that were combined, the greyer the resulting colour became. Another challenge was the limitation of the school workshop, where it was impossible to dye large pieces of fabric evenly. To meet the project’s goal of combining creative approaches with new technical skills, students used tied, wrapped, folded, and stencil batik methods, applying them to both fabrics and yarn.



The most satisfying results were achieved when dyeing with traditionally Latvian materials — onion skins, blackcurrants, and chokeberries — which produced rich, natural tones that students particularly enjoyed.

2.6. Reflections from Participants

Students and teachers highlighted that the entire process — from preparing the dyes to developing ideas and creating a unique handmade product — was both engaging and transformative. For the Fashion Design students, this was the first time they had the

opportunity to act not only as garment designers but also as creators of the fabric design itself, giving them a more complete understanding of the design workflow.

Active involvement in every stage of product development proved essential, helping participants gain a deeper appreciation of material behaviour, colour transformation, and craftsmanship. Equally valuable was the collaboration between different study programmes, which encouraged knowledge-sharing, cross-disciplinary teamwork, and the acquisition of new skills.



Overall, the experience broadened students’ perspectives on how materials and techniques can be used creatively in design, reinforcing the importance of experimentation and cooperation in developing contemporary, sustainable textile products.

3. Practical Applications & Creative Outcomes: Collection of dresses

3.2. Development stages

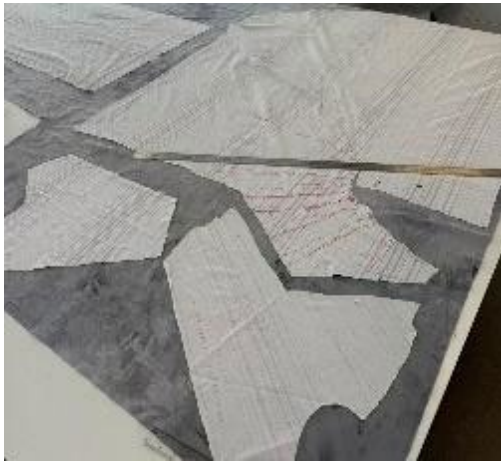
The process began with thematic research and concept development. Students identified their individual sources of inspiration—ranging from natural forms and textures to historical references or local cultural motifs—and translated them into preliminary design sketches. These visual explorations formed the basis for further material and structural experimentation.

The development stage centered on creating three-dimensional mock-ups through the draping (moulage) method. This couture technique involves shaping fabric directly on a mannequin to build the garment's silhouette and proportion in real space. Working with a neutral, plain-weave cotton fabric allowed students to study the fall, tension, and structure of the material in relation to the human form before transferring the design to the final dyed fabric. Draping also facilitated intuitive problem-solving: adjustments to seam lines, darts, and pleats could be made directly on the mannequin, refining the garment's form with immediate visual feedback.

Once the prototype was complete, students carefully translated the draped forms into flat patterns, ensuring symmetry, technical accuracy, and readiness for production. At this stage, the design team also planned the tie-dye layout—mapping where pigment concentration, gradients, or abstract motifs would best complement the structure of the garment.



The next phase involved fabric dyeing with plant-based colorants, obtained from natural sources studied within the project. Students tested various mordanting and dyeing



techniques to achieve different tonal intensities, exploring how fiber composition, temperature, and immersion time influenced the

resulting colors. These experiments provided not only artistic outcomes but also valuable material research for future sustainable fashion practices.

After dyeing, students cut and assembled the garments, applying appropriate couture sewing techniques to preserve the fabric's visual and structural integrity. Multiple fittings were conducted to fine-tune proportions and comfort, ensuring that each dress combined aesthetic refinement with functionality.

The completed garments were then prepared for final documentation. A professional photo shoot captured the results of the creative process—highlighting both the artistic individuality of each design and the unifying concept of sustainable, plant-based color. The photographs, accompanied by design sketches and process documentation, will be featured in the *Plant&Paint* digital catalogue and upcoming exhibition.



3.3. Key Insights & Lessons Learned

Through this training task, students not only gained practical skills in draping and natural dyeing techniques but also deepened their understanding of sustainable fashion design, where material research, creative expression, and ecological responsibility form an integrated process.

3.4. Potential for Future Work:

This methodology can be successfully applied to the development of graduation projects as well as to the organisation of workshops for anyone interested in exploring fashion and textile design. The approach offers a flexible framework that encourages creativity, experimentation, and sustainable thinking — making it suitable for both beginners and advanced learners. Building on the results of this project, the concept could be expanded into a structured series of educational workshops dedicated to natural dyeing, fabric manipulation, and pattern creation.



These workshops could be adapted for designing various types of clothing, such as lightweight summer garments made from cotton or silk, or autumn and winter pieces crafted from wool featuring distinctive, naturally coloured patterns and motifs inspired by plants. By continuing to integrate traditional techniques with contemporary design, the project has the potential to evolve into a broader platform for innovative, eco-friendly textile creation.

3.5. Expanding the Knowledge

The results will be shared widely through the project’s digital platform, where instructional materials, photos, and video tutorials will be accessible to partner schools and external audiences. In addition, workshops, the school’s website, and Instagram will serve as key channels for disseminating outcomes, inspiring other learners, educators, and creative communities to explore natural dyeing and sustainable textile practices.

This was the first year of project activities, during which students carried out initial research, experiments, and product development using natural dyes. In the next school year, the project will continue to evolve, involving a new group of students, expanding the scope of experiments, and introducing new creative tasks to further deepen the study of natural pigments and sustainable textile design

4. Practical Applications & Creative Outcomes: Collection of scarves

4.1. Development stages

During the development of the project concept, students acquired theoretical knowledge about plants and mordants, as well as practical skills in dyeing yarn with natural plant-based pigments. They prepared small test samples and carried out experiments using different mordants to observe how these influenced colour absorption and final results.



The first yarn samples were prepared using small test skeins to observe the resulting colours and select the most suitable shades for dyeing the yarn intended for the scarves. The choice of tones was also influenced by the



availability of natural materials, which depended on the season and the plants that could be collected at that time.

For the creation of the final products, 100% white wool yarn was used. The yarn was prepared in 100 g hanks, which made it easy to dye them in a range of shades. Before dyeing, some hanks were tied with string—similar to batik techniques—or dyed in two separate containers. As a result, part of the material developed solid, uniform tones, while another part obtained batik-like, patterned



effects.

The next stage was setting up the loom for weaving the scarves. For the base material, thin leftover wool yarn from production was used, while the dyed yarn served for the

weaving.

The composition was created according to the stripe principle, alternating between plain-colored yarn and batik-dyed yarn



After weaving the scarves, the piece was removed from the loom, finished, and made ready to wear.

4.2. Key Insights & Lessons Learned

Throughout the project, students gained new skills and knowledge about using plants for colouring textile materials. The results were always surprising, as the tones developed in unique and unexpected ways. This dyeing technique shows great potential, given the vast diversity of plants found in nature, offering countless opportunities for future experimentation. Students learned how to prepare the material and apply it in the development of design products, fostering the growth of design thinking while combining traditional techniques—dyeing and weaving—to create contemporary textile designs

4.3. Potential for Future Work

In the second year of the project, textile design students will continue their work, applying the knowledge gained so far to a sustainability-focused design project. They will dye various production leftovers, learn material recycling and upcycling techniques, create experimental samples, and develop design prototypes such as garment components, accessories, or complete clothing items. The aim of this work is to further develop sustainable

design thinking through research, hands-on exploration of new techniques, and their application in contemporary design products.

4.4. Expanding the Knowledge

The results will be shared widely through the project’s digital platform, where instructional materials, photos, and video tutorials will be accessible to partner schools and external audiences. In addition, workshops, the school’s website, and Instagram will serve as key channels for disseminating outcomes, inspiring other learners, educators, and creative communities to explore natural dyeing and sustainable textile practices.

5. Appendix – Additional Visuals & Resources

Photo Gallery of creation of scarves



Photo Gallery of creation of dresses



























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