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STŘEDNÍ ŠKOLA UMĚNÍ A DESIGNU
A VYŠŠÍ ODBORNÁ ŠKOLA BRNO
PŘÍSPĚVKOVÁ ORGANIZACE
pracoviště: Francouzská 101, 602 00 Brno
telefon: 545 125 611
e-mail: info@ssudbrno.cz, www.ssudbrno.cz



PLANT&PAINT

STUDY REPORT ON NATURAL PIGMENTS

A practical exploration of local plant-based dyes in textile creative education

Introduction

About the Study

The study offers a comprehensive view on how to efficiently and sustainably obtain and use natural pigments, how to increase their stability and functionality, and how to minimize environmental impact. The study also addresses the topic of sustainable textiles.

It explores:

- How to extract dyes from nature
- How to prepare fabrics for dyeing
- How to use mordants
- How colour binds to fabric – stabilizers

Environmental benefits

Project & Work Package Overview

Participants

Martina Deissová Víchová - The head of Interior design

Zuzana Běhalová Sedmidubská – The head of Fashion design

Dagmar Hejduková - Dyeing and Printing specialist

Ivan Matoušek – Graphic Designer specialist

Monika Woznicova – Fashion Designer, Ecotextile design specialist

Petr Kalouda – Fashion Designer, garden specialist

Radka Kopecka – Chemist Specialist

Jana Urbanova – Project manager

1. Discovering Local Plant-Based Colours

1.1 Exploring Regional Plants

Natural dyes derived from plants, insects, or minerals have a history spanning thousands of years and have experienced a renaissance in recent years, particularly in the context of sustainable and eco-friendly fashion. Unlike synthetic dyes, which often burden the environment, natural alternatives offer a gentler and renewable solution.

Traditional sources include:

Plants – e.g., madder root, turmeric, oak bark, nettle, rose hips, etc.

Minerals and earths – ochres – yellow, red, and brown pigments from clay soils

In eco-textiles, additional sources include:

Food waste – coffee grounds, onion skins, avocado pits, etc.

Industrial by-products – bark, sawdust, etc.

Microorganisms – algae, bacteria, fungi, and others.

1.2 Historical & Cultural Insights

Most of the plants and other natural sources mentioned in connection with natural dyes have historically been used extensively in both the textile and art industries.

Textile industry:

Before the advent of synthetic dyes in the mid-19th century, natural dyes were the only way to color fabrics. Indigo, madder, turmeric, cochineal, and many others were used for thousands of years to dye clothing, carpets, tapestries, and other textiles around the world. Their use was an integral part of rich cultural traditions.

Art industry:

Pigments derived from these plants and minerals were also widely used in the production of paints for fine art, paper dyeing, and inks. Many classical works of art were created using pigments sourced directly from nature.

1.3 Sustainable Aspects

Natural pigments are considered an eco-friendly alternative primarily for several key reasons, which stand in contrast to the impacts of synthetic dyes:

Renewable sources – plants, roots, bark, leaves, flowers, insects, minerals. These resources can be regrown, cultivated, or mined with a lower impact on ecosystems when managed sustainably.

Lower toxicity and biodegradability – natural pigments break down more easily in the environment and are generally less harmful to human health and wildlife.

Less water pollution – the dyeing process with natural materials typically uses fewer harmful chemicals, resulting in cleaner wastewater.

Smaller carbon footprint – natural dye production often requires less energy and generates fewer greenhouse gas emissions.

Circular economy – many natural dyes can be sourced from waste materials or by-products, supporting reuse and reducing overall waste.

2. Experimenting with Natural Pigments

2.1 Methods of Extraction

Due to climatic conditions, we purchased the pigment because it was winter and we needed to carry out the dyeing process.

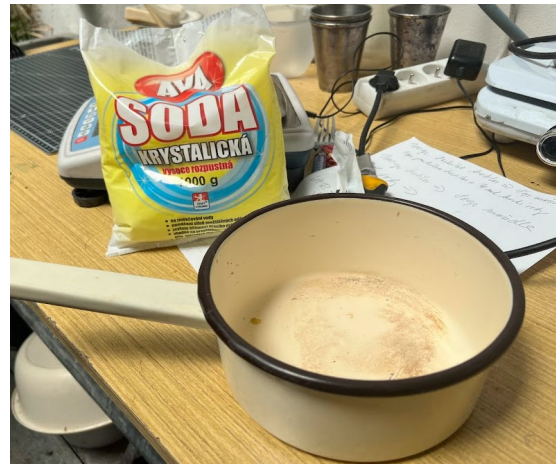
In our local conditions, it is possible to grow plants such as madder (*Rubia tinctorum*), goldenrod, oak bark, and beet, among others.

1. Preparation of raw material
2. maceration in water
3. boiling/heating, filtration
4. pH adjustment or addition of mordants
5. storage (optional)

2.2 Testing on Different Materials

The test was conducted on samples of fabric – 100% cotton.

It was tested only on natural cotton of various weights.



2.3 Challenges Faced & Solutions Found

The concentration test of the dye bath was conducted under different conditions to determine its effectiveness and the influence of the environment on dyeing. We tested reactions in acidic, alkaline, and neutral environments on untreated cotton and cotton mordanted with alum and copper sulfate.

New findings showed that mordanting with alum leads to a loss of fabric strength and increased brittleness. The use of copper sulfate had only a slight effect on fabric strength. In a neutral environment, unmordanted cotton remained stable, and its strength was preserved. Acidic and alkaline environments significantly affected the dyeing with turmeric, influencing the final shade and quality of the color.

2.4 Reflections from Participants

Participants highlighted the value of teamwork and the sharing of experiences among colleagues as a key part of the learning process. They discussed the results of the dyeing experiments, noting the intensity and diversity of the colours achieved. Many expressed enthusiasms about experimenting with new techniques, including batik and various dyeing methods. They also shared insights on the

pigments used and their versatile applications, emphasizing the broad potential uses across different materials and creative projects.

3. Practical Applications & Creative Outcomes

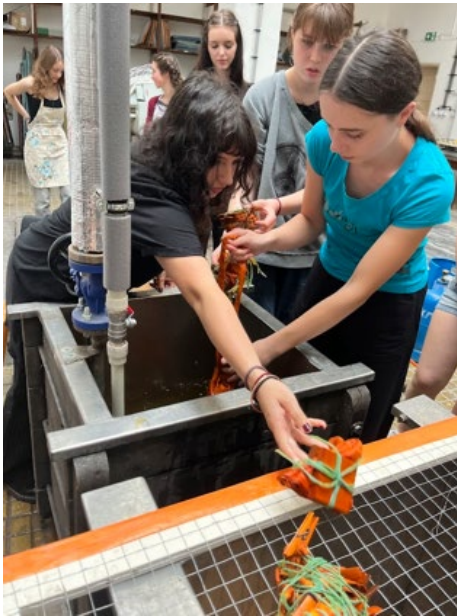
3.1 Student & Teacher Creations

The main output of the project was the acquisition of a comprehensive overview of effective and sustainable methods for obtaining and utilizing natural pigments in the textile and art industries. A set of best practices was developed for the extraction, preparation, and application of natural dyes that minimize environmental impact.

Additionally, the project provided valuable insights into the effects of various chemical and physical factors on color fastness and intensity, particularly depending on the type of fabric, the use of mordants, and the dyeing environment.

An important output was also the documentation of participants' experiences and reflections, which will serve as inspiration and a practical guide for other creators and producers of sustainable textiles.





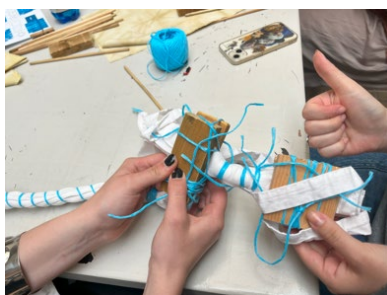
The produced items include bags, placemats, scarves, and decorative objects created using the methods described below. These products showcase the possibilities of using natural pigments and various dyeing techniques such as batik, mordanting, hand dyeing, or combinations of several methods. The finished products stand out not only for their aesthetic appeal but also for their ecological sustainability and environmental friendliness.





3.2 Masterclass Takeaways

Bags were made using folded batik, indigo printing, screen printing, stamping, and combined techniques. The best results were achieved with folded batik, indigo printing, and screen printing, while tied batik allowed for more detailed patterns.



4. Conclusion & Next Steps

4.1 Key Insights & Lessons Learned

Traditional dyeing methods using natural pigments remain effective and reliable. All of these techniques can be easily transferred and adapted to meet the demands of modern contemporary design. Their versatility and aesthetic appeal allow for the creation of original yet sustainable products that align with current fashion and decoration trends.

4.2 Potential for Future Work

Traditional techniques don't have to be used separately as in the past; by combining them, new techniques can emerge.

Some traditional craft methods have been enhanced with modern techniques such as screen printing and 3D printing combinations.

We will continue to explore new colour sources and new dye sources, which will enrich the colour palette.

4.3 Expanding the Knowledge

The results will be shared through a digital platform featuring tutorials, photos, and practical tips. Workshops and presentations will allow others to try the techniques hands-on. Social media and printed materials will help spread the knowledge further and support wider use in sustainable design.

5. Appendix – Additional Visuals & Resources

Example Table of Plant-Based Colours

Plant Name	Part Used	Colour Outcome	Notes
Goldenrod	Plant (leaves, stems)	Golden, golden-green	holds well, but fades in sunlight
Oak bark	bark	brown in various shades	provides good colour fastness, especially with mordants; earthy, natural tones suitable for textile dyeing.

Plant Name	Part Used	Colour Outcome	Notes
Weld (Reseda)	Stems and leaves	Light yellow	the colour tends to reflect or be influenced by the base material; works best on well-mordanted light fabrics for brighter results.
Turmeric	root	Yellow to brown	not colourfast; highly sensitive to pH. In acidic environments, it remains bright yellow, while in alkaline conditions it shifts toward orange or brown tones. Not ideal for textiles exposed to frequent washing or sunlight

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