



INNOVATIVE BIO-DYEING TECHNIQUES FOR THE PROMOTION OF TRADITIONAL MOTIFS

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Abstract: Brands, collections, colors and styles are increasingly being created every season, changing accordingly to the many trends' society generates. People and lifestyle transform rapidly, and so their expectations. With all the demanding adjustments this sector has to currently face, it seems, the industry is facing unprecedented challenges to meet consumer needs. The textile industry is one of the many industries that has the capacity to have a big impact on the environment and society. In the presents that impact leads toward the negative side. It is known that the fashion industry is responsible for 10% of global annual carbon emissions. This creates an urgency for us to reduce the effects the industry has as much as possible. One way is going back what we know from our ancestors and that is bio-dying. The processes of bio-dying successfully exploit the potential of natural biological systems, making industrial activity more environmentally friendly. This paper is the result of using the bio-dying method as a way to be sustainable and, at the same time, bring back the knowledge we have while using contemporaneous technology, by creating a project and products that balances the past and present with the aim of offering people the possibility to preserve memories of the past and now, in the present.

Key words: bio-dye, modifiers, semi-natural, fibers, natural ingredients.

1. INTRODUCTION

Natural dyes offer a sustainable and eco-friendly alternative to synthetic dyes, which can have a significant impact on the environment. The production of synthetic dyes involves the use of petrochemical-based dye intermediates, which can generate hazardous and toxic chemicals that pollute the environment. In contrast, natural dyes are derived from renewable sources, such as plants, insects, and minerals, and their production involves fewer chemical reactions and energy consumption. By using natural dyes, textile products can be produced using a more environmentally friendly process. Bio-mordant and natural finishing agents can also be used in the process, further reducing the environmental impact. Such eco-friendly textile products are considered sustainable because they begin and end their life cycle without causing harm to humans or the environment. Many researchers worldwide are investigating methods to produce more eco-friendly natural dyed textile products to promote the use of sustainable textiles. The use of natural dyes can contribute to a cleaner and greener environment, making it an attractive option for those who want to promote sustainability. [1-3, 10]

Bio-dyes are becoming increasingly popular in the textile industry, as there is a growing demand for sustainable and environmentally friendly products. Bio-dyes can be used to dye natural fibers such as cotton, wool, and silk, as well as synthetic fibers such as polyester, nylon, and acrylic.

One advantage of using bio-dyes is that they can create a wide range of colors, and many of them have excellent color fastness properties. Bio-dyes can be applied to fabrics using a variety of techniques, including exhaust dyeing, cold pad batch dyeing, and continuous dyeing. Another advantage of using bio-dyes is that they can have beneficial properties for the skin. For example, some natural dyes, such as indigo and henna, have anti-inflammatory and anti-bacterial properties that can benefit the skin. [4-6, 10]

2. GENERAL INFORMATION

Bio-dyes refer to dyes that are derived from natural sources and are considered eco-friendly because they do not contain harmful chemicals or pollutants and their production does not harm the environment. Overall, the use of bio-dyes in the textile industry is a promising area of research, and it offers a sustainable and eco-friendly alternative to conventional synthetic dyes. [4-6, 10]

Based on this an experiment was started with different natural materials and modifiers to see what can be obtain by bio-dyeing natural fibers and textile.

2.1 Bio-Dyeing. First trial

The first step in any dyeing process is to prepare the fibers and textiles. This is done by weighing the fibers (WoF). We will need the WoF for future recipes for the dyeing process. Everything begins with the scouring process, that is a process in which we clean our fibers.

For the vegetable fibers, unbleached cotton and linen, sodium bicarbonate is used, 2 spoons of sodium bicarbonate to 4l of water. For the animal fibers, wool and silk a warm bath was given to the fibers. [7] The next part is the mordanting step. This is a substance, typically an inorganic oxide, that combines with a dye or stain and thereby fixes it in a material. Alum was selected as the mordant. The ratio is for animal fiber 10-20% of WoF, for plant-based fibers is 10-15% of WoF. After all of the above is done, the preparation of the dye bath was started. Through the vast majority of different natural dyeing options, it was decided to use the next ones: Onion peels, blueberry, red cabbage, avocado pits and hibiscus. Based on this the following colors were obtained. Figure 1 shows the colors obtained by using different coloring substances (onion peels, blueberry, red cabbage, avocado pits and hibiscus), for four types of textile materials (wool, silk, linen, cotton), for three variations of time periods (30 min, 2 hours, overnight).



Fig. 1: Bio dye results for simmering the textile in the dye bath 30 min, 2 hours and overnight.

To create even more colors, it was decided to use 4 color modifiers: vinegar, baking soda, iron and citric acid. The used recipe to create the modifiers is: 100 ml vinegar + 200 ml water; 25 gr backing soda + 300 ml water; 10 gr iron + 300 ml water; 10 gr citric acid + 300 ml water. Next are the obtained results using these mediums. (Fig.2) [7]

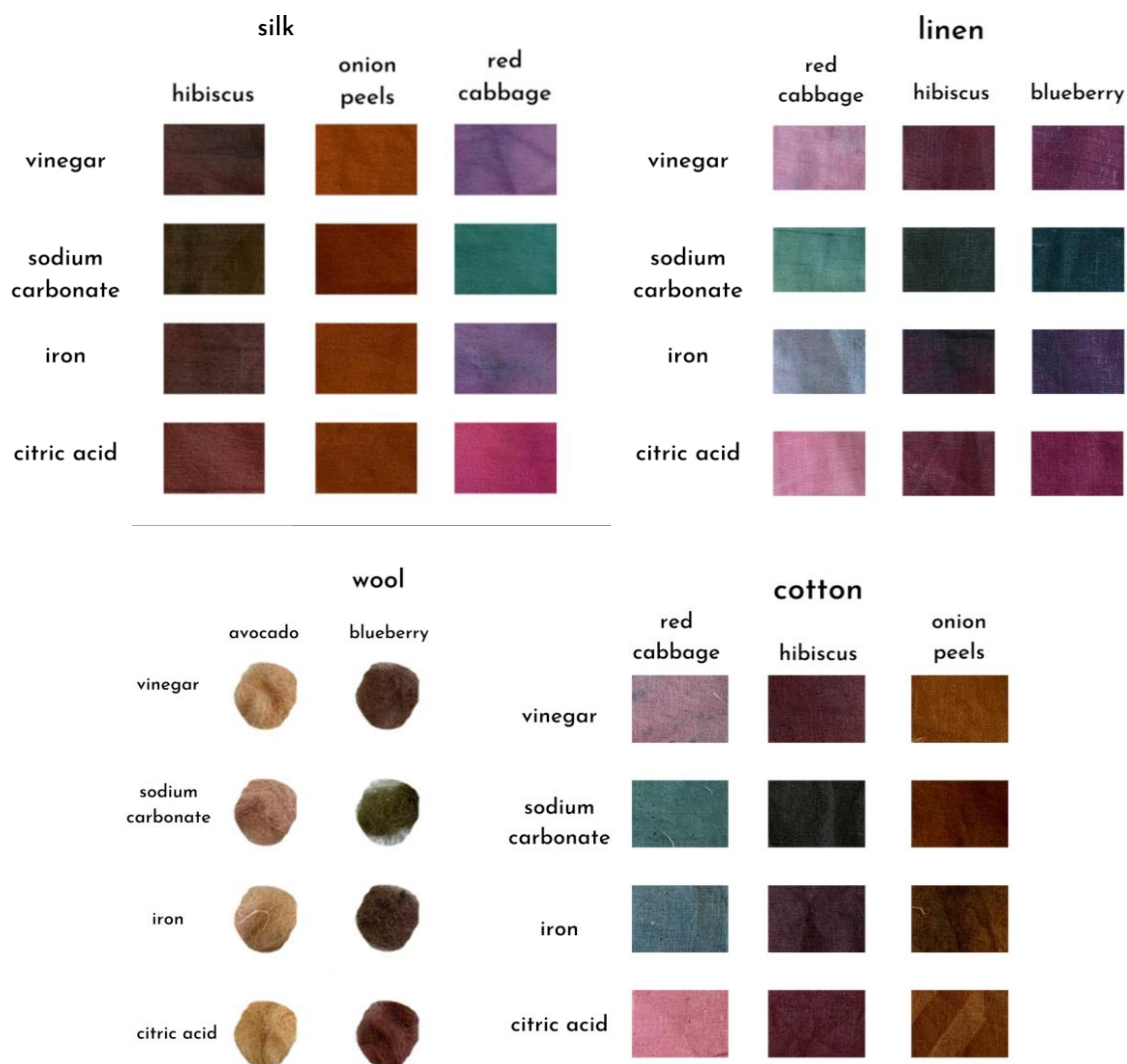


Fig. 2: Results on color modification applied to different type of textile

2.2. Bio-Dyeing. Second trial, semi natural fibers.

Based on the first trials, it was decided to try bio dyeing some semi natural threads. For this the exact same steps mention previously were followed.

First, semi natural threads were selected, 50% cotton and 50% acrylic. Then the threads were weighted. For the semi natural threads 2 spoons of sodium bicarbonate to 4l of water was used. As for mordant Alum Was elected. The ratio was 10 % of WoF.

The most important and interesting part was the dyeing process. Based on the previous experience with the color modifications specific ingredients were used to obtain the wanted colors.

For the greens the blueberry, red cabbage and hibiscus were selected. For a beige and brown colors avocado pits and onion peels were used. And for the red and violets colors beetroot and red cabbage were chosen.

Because the thread is semi-natural, it can be seen that as a result of bio-dyeing the colors are not as intense as in the previous trial. The obtained colors are calmer and pastel. Thanks to the preparation of the fibers and doing the mordant step the fastness of the dyed samples is guaranteed (Fig.3)



Fig. 3: Results of the dye process of seminatural threads

As a way to better see the outcome and to add value to this experiment, it was decided to create a project was the main idea is the combination of the past and the future, the research on these issues being current in the conditions of globalization. [8]

Based on this the work started by first creating working canva by using a laser to cut the canva from felt. (Fig.4) [9]



Fig. 4: The process of laser cutting the felt for the canva.

The next step consists of choosing the object that reflect the past and traditions. And so, a traditional embroidery was selected. After carefully selecting the embroidery, the conversion of the pattern began and a virtual embroidery pattern was created, by taking into account the obtained bio-dyed threads and their color. (Fig.5)

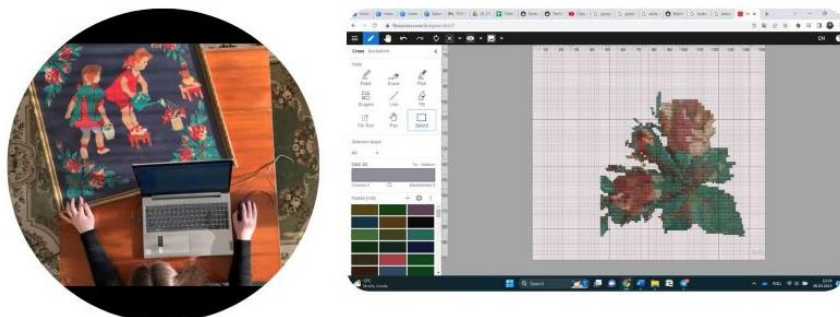


Fig. 5: The process of creating the pattern for the embroidery.

After preparing all the necessary tools and components, the embroidering work started. (Fig.6)

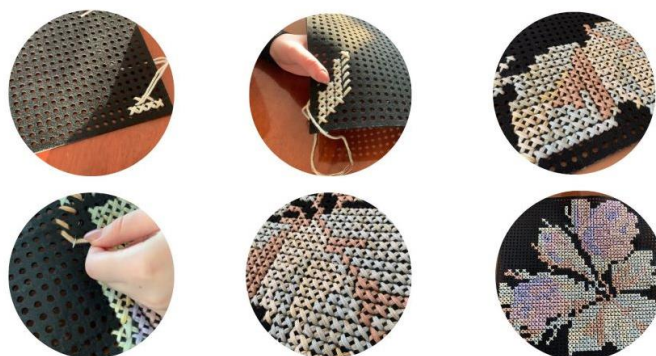


Fig. 6: The process of creating the embroidery.

This project was created with the intention to reflect on the beautiful memories, returning to the primary roots and values of childhood. It is a project that balances the past, traditions, present, and future. The project is a combination of traditional and innovative techniques, created with the aim of offering people the possibility to preserve memories of the past and now, in the present. (Fig.7)

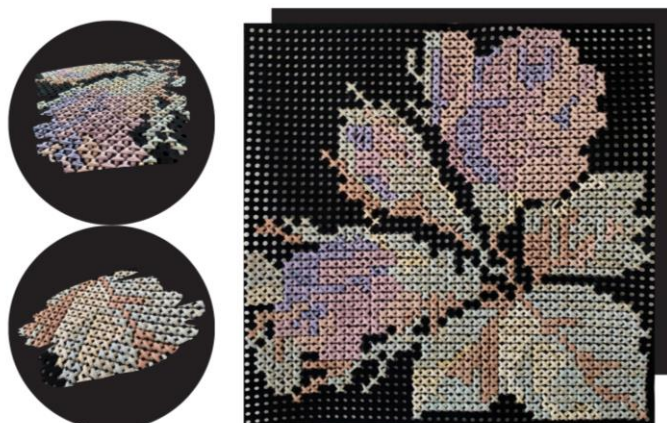


Fig. 7: Embroidery done using the bio-dyed and bio-modified color threads.



5. CONCLUSIONS

The obtained results shows that we bio-dyeing can be used as a way to be sustainable and care for the environment. Additionally, by using bio-dyes we can help support local farmers and communities who grow the natural sources used in the dyeing process. Based on the results we can confirm the semi-natural threads, can be a good option for bio-dyeing. While the natural ones can absorb the dyes better, semi-natural threads can have the advantages of both natural and synthetic fibers, allowing for a wider range of dyeing options. Overall, using bio-dye on semi-natural threads can be a sustainable and eco-friendly choice that supports both the environment and local communities.

As a further research direction, it is proposed to determine the characteristics of the obtained dyed samples.

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REFERENCES

- [1] Ashis Kumar Samanta, (2020, July). Bio-Dyes, Bio-Mordants and Bio-Finishes: Scientific Analysis for Their Application on Textiles [Online]. Available: https://www.researchgate.net/publication/343103769_Bio-Dyes_Bio-Mordants_and_Bio-Finishes_Scientific_Analysis_for_Their_Application_on_Textiles#fullTextFileContent
- [2] Mazharul Islam Kiron, (2022, October). Natural Dyes: Properties, Classification, Production, Advantages and Disadvantages [Online]. Available: <https://textilelearner.net/natural-dyes-properties-types-production/>
- [3] Bide, M. (2014). Sustainable Dyeing with Synthetic Dyes. Roadmap to Sustainable Textiles and Clothing, pp. 81–107. [Online]. Available: https://link.springer.com/chapter/10.1007/978-981-287-065-0_3
- [4] Jadwiga Sójka-Ledakowicz, Joanna Olczyk, Jolanta Polak, Marcin Graż, Anna Jarosz-Wilkolażka, (2015, Jan). Dyeing of Textile Fabrics with Bio-dyes, pp.120-126. [Online]. Available: https://www.researchgate.net/publication/282285052_Dyeing_of_Textile_Fabrics_with_Bio-dyes
- [5] Carvalho, C., & Santos, G. (2015). Global Communities, Biotechnology and Sustainable Design – Natural / Bio Dyes in Textiles. Procedia Manufacturing, 3, pp. 6557–6564. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S2351978915009579>
- [6] How synthetic biology is dyeing the future of fashion, [Online]. Available: <https://www.synbiobeta.com/read/how-synthetic-biology-is-dyeing-the-future-of-fashion>
- [7] <https://class.textile-academy.org/2023/valentina-frunze/assignments/week04/>
- [8] E. Florea Burduja, M. Irovan, L. Indrie, "Creativity and modern technologies for the promotion of Romanian traditional motifs" in Journal of Social Sciences, Vol.II(3), 2019, pp. 21-25.
- [9] <https://class.textile-academy.org/2023/valentina-frunze/project/>
- [10] <https://www.lamphoonmagazine.com/article/2021/10/15/food-waste-dyes-cmp-dye-house/>