

Development and optimization of the separation of pigments from seaweed for use as natural dyes for textiles.

Introduction

The world is full of big polluters. The textile dye industry is one of these major polluters. Every year thousands of tons of chemicals and by-products are released into the environment. These discharges cause health problems and environmental pollution, because the synthetic dyes are very stable and cannot be broken down naturally. As a result, it will remain in the environment for a long time. The textile dye industry also uses a lot of drinking water for the production of the dyes. This is a major problem because a worldwide shortage of drinking water is expected in the future^{[1][2][3]}.

To solve this problem one can use natural dyes. Natural dyes are not only biodegradable, but also pose lower risks to human health and the environment. In this project the researchers of the company Zeefier BV will use seaweed to obtain natural dyes. Seaweed grows in water, eliminating the need for agricultural land to grow seaweed. Also, seaweed does not need fresh water or chemicals to grow. Seaweed grows naturally in salt water, so all that needs to be done is harvesting and drying. This will reduce the discharge of chemicals. Furthermore, seaweed ensures the purification of carbon dioxide (CO₂) and oxygen is formed. Because seaweed provides natural dyes, it is also less harmful to human health^{[4][5][6][7]}.

The aim of the project

The aim of this project is to develop and optimize the separation process of the isolated dyes from seaweed in order to eventually apply the dyes individually to textiles. The isolated dyes will be detected using the HPLC-DAD.



Figure 2: dyed wool

Results

The results of this project show that it is possible to separate the carotenoids from the chlorophylls out of a seaweed extract by using different separation methods such as adsorption chromatography and saponification. However with the used methods it was not yet possible to win back the separated chlorophylls. During the separation methods the chlorophylls turn into water soluble products or they stick to the adsorption material.

The HPLC-DAD results confirm that the separation has taken place (figure 1). With the used methods natural pigments will be obtained. The obtained pigments are used to dye wool. As you can see in figure 2 it is possible to dye different colors and dye evenly with the obtained pigments.

The dyed wool will be tested on their stability with the Accelerated Weathering Tester.

The experiments were carried out with one specific kind of seaweed. For further research the same experiments could be carried out with other kinds of seaweed to find out the differences.

Literature

- [1] C. BBE, „Milieuvriendelijkere alternatieven voor kleurstoffen,” CoE BBE, 2022. [Online]. Available: <https://www.coebbe.nl/projecten/biokleur/>. [Geopend 01 06 2022].
- [2] Zeefier, „Kick off stage periode,” Zeefier, Bergen op Zoom, 2022
- [3] T. S. A. M. C. D. M. L. F. B. J. & ., F. H. ROSSI, „Waste from Eucalyptus Wood Steaming as a Natural Dye Source for Dyeing Cotton,” International workshop advances in cleaner production, Sao Paulo, Brazil, 2015
- [4] Zeeland, „Groene grondstof van de toekomst,” Zeeland, 2022. [Online]. Available: <https://www.zeeland.com/nl-nl/live-work/zeewier-kweken#:~:text=Voor%20vegetari%C3%ABrs%20is%20zeewier%20een,en%20veel%20meer%20geproduceerd%20wordt..> [Geopend 01 06 2022].
- [5] M. I. M. M. R. A. W. S. R. Muhammad Ismail Ab Kadir, „Utilization of Eco-Colourant from Green Seaweed on Textile Dyeing,” International Colloquium in Textile Engineering, Malaysia, 2014.
- [6] D. Y. & M. Scholz, „Textile dye wastewater characteristics and constituents of synthetic effluents: a critical review,” International Journal of Environmental Science and Technology, 2018.
- [7] Zeefier, „Zeefier our story,” Zeefier, [Online]. Available: <https://zeefier.eu/our-story/>. [Geopend 02 02 2022].

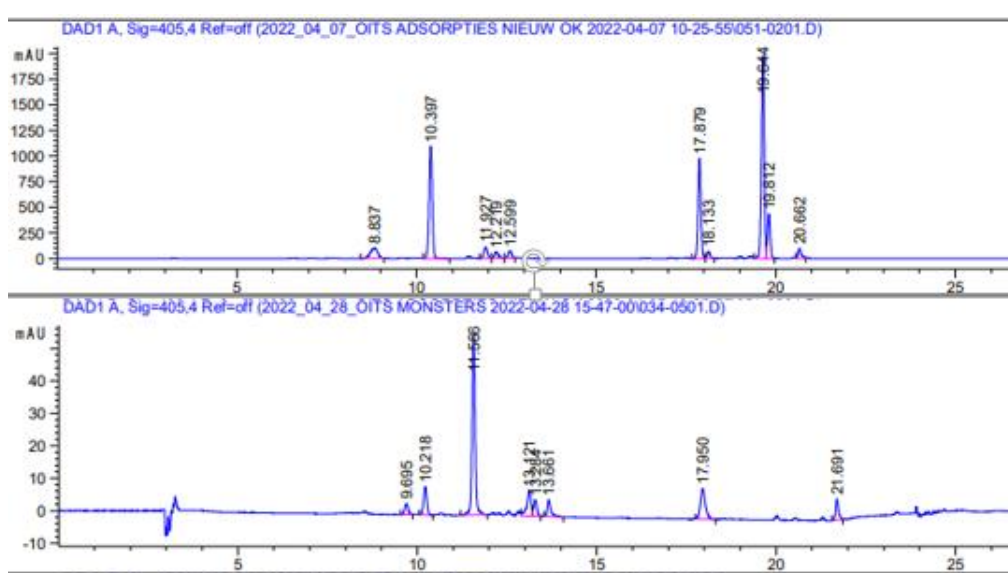


Figure 1: non purified extract (top) versus purified extract (bottom)

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