Natural Dyes in the Context of Textile Industry Sustainability

Tutor: Professor Cristina Barrocas Dias
Location: Laboratório HERCULES- Universidade de Évora

Introduction

The global textile industry has experienced exponential growth, with production nearly doubling in the last two decades. Today, it is one of the most polluting industries worldwide, with severe environmental consequences. For instance, producing a single pair of jeans requires approximately 11,000 liters of water, while a simple t-shirt consumes around 2,700 liters. A significant portion of this water consumption is linked to dyeing processes, which also generate toxic wastewater harmful to ecosystems and human health.

In this context, natural dyes, used in textile dyeing since ancient times, are gaining renewed attention as a potential alternative to synthetic dyes. However, they are not free of limitations, as challenges such as color reproducibility, light fastness, and large-scale application persist.

Internship Objectives

The internship will provide the student with an opportunity to explore the role of natural dyes within the framework of sustainable textile production. The activities will include:

1. Literature Review:

1.1 Mapping the main natural dyes historically and currently used in textile dyeing.
1.2 Identifying environmental and cultural advantages of natural dyeing practices.
1.3 Reviewing technological challenges and barriers to industrial-scale adoption.

2. Local Resources and Sustainability:

2.1 Exploring the potential of locally available natural products (plants, roots, insects, etc.) as sustainable dye sources.
2.2 Discussing the role of circular economy and bio-based resources in textile production.

3. Practical Component:

3.1 Hands-on laboratory experience in natural dyeing processes, including preparation, application, and evaluation of results.
3.2 Testing the reproducibility and colorfastness of selected dyes, with attention to issues such as photodegradation.

4. Expected Outcomes

By the end of the internship, the student will:

- Gain an in-depth understanding of the environmental challenges linked to the textile industry, in particular to the dyeing process.
- Acquire practical laboratory skills in natural dyeing techniques, and be able to critically evaluate the potential of natural dyes for industrial application.
- Become a more informed consumer.

Relevance to Sustainable Development Goals (SDGs):

This internship aligns closely with several of the United Nations Sustainable Development Goals:

SDG 6: Clean Water and Sanitation
By addressing the reduction of toxic wastewater and exploring alternatives that decrease water pollution, this internship contributes to improving water quality.

SDG 12: Responsible Consumption and Production
The focus on natural dyes and local resources promotes awareness about the pollution associated with the textile industry and the fast fashion.

SDG 13: Climate Action
Exploring bio-based materials supports the mitigation of the environmental footprint of textile production, contributing indirectly to climate resilience.

SDG 15: Life on Land
Investigating plant-based dyes encourages biodiversity conservation and responsible use of terrestrial ecosystems.

SDG 9: Industry, Innovation, and Infrastructure
By addressing technical challenges (e.g., reproducibility, color stability), the internship reviews innovative solutions for a more sustainable textile industry.