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**CBS**  
CHEMICAL &  
BIOCHEMICAL SCIENCES  
GREEN PROCESS ENGINEERING



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# Sustainable Dyeing of Wool with Agricultural Wastes

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Pr. Khalid Bougrin



The graphic features a blue circle on the left containing the text 'table of Contents'. To its right is a vertical list of four items, each consisting of a number inside a blue circle followed by a blue rounded rectangle containing the item's title. The items are: 1 Background, 2 Material & methods, 3 Results & discussion, and 4 Conclusion and perspectives. The background is white with blue decorative bars on the left and right sides.

## table of Contents

1

Background

2

Material & methods

3

Results & discussion

4

Conclusion and perspectives

# 1

## Background

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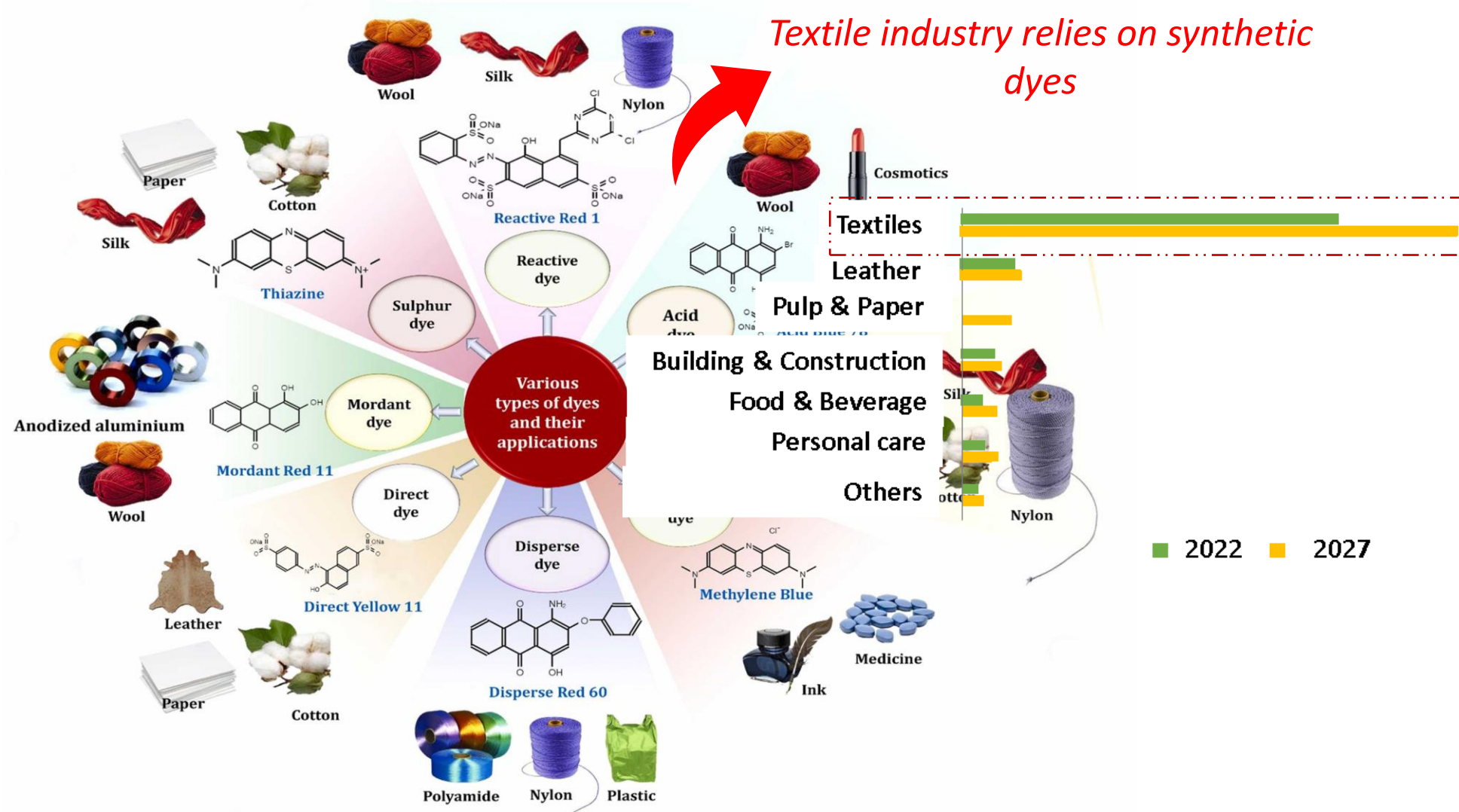
√ Introduction

√ Synthetic dyes

√ Natural dyes

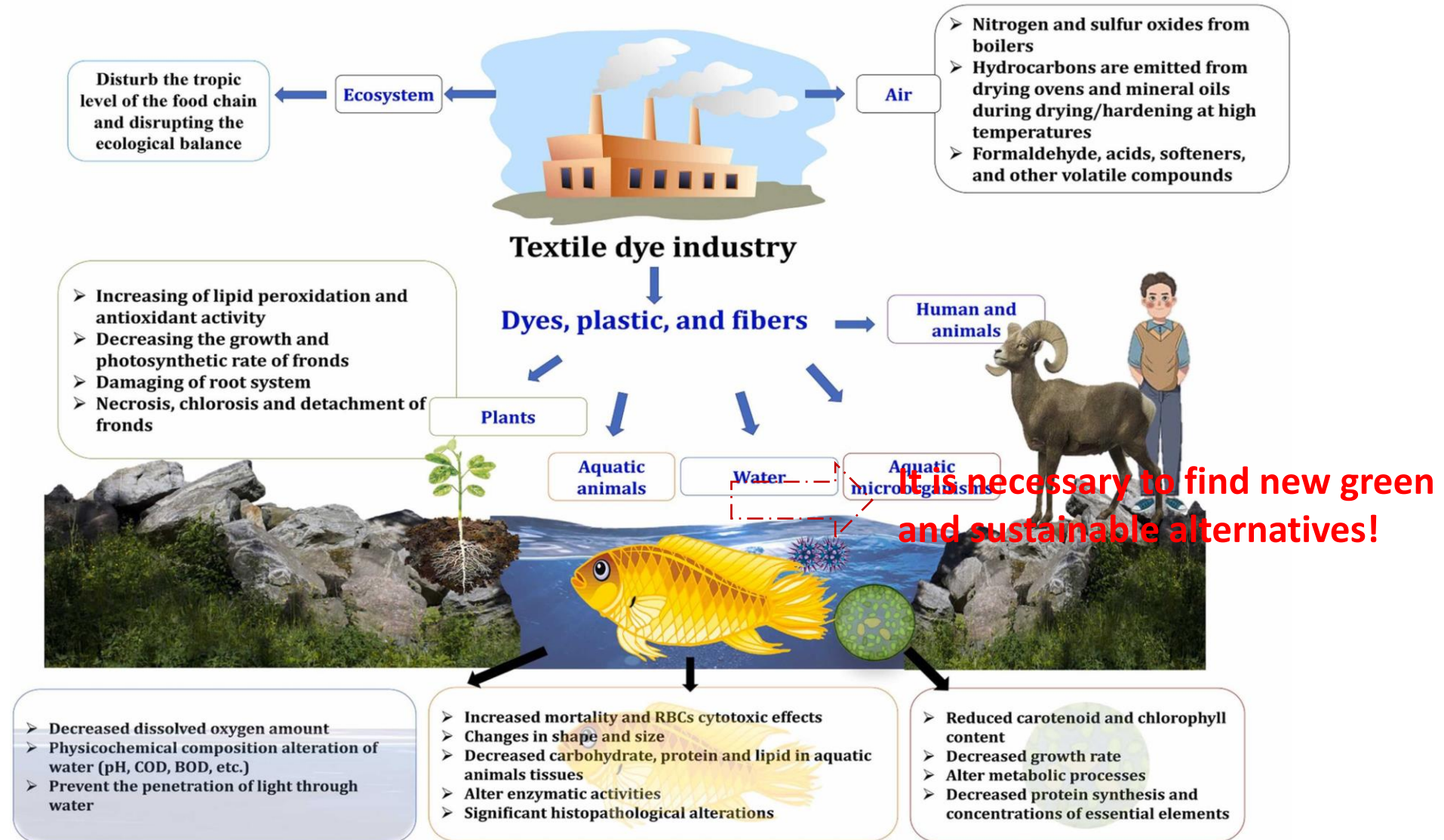
√ Problematic

# Synthetic dyes and their industrial applications





# Toxicity and the impact of textile dyes



# Natural dyes: towards sustainable dyeing

**01** Harmonized with nature

**02** Biodegradable

**03** Not hazardous to health

**04** Minimal impact on environment

**05** Renewable

**06** Antimicrobial activity

**07** UV-protection

**08** Insect repellent





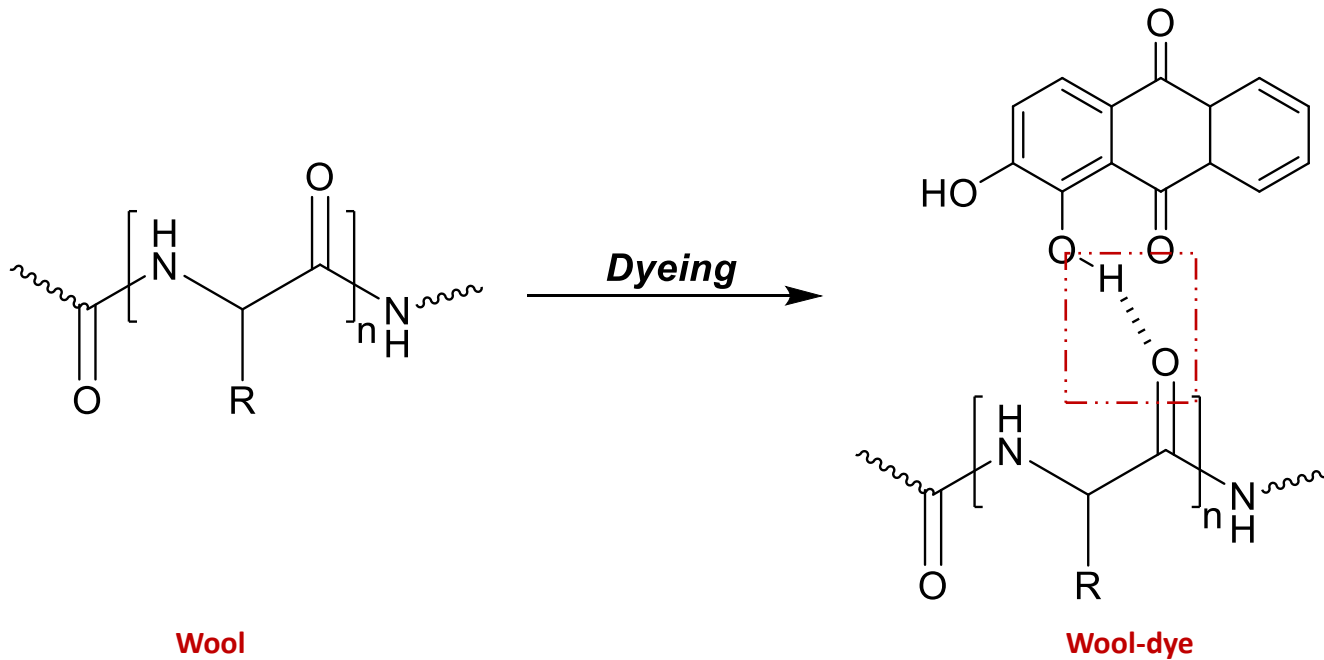
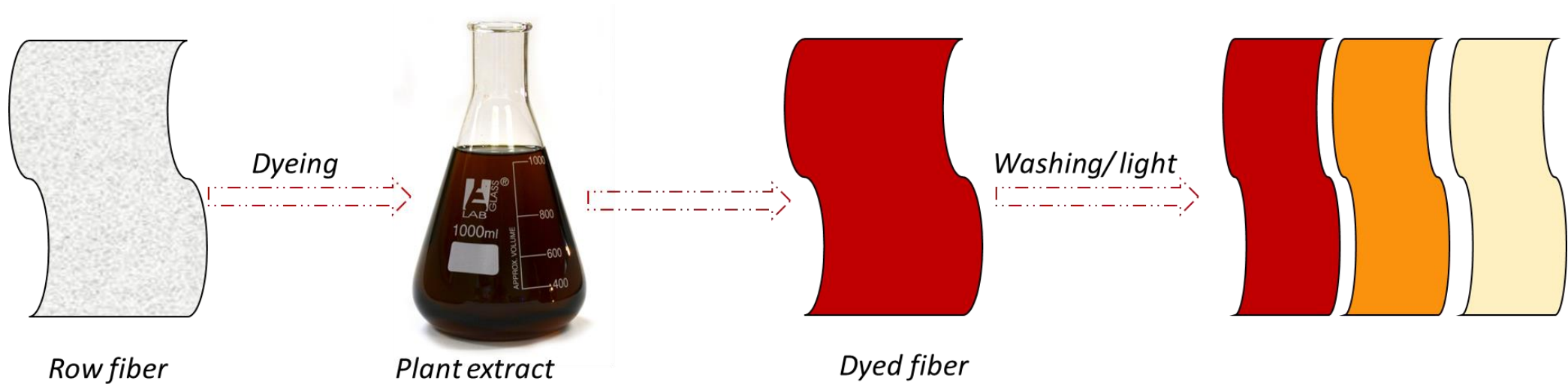
# Natural dyes sources



→ The common widely used natural dyes

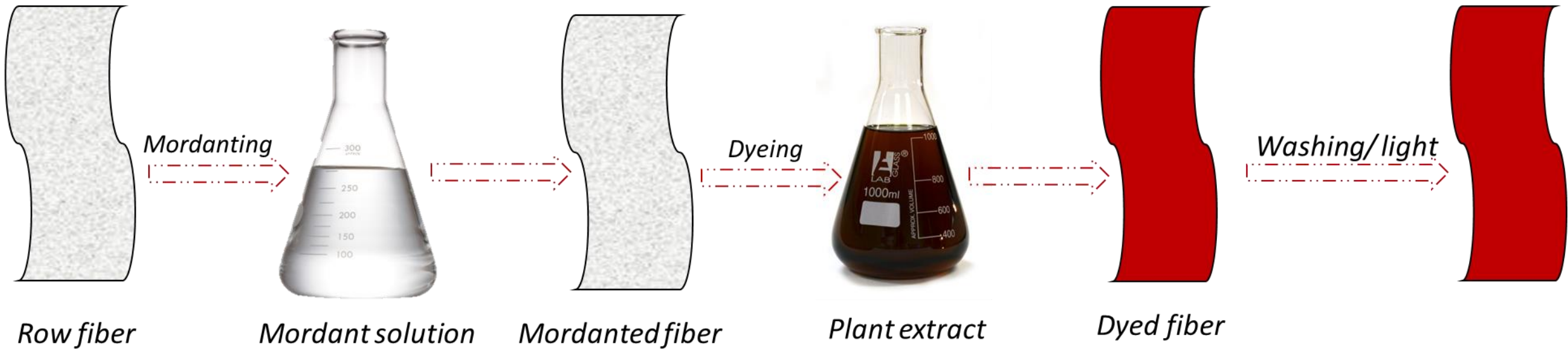
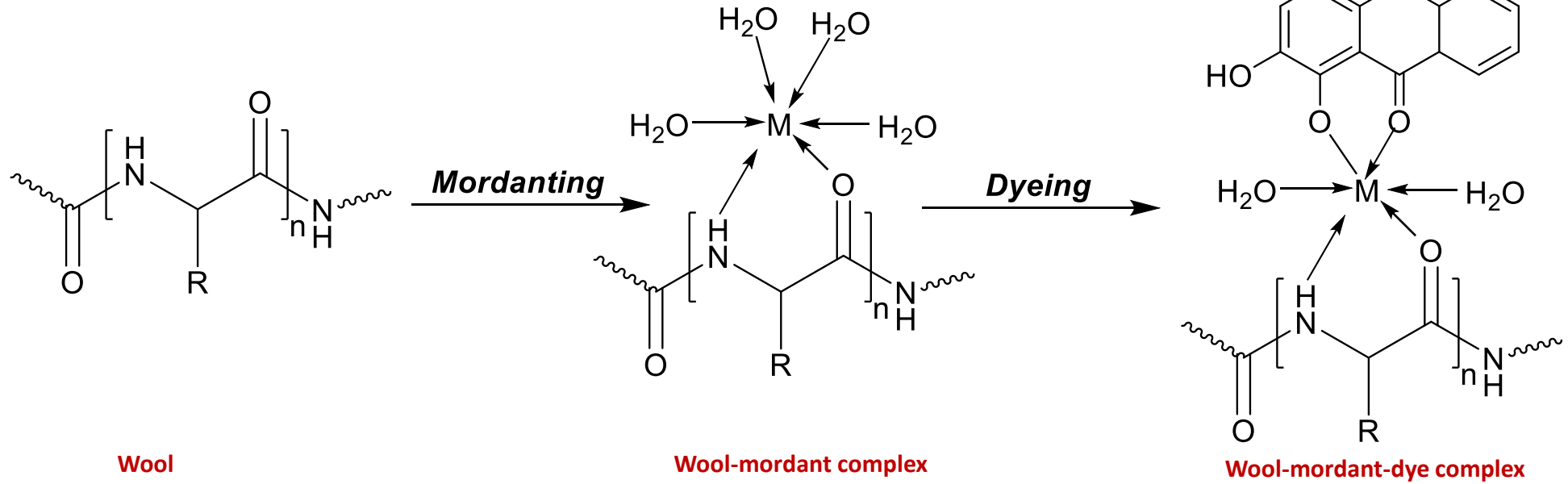


# Problematic



**Color fading due to weak interaction between dye and fiber.**

# Mordanting







2

# **Material & Methods**

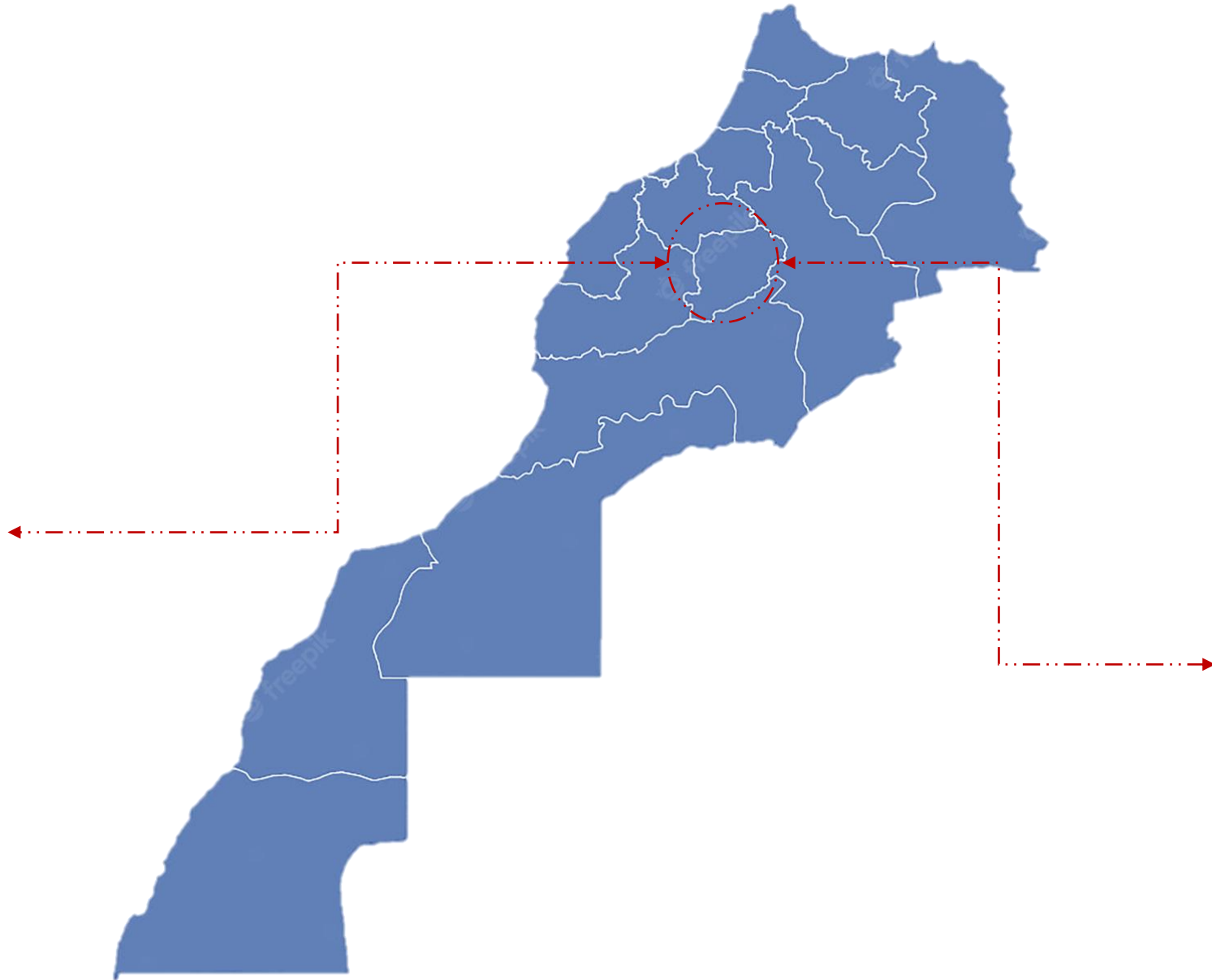
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# Valorization of agricultural wastes



**58,000 tons/year**

[doi.org/10.1016/j.jssas.2016.06.002](https://doi.org/10.1016/j.jssas.2016.06.002).

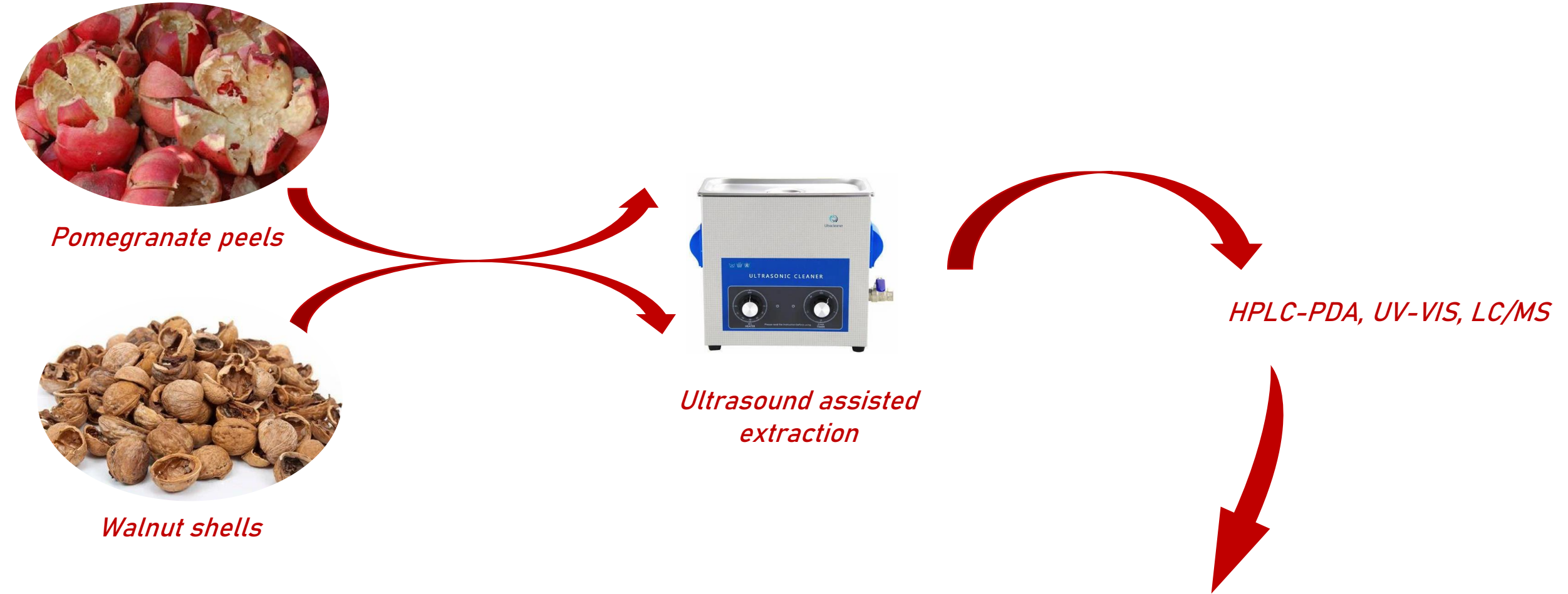


**12,667 tons/2019**

<https://agronomist.pl/artykuly/morocco-production-of-nuts>



# Analysis of agricultural wastes



Screening and identification of active coloring compounds

# Natural dyeing of wool fabric

3

## Dyeing

Exhaust dyeing of mordanted wool in the dye extracts

2

## Dye bath preparation

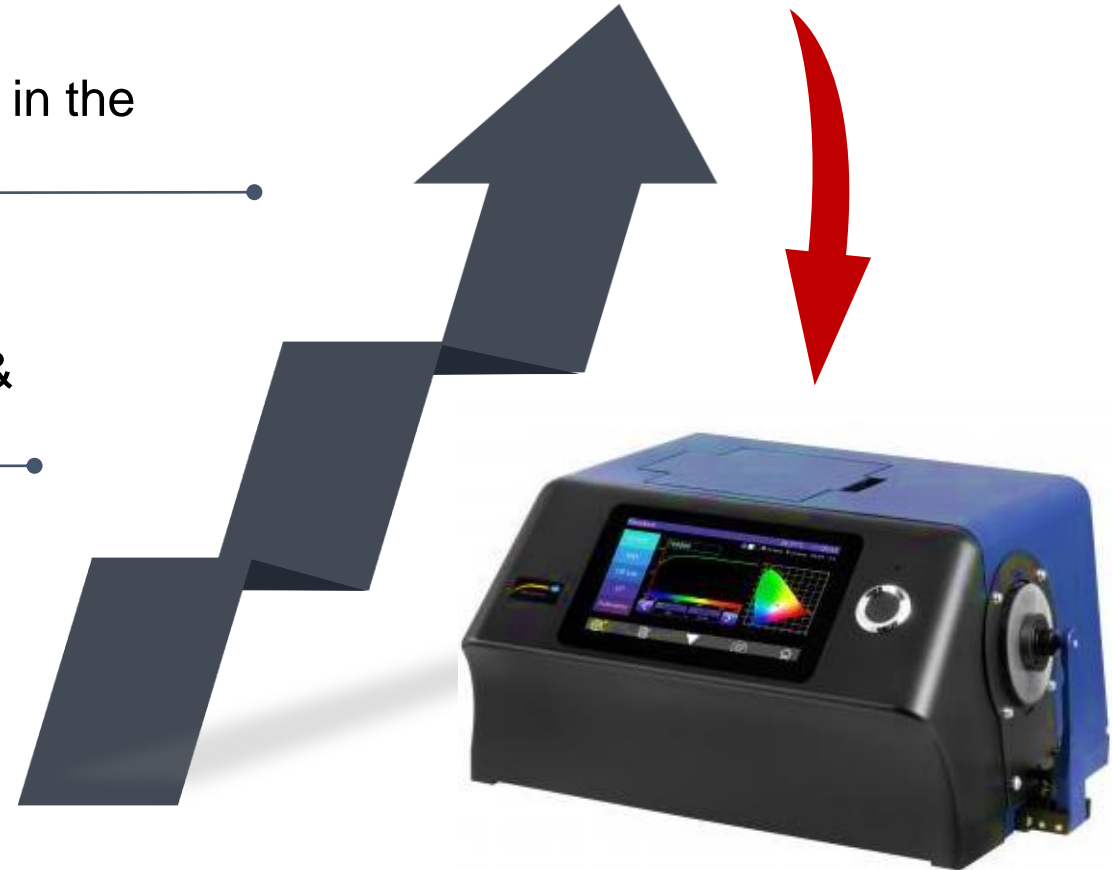
Aqueous extraction of pomegranate peels & walnut shells

1

## Mordanting

Use of Alum as mordanting agent

Dyed wool



Color coordinates



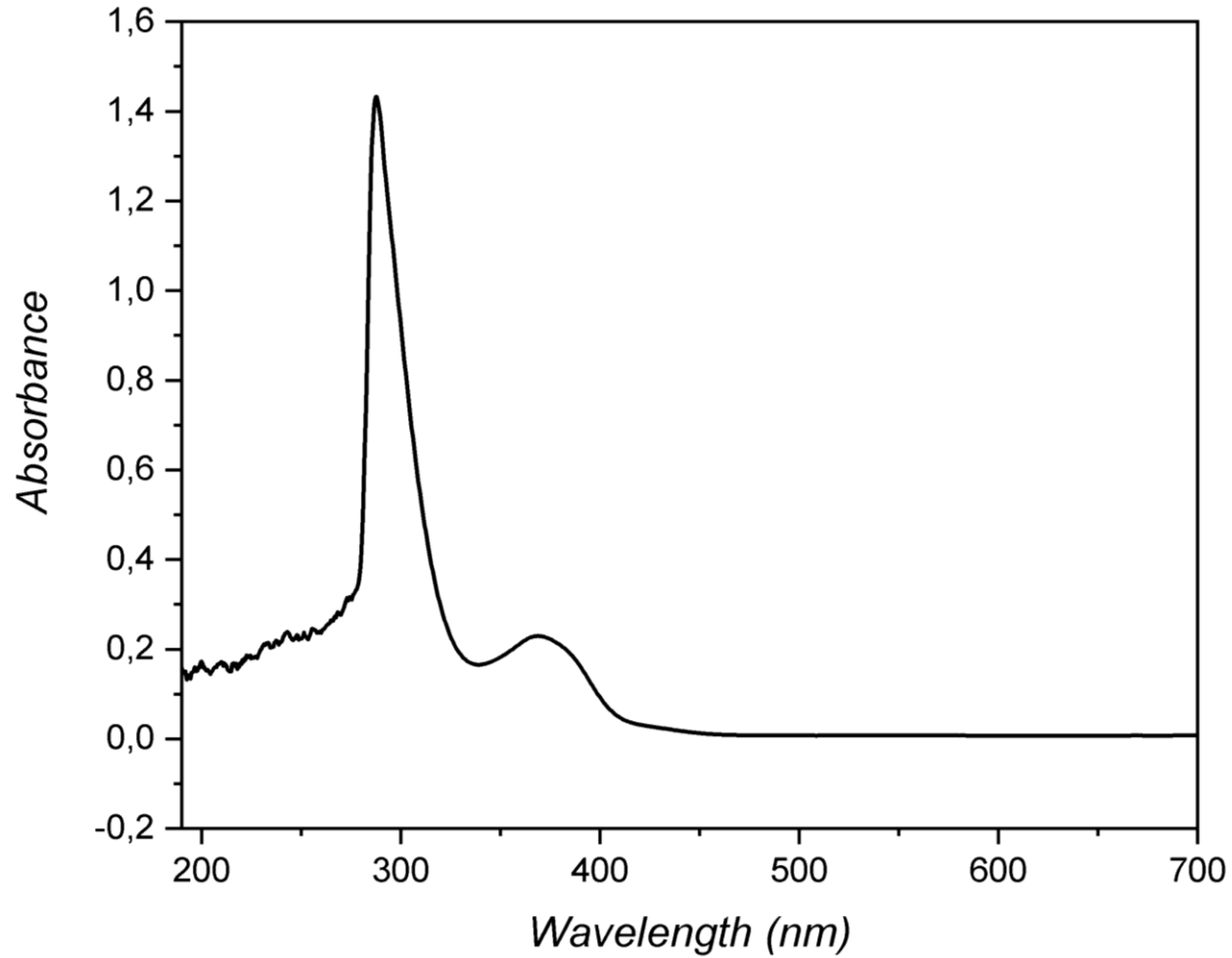


3

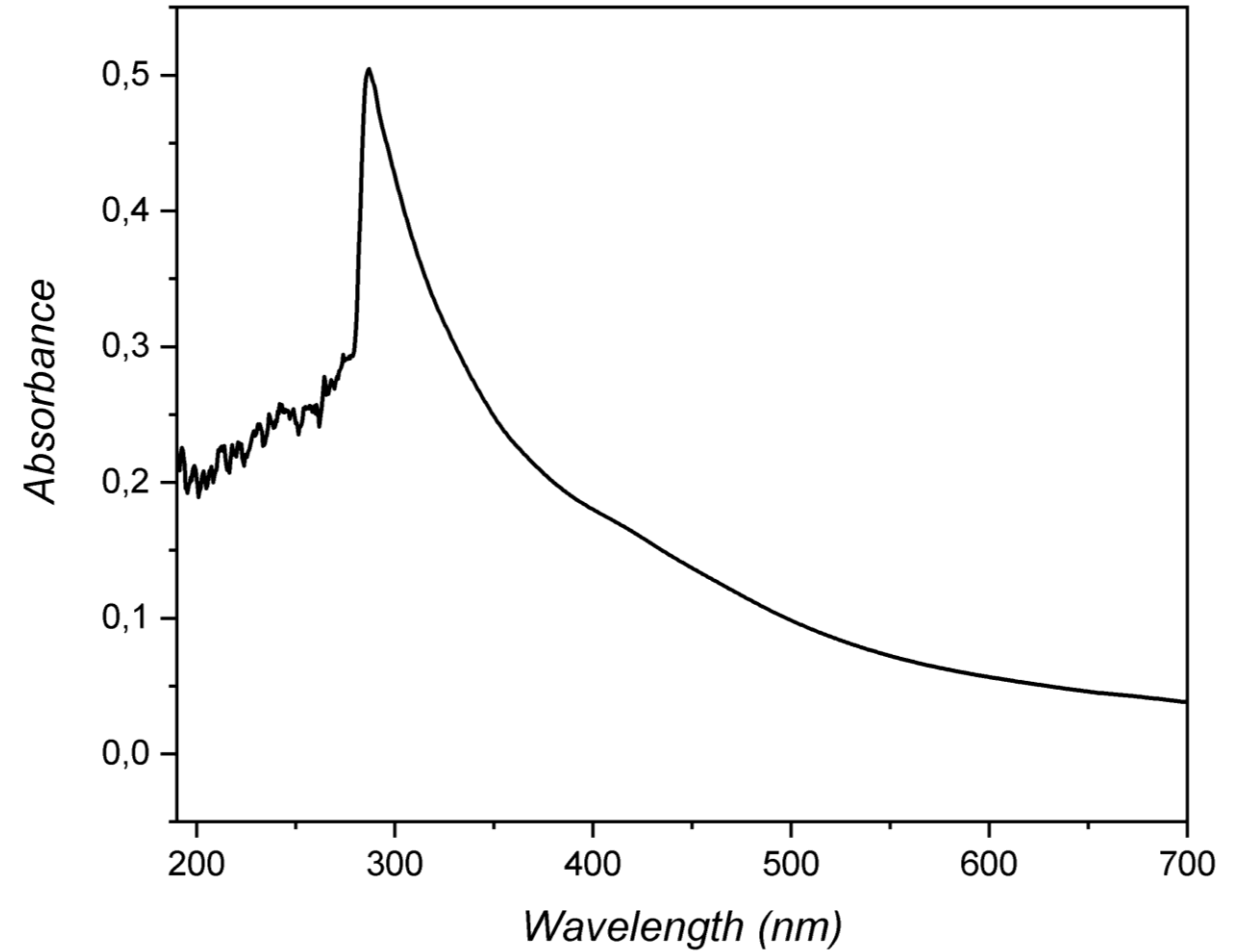
## **Results & Discussion**

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# Analysis of pomegranate peel and walnut shell extracts



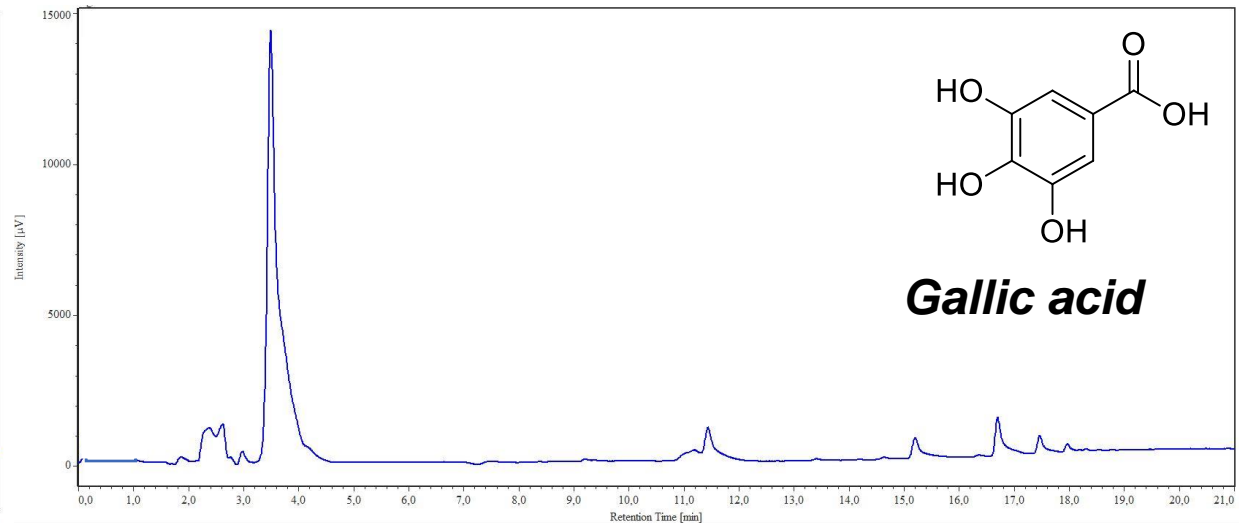
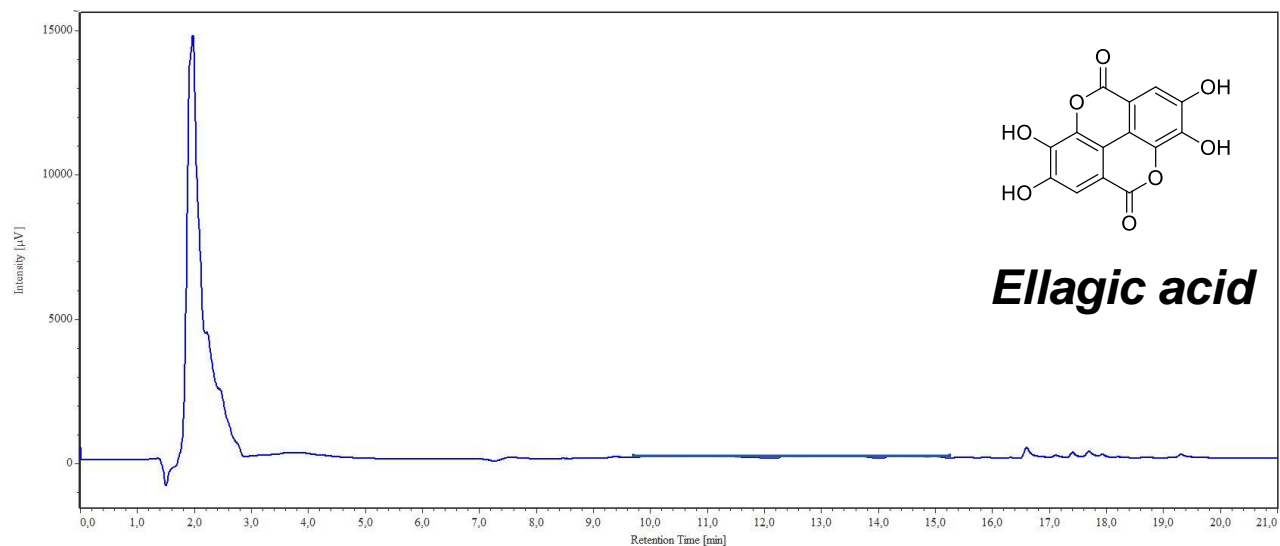
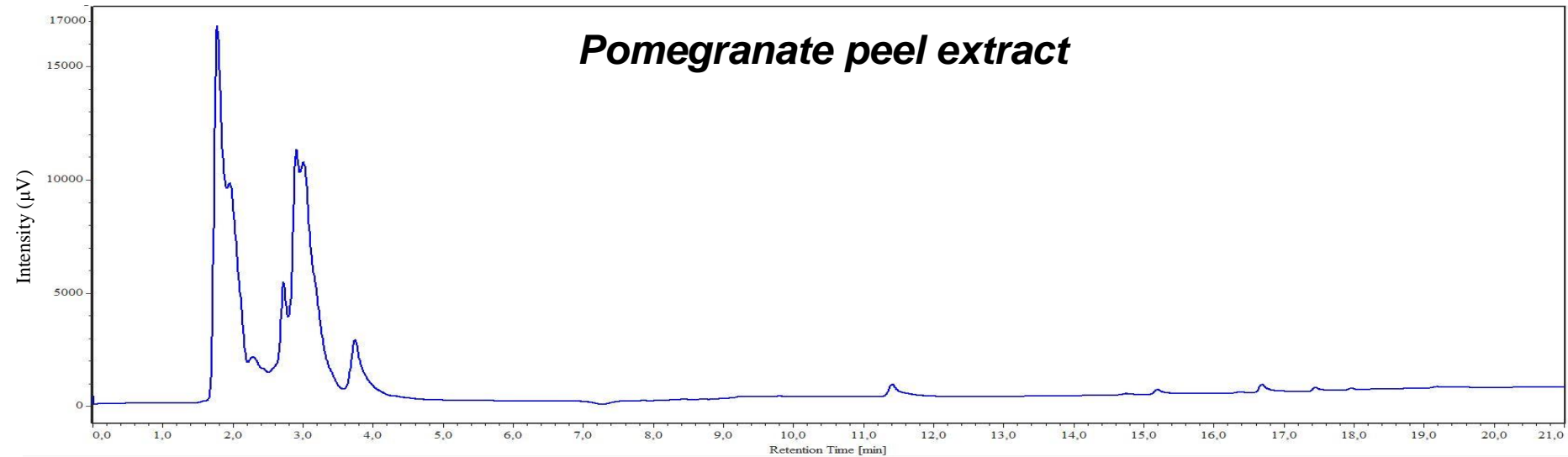
*UV-VIS profile of pomegranate peels.*



*UV-VIS profile of walnut shells .*

# Analysis of Pomegranate peels extract

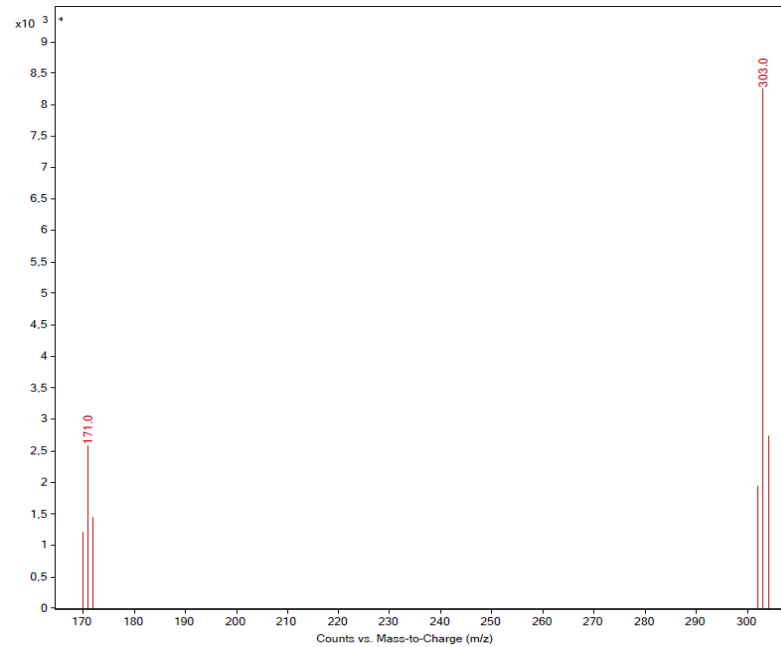
*HPLC profiles of pomegranate peels and gallic acid and ellagic acid standards.*



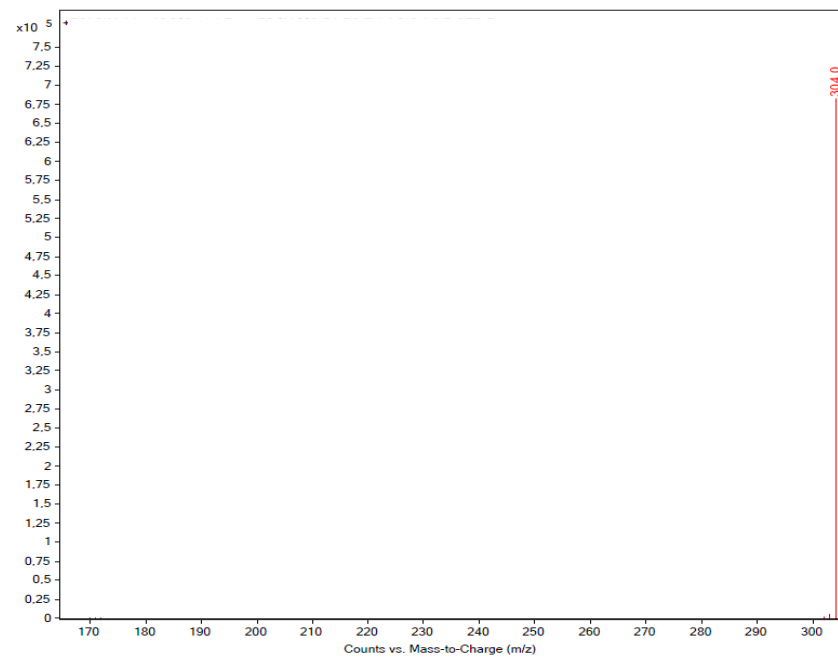


# Analysis of Pomegranate peels extract

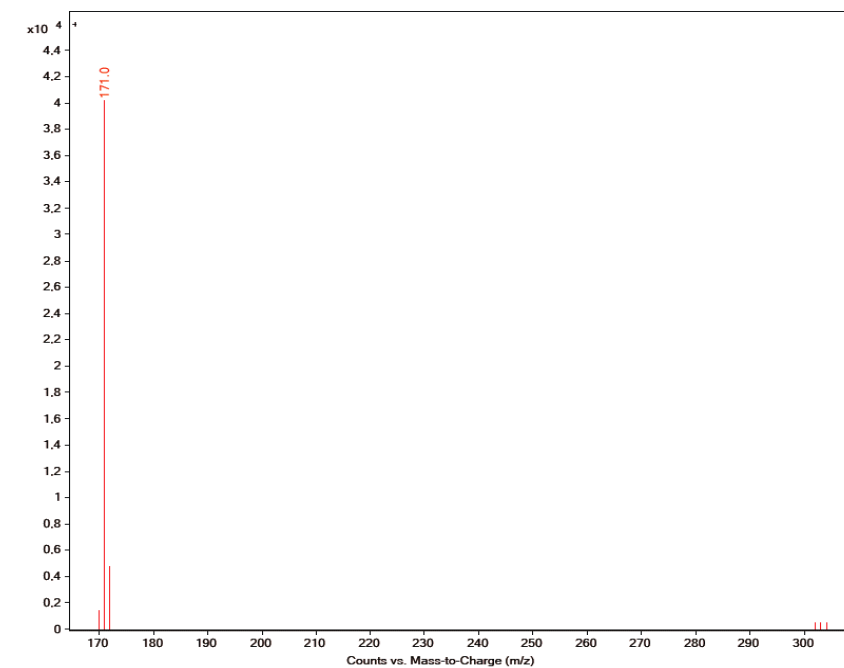
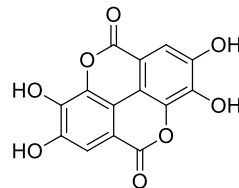
*LC/MS profiles of pomegranate peels, gallic acid and ellagic acid standards.*



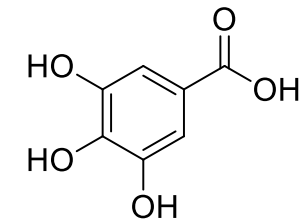
***Pomegranate peel***



***Ellagic acid***

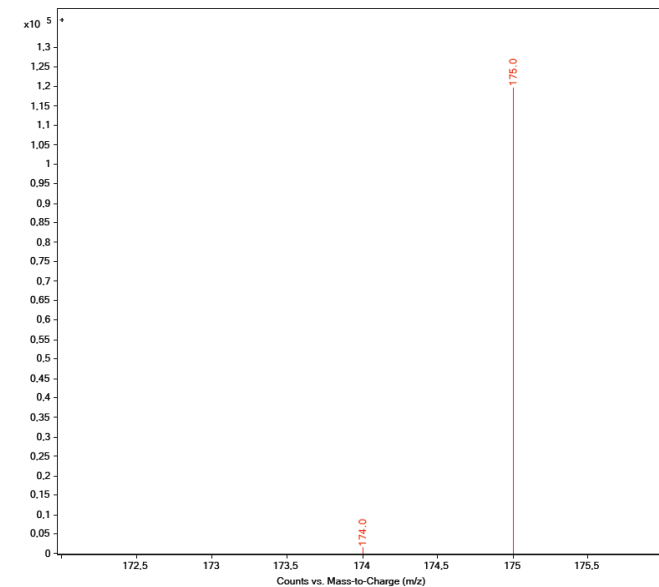
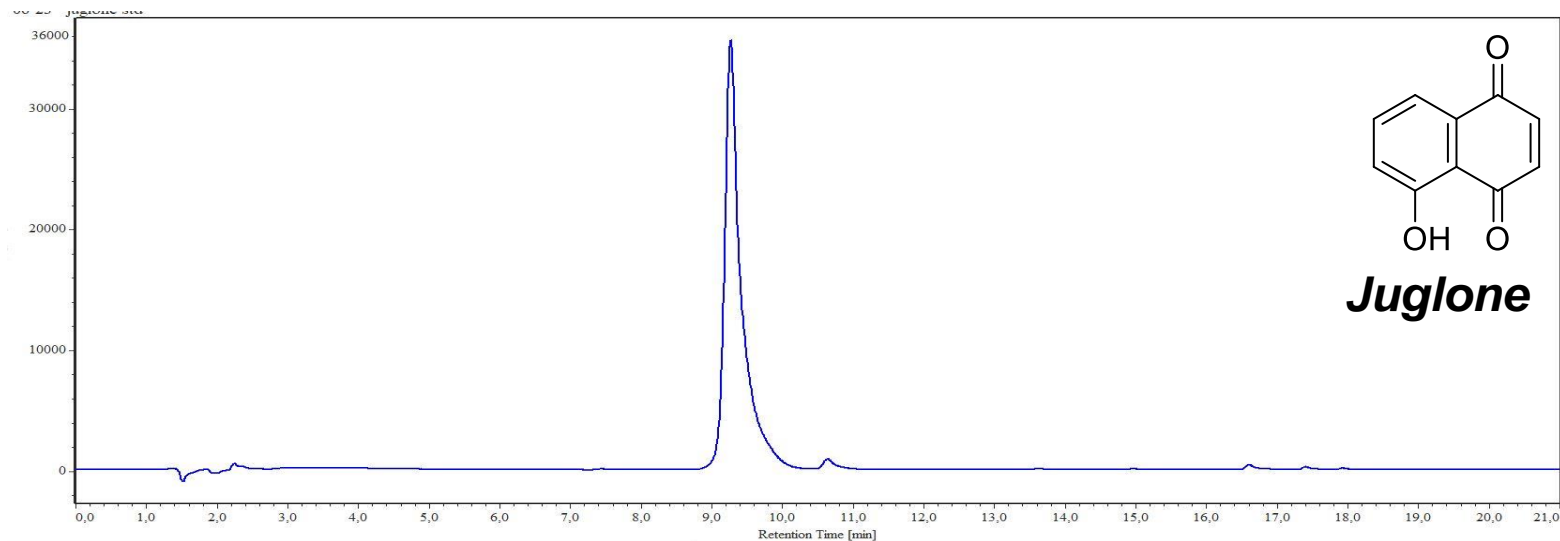
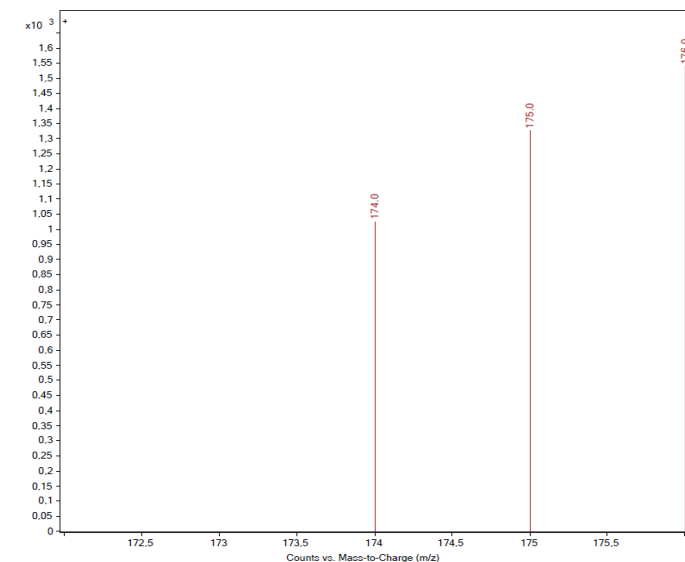
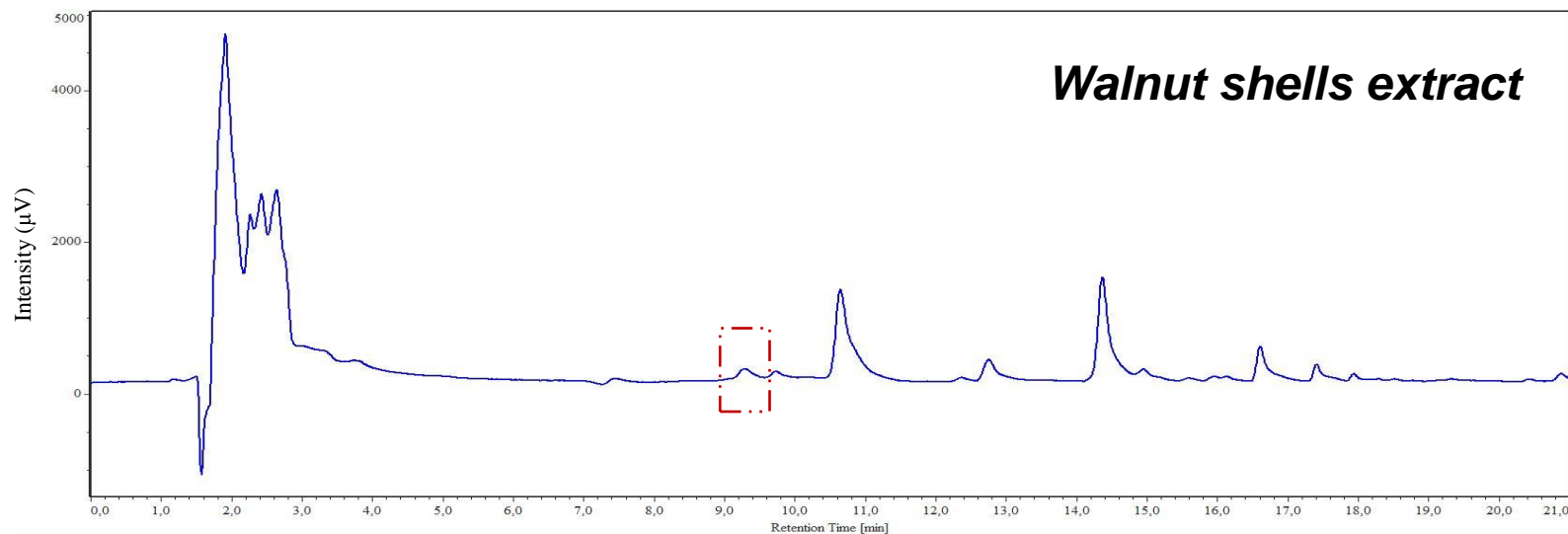


***Gallic acid***

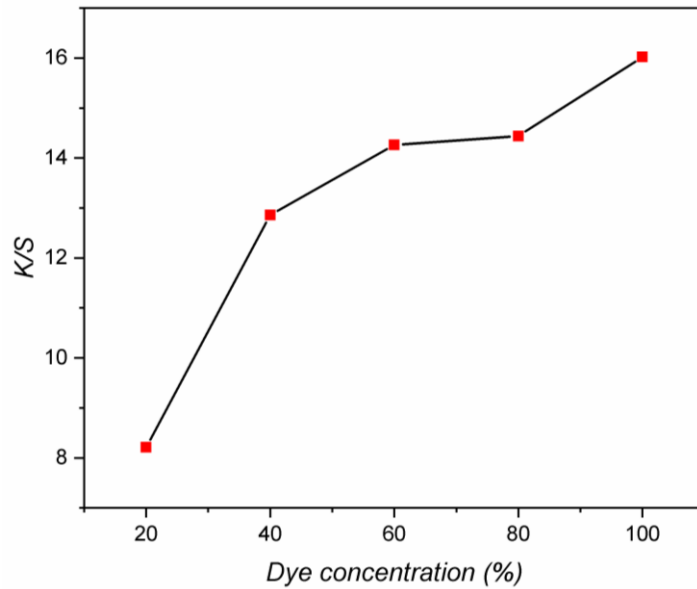


# Analysis of Walnut shells extract

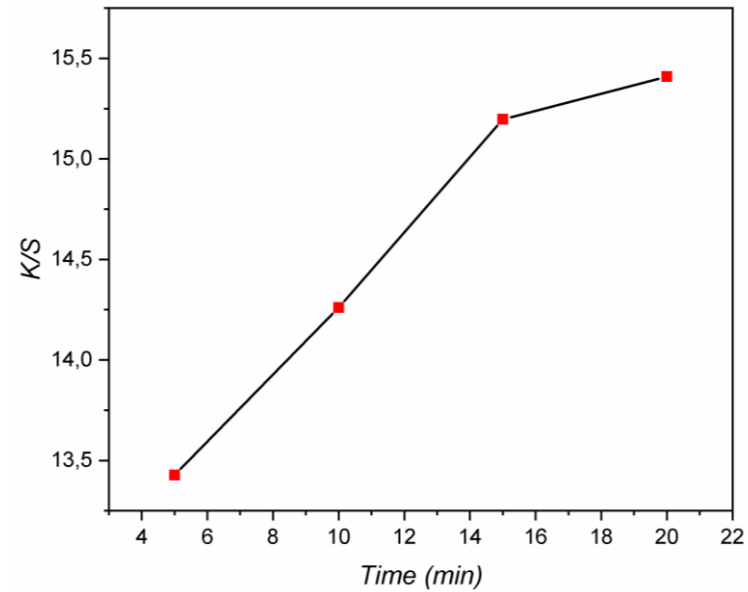
*HPLC & LC/MS profiles of Walnut shells and juglone standard.*



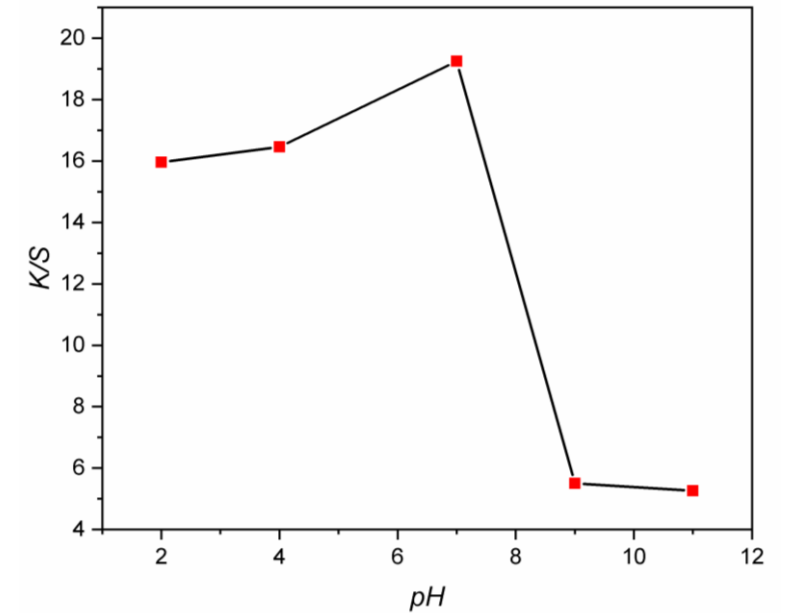
# Natural dyeing of wool fabric with pomegranate peel extract



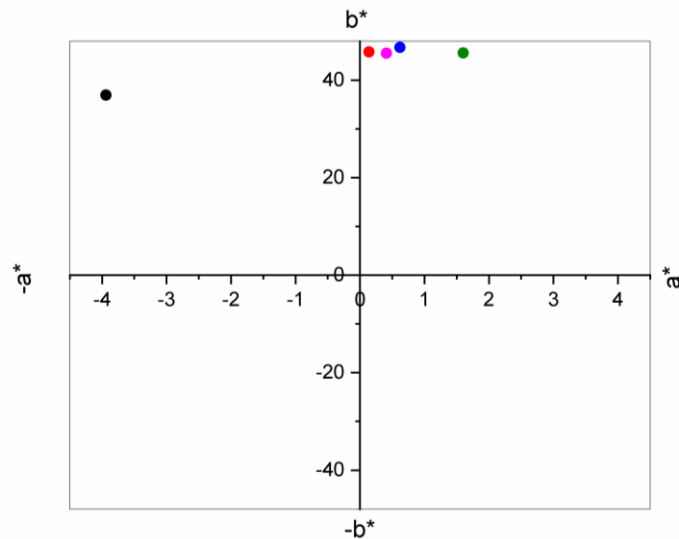
*Effect of dye concentration on K/S of dyed wool*



*Effect of extraction time on K/S of dyed wool*



*Effect of pH on K/S of dyed wool*

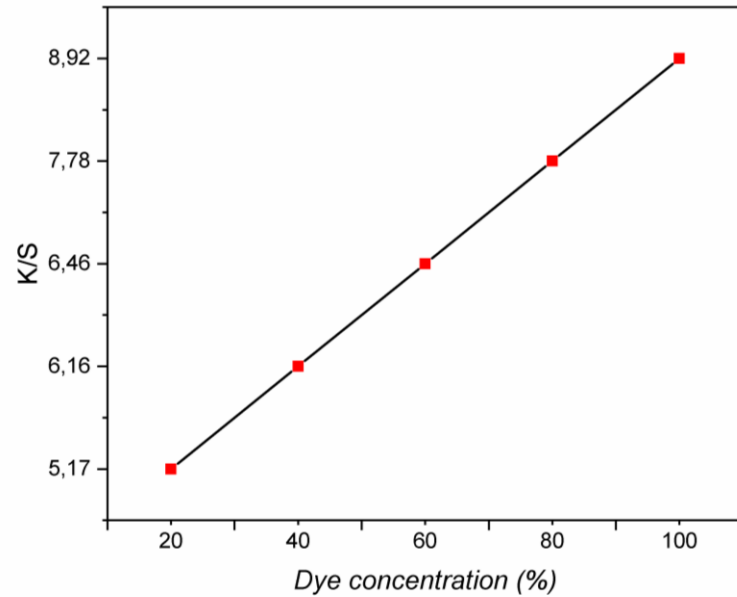


*$a^*b^*$  of dyed wool yarns*

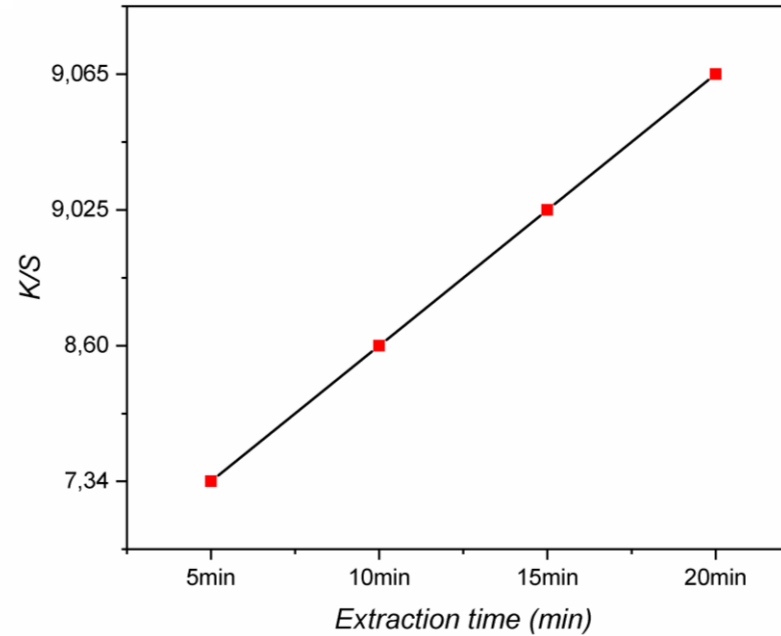




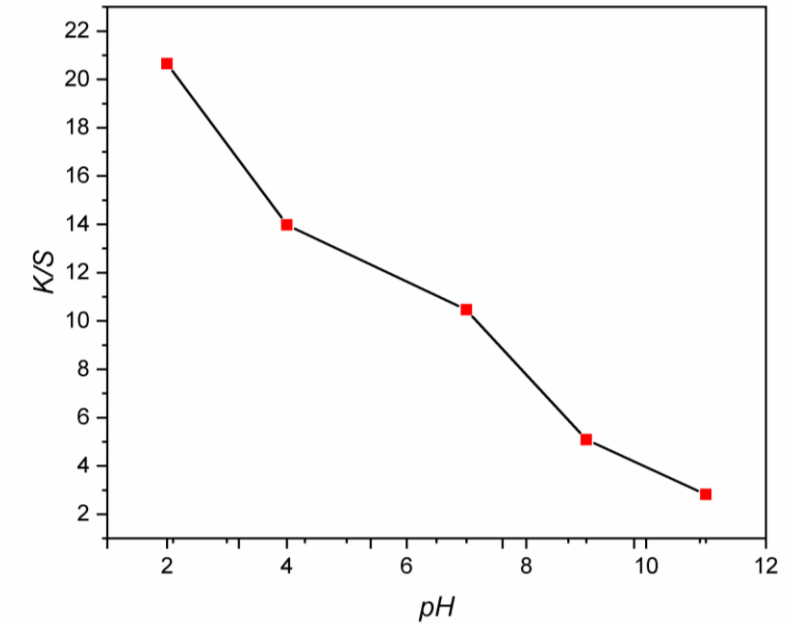
# Natural dyeing of wool fabric with walnut shells extract



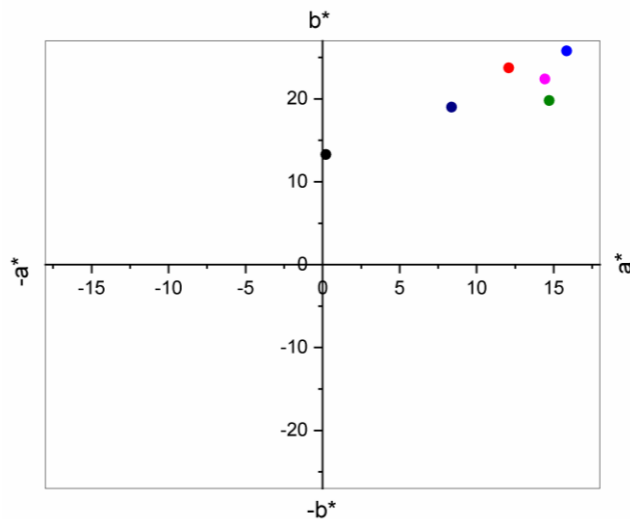
*Effect of dye concentration on K/S of dyed wool*



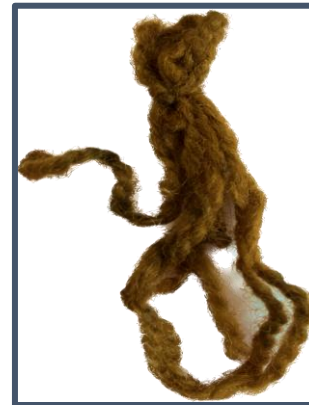
*Effect of extraction time on K/S of dyed wool*



*Effect of pH on K/S of dyed wool*



*a\*b\* of dyed wool yarns*



## Natural dyeing of wool fabric

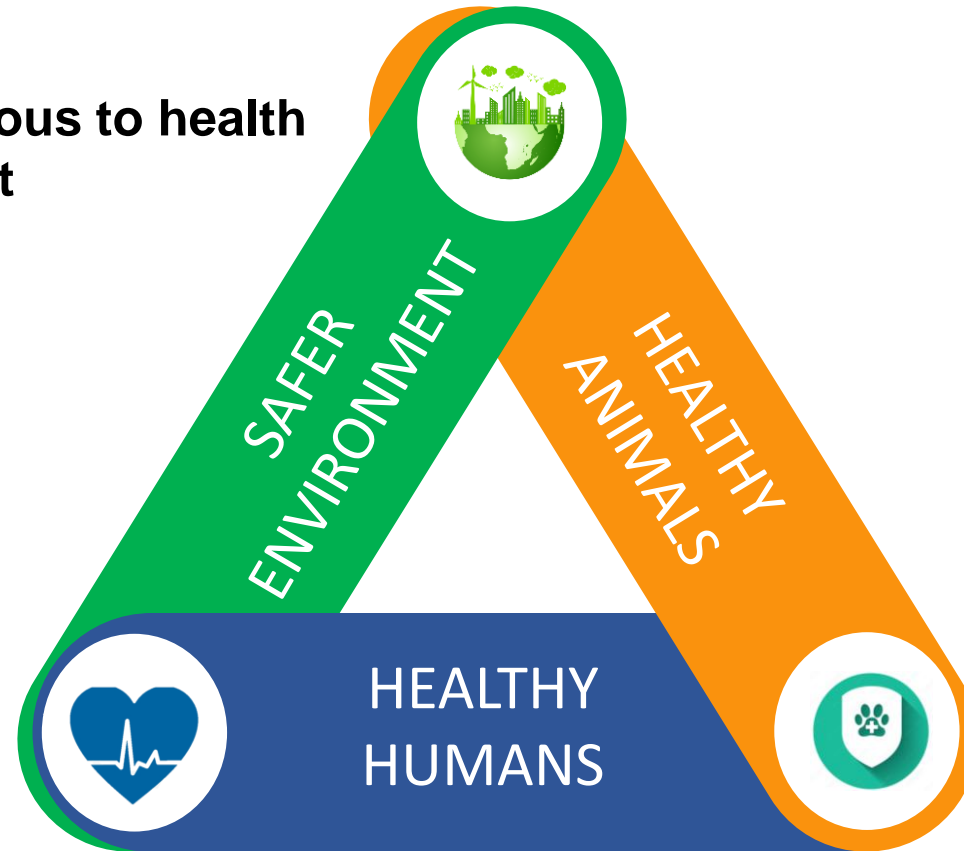


*100% Naturally dyed traditional carpets*

# Conclusion

**Synthetic dyes are hazardous to health & environment**

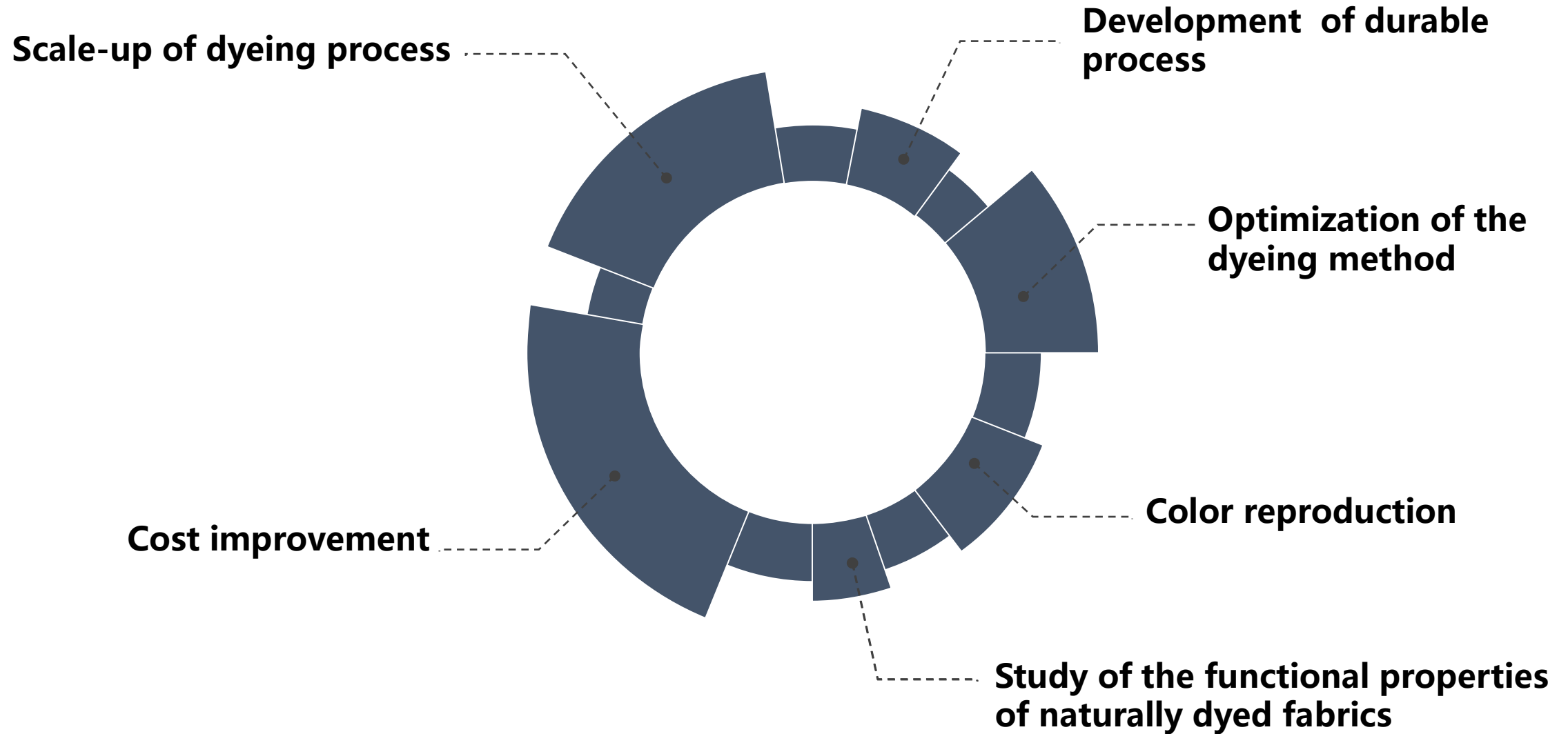
**Agricultural wastes can be effective dye sources**



**Natural dyes are the sustainable & ecological alternative**



# Perspectives



## Our team



PhD. FatimEzahra Mesrar



Dr. Hamza Tachallait



Pr. Khalid Bougrin



Pr. Rachid Benhida\*

## Acknowledgment



Two overlapping semi-circles at the top of the slide: a dark navy blue one on the left and a light gray one on the right.

THANK YOU!

A dark navy blue semi-circle at the bottom of the slide.