

## 1.- INTRODUCTION

Studies on recycling and natural dyeing have gained great importance for the textile sector, which creates the most pollution and causes significant problems. Chitosan and its forms with their versatile properties are of great importance for many industrial areas from textiles to medicine. In this study, the effects of different molecular weight chitosans as bio-mordants on the natural dyeing of recycled cotton and cotton-polyester yarns were investigated.

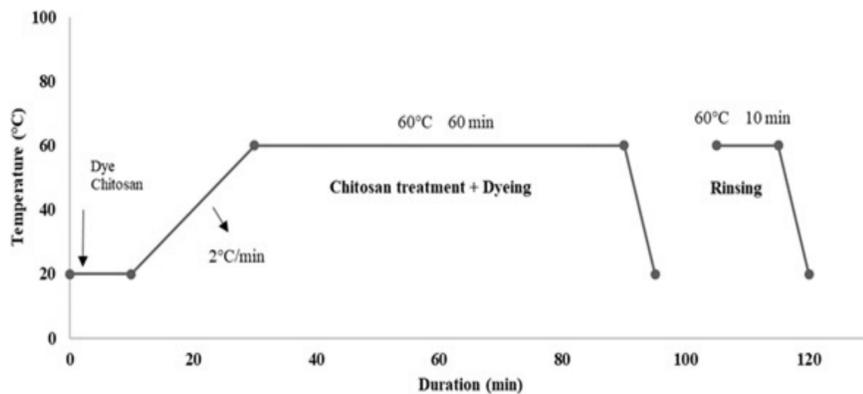


Figure 1. Chitosan treatment in dyeing process

## 2.- MATERIALS AND METHODS

In this study, 42 yarns with two different properties were tested:

- 80 % Pes – 20% Co (PC), Ne 20/1, was tested, from **recycled fiber and clothing waste**.
- 100 % Co (CO), Ne 20/1, was tested, from **recycled fiber and clothing waste**.

The yarns were industrially desized and scoured.

Chitosan was used as a mordanting agent, at two different molecular weight:

- Low molecular weight (LMW)
- Medium molecular weight (MMW).

The chitosan solution was prepared using soft water and 80% acetic acid.

Rubia tinctorum (C.I. Natural Red 8) natural dye was used for dyeing.

## 3.- RESULTS

Chitosan molecular weight	Chitosan conc. (%)	Fiber	L*	a*	b*	C*	h°
-	-	CO	67.63 ± 0.17	20.92 ± 0.11	12.86 ± 0.19	24.56 ± 0.16	31.56 ± 0.07
-	-	PC	68.52 ± 0.16	20.71 ± 0.13	12.85 ± 0.07	24.38 ± 0.20	31.82 ± 0.15
LMW	1	CO	73.48 ± 0.16	13.03 ± 0.07	10.66 ± 0.19	15.16 ± 0.11	44.67 ± 0.12
	3	CO	69.33 ± 0.14	11.30 ± 0.06	11.94 ± 0.11	16.44 ± 0.14	46.57 ± 0.17
	5	CO	68.26 ± 0.17	10.71 ± 0.06	19.73 ± 0.13	23.65 ± 0.14	56.47 ± 0.20
	1	PC	72.64 ± 0.15	13.04 ± 0.19	12.54 ± 0.09	15.70 ± 0.10	46.30 ± 0.12
	3	PC	73.35 ± 0.13	11.77 ± 0.10	13.61 ± 0.17	18.86 ± 0.14	52.96 ± 0.14
MMW	5	PC	72.90 ± 0.14	9.44 ± 0.14	18.41 ± 0.11	21.87 ± 0.10	57.21 ± 0.18
	1	CO	69.57 ± 0.15	14.65 ± 0.13	14.07 ± 0.06	21.18 ± 0.07	38.37 ± 0.07
	3	CO	69.34 ± 0.11	14.71 ± 0.07	15.19 ± 0.10	22.67 ± 0.09	45.91 ± 0.10
	5	CO	68.07 ± 0.08	17.77 ± 0.18	17.64 ± 0.11	22.99 ± 0.19	50.01 ± 0.09
	1	PC	73.72 ± 0.10	19.43 ± 0.06	18.65 ± 0.05	22.16 ± 0.08	43.81 ± 0.09
3	PC	74.43 ± 0.13	14.67 ± 0.20	18.55 ± 0.18	23.01 ± 0.14	48.45 ± 0.13	
5	PC	72.86 ± 0.17	13.52 ± 0.17	16.49 ± 0.08	26.93 ± 0.14	53.72 ± 0.08	

Table 1. Chromatic coordinates in LMW and MMW in different concentrations

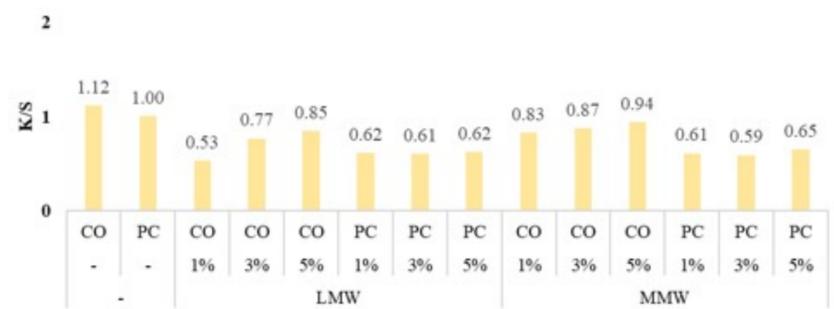


Table 2. Relation K/S per samples

Chitosan molecular weight	Chitosan conc. (%)	Fiber	Staining	Fading
-	-	CO	4/5	4/5
-	-	PC	4/5	4/5
LMW	1	CO	5	5
	3	CO	4/5	4/5
	5	CO	4/5	4/5
	1	PC	5	5
	3	PC	5	5
MMW	5	PC	5	5
	1	CO	4/5	4/5
	3	CO	4/5	4/5
	5	CO	4/5	4/5
	1	PC	5	5
3	PC	5	5	
5	PC	5	5	

Table 3. Staining and fading values

## 4.- CONCLUSIONS

- L\* values decreased with the increase in bio-mordant chitosan concentration
- The color strengths increased as the L\* value decreased.
- Comparison of LMW and MMW chitosans as mordant in natural dyeing of two different fibers revealed that more red, yellow and saturated colors were obtained with bio-mordant MMW chitosan.
- Results suggested that chitosan could be more reactive to fiber than dye and this could be due to the cellulose-like structure of chitosan.
- The color depths are directly related to chitosan concentration.
- One of the chitosan tested, the MMW, had a greater effect on increasing color depth than LMW. MMW chitosan either binds to the fiber more than LMW or retains a higher amount of dye on it even if it binds at the same rate as LMW.
- The increase in color depths with the increase in chitosan concentration was more evident especially in cotton yarns compared to blended yarns. It could be interpreted that the affinity of chitosan and natural dye towards CO was much higher than that of PC.
- Detailed optimization studies for chitosan concentration and dyeing conditions are needed to improve the results of this study, which reveals that chitosan can be used as a mordant, especially in dyeing cotton fabrics with natural dyes.
- In General, staining and fading values were good to excellent in all samples