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SUITABLE MORDANTS FOR DYEING POSIDONIA OCEANICA FIBERS

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***Abstract**: Posidonia oceanica is the most extended sea grass in the Mediterranean Sea. Important quantities of this alga are accumulated on coasts making necessary the cleaninness of those beaches where it can be found. For this reason, many authors are developmenting new products made by this raw material, like green composites or are studing this material to be used as biomass, for example. The aim of this study is to dye the Posidonia Oceanica fiber using commercial natural dye to change their appearance to get a material more attractive for different areas. To achieve this aim, fibers were scoured and bleached in order to remove the brown colour of the Posidonia Oceanica fibers. Scoured and bleached processes were followed by the treatment done for cellulosic fibers, because some researches indicate that P. Oceanica is composed of high quantity of cellulose. Different types of biomordants were use in the pre-treatment of the fiber to improve the affinity between the fiber and the dye used.*
To compare the results, we evaluate the colour of each sample using CIELAB parameters and colour differences (ΔE), which are obtained by reflexion spectrophotometre. The results showed that medium molecular weight chitosan, which was used as biomordant, gets the highest intensity of colour*

***Key words:** Posidonia Oceanica, scouring, bleaching, biomordant, dyeing*

1. INTRODUCTION

Posidonia is an endemic marine plant at the Mediterranean Basin forming wide grasslands playing an important ecological role in the Mediterranean system [1], which are involved in the oxygenation of seawaters, fauna protection and littoral erosion prevention [2]. The P. oceanica dead leaves in the form of called “Neptune balls” are accumulated in a large scale on the beaches. These residues represent a great environmental, economical, social and hygienic problem in all coastal zones of Mediterranean and the high costs for their removal and disposal to landfill. For this reason there are many authors, which have reported different alternatives to reuse Posidonia Oceanica (PO) residues [2], [3].

These fibers show a brown colour consequently, the number of applications to develop new products are limited because of their appearance.

In order to remove the colour from Posidonia fibers the same treatment for prepearing cellulosic fibers, scouring and bleaching processes were carried out. Moreover, to get a new appearance more attractive bleached fibers were dyed using a natural dye. However, those dyes do not show deep intensities in colour and a mordant is requested to improve the colour yeld. Mordants

which should be eco-frendly in order to maintain the process as an environmentally friendly one [4],[5], [6].

2. EXPERIMENTAL

2.1 Materials

The balls of Posidonia Oceanica were collected from Valencia beach (Spain). First of all, these balls were shred in order to get individual fibers and washed with water to remove the sand (figure 1).

Fig. 1: *Images of balls of Posidonia Oceanica and these srhed.*

To remove the brown colour of the fibers, scouring and bleaching processes were carried out using NaOH, Leophen (suministrated by Basf) as moistening agent and Kieralon (suministrated by Basf) as surfactant for scouring process and H_2O_2 and a stabilizer for bleaching process. Red natural dye was supplied by Irisem. Chitosan with different molecular weight, low and medium, and alum were used in a pre-treatment of bleached fibers as mordants, using the same concentration of each one (5 g/L).

2.2 Methods

In table 1 conditions followed for scouring, bleaching and dyeing processes are shown.

Table 1*: Scouring, bleaching and dyeing conditions*

Scouring		**Bleaching**		**Dyeing**	
R/b	1/40	R/b	1/40	R/b	1/40
NaOH (g/L)	8	H_2O_2 (g/L)	25	Dye concentration	2% spf
Moistening (g/L)	1	Moistening (g/L)	1	Temperature (ºC)	90-95
Surafactant (g/L)	1	NaOH (g/L)	1	Time (min)	60
Temperature (ºC)	90-100	Surfactant (g/L)	0,5		
Time (min)	120	Stabilizer (%)	1		
		Temperature (ºC)	80-90		
		Time (min)	120		

Scoured, scoured and beached and scoured, beached and dyed samples were prepared for colour measurement. To investigate the effect of biomordant used on the dyed samples, the reflectance spectra were measured before and after treatments using an Minolta CM-3600d. CIELAB color coordinates (L*, a*, b*) were calculated from the reflectance data for 10° observer

and illuminant D65. The shift of the coordinates of the color in the colour spaces L*, a*, and b*, based on the theory that color is perceived by black-white (L), red-green (a), and yellow-blue (b), was summarized by the ΔE* value. The value of ΔE* represents the overall color difference between each treated sample and the standard (untreated sample).

3. RESULTS

To compare the effect of using different mordants and evaluate dyed fibers, CIELAB and ΔE* values of each sample are shown in table 2.

***Table 2**: CIELAB parameters and ΔE**

Posidonia sample	L*	a*	b*	ΔE*
Untreated	50,9557	3,8666	10,7047	
Scoured	50,1729	4,1665	10,61	0,8436
Bleached	62,3764	3,7052	16,8276	12,9595
Chitosan Low + dyed	54,0729	6,0683	12,2579	4,1203
Chitosan Medium + dyed	44,7564	15,5356	7,5954	13,5745
Alum + dyed	57,6869	9,6967	15,7451	10,2325

First of all, it has been observedthat there are no significant differences when fibers are only descrudadas, however we can appreciate the big difference of L* and ΔE* values when the Posidonia fibers are descrudadas and bleached. L* values refer to light-dark values from 100 to 0 representing white to black, then these results verify the loss of brown colour of untreated Posidonia fibers, because L is higher than the untreated and descrudada sample.

Regarding dyed samples, if we compare the different mordant used in the pre-treatment, before the dyeing process, it is observed that chitosan with medium molecular weight shows the highest ΔE*.

Furthermore, if we focus our attention on a* value, whose positive values indicate red colour, all dyed samples using different mordants show higher values than untreated, descrudado and bleached samples. In figure 2 we compare the results of a* value of each sample.

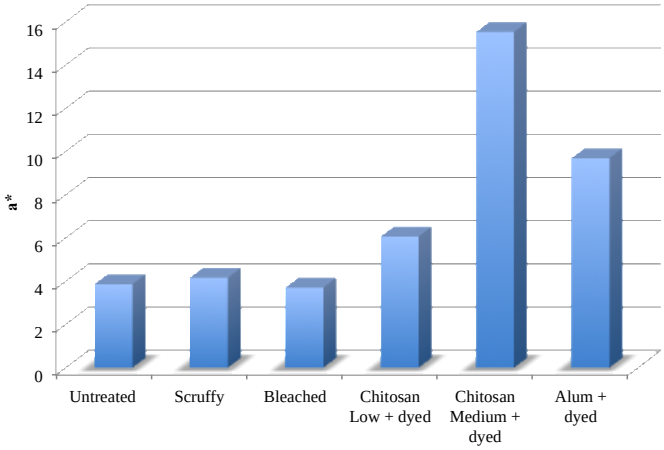

***Fig. 2:** Graphic of a* value of each sample*

It is clearly observed that pre-tretated sample with medium molecular weight chitosan show the highest result, being pretreated fibers with alum the second best result.

5. CONCLUSIONS

We can conclude that scouring and bleaching processes used to treat cellulose fibers are effective to treat Posidonea Oceanica fibers, as the bleached fibers show highest L* value which indicates the sample is whiter than untreated and scoured samples. On the other hand, when bleached fibers are dyed, using different types of mordant, all dye samples show higher a* value, this value indicates the red color. Pretreated samples with medium molecular weight show the highest a* value, being the best result.

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