



**STUDY REGARDING THE INFLUENCE OF THE BIOSCOURING
TREATMENT IN ULTRASOUND ON
60 % COTTON + 40 % HEMP MATERIALS
PART II. STUDY REGARDING THE INFLUENCE OF BIOSCOURING
TREATMENT FOLLOWED BY A WHITENING TREATMENT USING
VARIOUS METHODS**

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Abstract: This study shows a comparative characterization of whitening treatment using various processes for 60 % cotton +40 % hemp materials scoured by Bioscouring treatment in ultrasound described in our previous work. The results of the extraction of noncellulosic impurities using the Bioscouring treatment was expressed as weight loss, hydrophilicity. Some of these bio-scoured samples were whitened using various procedures: Classical procedure with hydrogen peroxide (30%), with catalyst and with laccase enzyme. By whitening procedure, the double bonds from chromophore groups of natural pigments from cotton and hemp are destroyed by oxidation reactions, the Π electrons being those responsible for the yellow color of the fabrics.

In order to characterize the quality of the enzymatic pretreatment compared to the classical one, the values of the degree of white were studied after different type of bleaching (hydrogen peroxide, catalyst and laccase) for the samples treated with the same concentration of enzyme SERA ZYME C-PE (ROGLYR ECO 183) - Pectate Lyase.

For comparing the degradation occurred during the enzymatic pretreatment of cellulosic fabrics, before and after bleaching with enzymes, catalyst and classical method, measurements of the tensile strength and elongation at break for the treated 60 % cotton +40 % hemp material, were performed.

Key words: cotton, hemp, bioscouring treatment with ultrasound, weight loss, whitening, whiteness degree.

1. INTRODUCTION

After the Bioscouring treatment the material becomes much cleaner with higher absorbent properties (hydrophilic). By whitening procedure, the double bonds from chromophore groups of natural pigments from cotton and hemp are destroyed by oxidation reactions, the Π electrons being those responsible for the yellow color of the fabrics. Whitening can be done using several methods, such as classical method with peroxide or enzymatic method with different type of enzymes.

2. EXPERIMENTAL PART

Researches were carried out using fabrics treated using the method Bioscouring presented in the first part. The Bioscouring treatment was performed in the presence of ultrasounds, under following conditions: (1-3%) SERA ZYME C-PE (ROGLYR ECO 183) - Pectate Lyase, 2 mL/L HEPTOL NWS - sequestering agent with the role to bind the metal ions in water with high hardness

regardless of temperature; 2 mL/L SULFOLEN 148 - wetting and scouring agent; 10 % of the fleet treatment was buffer (0.1 molar sodium dihydrogen phosphate/disodium hydrogen phosphate, pH 7.5); fabric to liquid ratio – H- 1:10, at temperature T = 55 °C and time “t” between 20-60 minutes [1].

The bleaching treatments applied to the scoured samples were carried out under the following conditions: [2, 3]

- *Classical procedure*: 3 mL/L hydrogen peroxide (30%) + 1 g/L NaOH + 4.5 mL/L sodium silicate; fabric to liquid ratio – H - 1:20; Temperature = 90-95 °C (in ultrasounds only 80 °C); time = 40 min.

- *Procedure with catalyst*: 3 mL/L of catalyst solution prepared from 1 g of catalyst + 1.5 mL 30 % hydrogen peroxide); fabric to liquid ratio – H - 1:20; Temperature = 60 °C; time = 40 min.

- *Procedure with laccase enzyme*: 3% o.w.f. (over fiber) commercial Laccase - Lava Zyme LAC, which is a suitable enzyme for bleaching of cellulosic materials + buffer 0,1 molar acetic acid/sodium acetate (pH = 5); fabric to liquid ratio – H - 1:20; Temperature = 60 °C; time = 40 min.

The properties of 60 % cotton + 40 % hemp materials bioscoured according to the experimental program [4] presented in the first part are presented in Table 1.

Table 1: The properties of cotton 60 % + hemp 40 % materials after the Bioscouring treatment

Samples	Enzyme concentration (%)	Weight loss (%)	Hydrophilicity (s)	Degree of white R (%)
1	1.70	3.09	6	46.20
2	2.70	2.98	3	45.33
3	1.70	3.40	8	46.23
4	2.70	2.46	7	46.05
5	1.00	2.34	5	44.55
6	3.00	3.39	3	46.48
7	2.00	2.74	3	45.90
8	2.00	3.00	9	47.53
9	2.00	3.11	5	45.43
10	2.00	3.12	8	45.45
11	2.00	2.90	7	44.75
12	2.00	2.97	8	44.80
13	2.00	3.10	6	46.48
Blank				43.63

In order to characterize the quality of the enzymatic pretreatment compared to the classical one, the values of the degree of white were studied after different type of bleaching (hydrogen peroxide, catalyst and laccase) for the samples treated with the same concentration of enzyme SERA ZYME C-PE (ROGLYR ECO 183) - Pectate Lyase.

The results of the extraction of noncellulosic impurities using the Bioscouring treatment expressed as weight loss, hydrophilicity and degree of white, obtained by different bleaching treatments are shown in Table 2.

Table 2: Comparative characterization of bleaching treatments on the scoured samples using the Bioscouring treatment with Pectate Lyase

No.	Samples	Type of bleaching	Weight loss (%)	Hydrophilicity (seconds)	Degree of white R (%)	Observations
1.	Blank	-	-	-	43.63	Extraction with Pectat Lyase shows a lower weight loss compared with the samples treated with catalyst or laccase. The degree of white obtained after the classical treatment is higher than that obtained after the other
2.	10	Classical: Fabric to liquid ratio H = 1:20 Temperature = 90-95°C (in ultrasounds only 80 °C) time = 40 min 3 mL/L H ₂ O (30 %) 1 g/L NaOH 4.5 mL/L Na ₂ SiO ₃	0.99	2	64.73	
3.	11	With Catalyst:	1,91	2	46.45	

		Fabric to liquid ratio H = 1:20 Temperature = 60 °C time = 40 min 3 mL/L of the catalyst (solution prepared from 1 g catalyst + 1.5 mL 30% hydrogen peroxide)				treatments
4.	12	With laccase Fabric to liquid ratio H = 1:20 Temperature = 60 °C pH = 5 - 0.1 molar buffer solution of acetic acid / sodium acetate time = 40 min 3% o.w.f. Laccase (Lava Zyme LAC) soluble enzyme for bleaching cellulosic materials	2,72	2	46.75	Extraction with Pectat Lyase shows a lower weight loss compared with the samples treated with catalyst or laccase. The degree of white obtained after the classical treatment is higher than that obtained after the other treatments
5.	13	Control Fabric to liquid ratio H = 1:20 Temperature = 60 °C time = 40 min	0.40	2	47.48	

In order to compare the degradation occurred during the enzymatic pretreatment of cellulosic fabrics, before and after bleaching with enzymes, catalyst and classical method, measurements of the tensile strength and elongation at break for the treated 60 % cotton +40 % hemp material, were performed [5]

Table 3 summarizes the results of these measurements.

Table 3: Determination of material degradation after enzymatic pretreatment

No.	Pretreatment type	Tensile strength [N]	Elongation at break [%]	Observations
1.	Classical	364.1	15.2	The degradation evidenced by measurements of the tensile strength and elongation at break is 16.9 % after the treatment with catalysts, 15.2 % after the treatment using the classical method and 14.5 % after the treatment with laccase
2.	Catalyst	344	16.9	
3.	Laccase	373.3	14.5	
4.	Control	360.8	15	
5.	Blank	302.9	8.9	

3. CONCLUSIONS

During the researches carried out in this study it was found out that:

- The sample treated with enzyme Pectate Lyase shows a lower weight loss than the sample treated with catalyst or laccase enzyme.
- The degree of white obtained after the classical treatment is higher than the degree of white obtained after the other treatments.
- The degradation evidenced by measurements of the tensile strength and elongation at break is higher after the treatment with catalysts, followed by the classical treatment then the treatment with laccase.

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