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INFLUENCE OF THE AMOUNT OF THE BTCA ON THE EFFECTIVENESS CROSSLINKING

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Abstract: *Cellulosic textiles mainly cotton fibres, are finished in order to improve their properties, dimensional stability and crease resistance play a considerably important role. These properties can be satisfactory achieved by crosslinking agents, which react with hydroxyl groups of cellulose fibers. Esterification between polycarboxylic acids and cotton cellulosic has been investigated since long ago. Over the past few years, there has been an attention on application of nanoparticles with crosslinking agents to impart other properties to the fabric, such as antimicrobial, flame retardant, water repellency or UV protective. The present study is aimed at imparting polyfunctional finishes on cotton fabrics using polycarboxylic acids (PCAs) which are able to crosslinking with cellulose. 1,2,3,4-butane tetra carboxylic acid (BTCA) have been selected and applied using different concentration on 100% cotton fabrics using pad-dry-cure process. This work is focused on studying the influence of the BTCA concentration on the wrinkle recovery and flexural rigidity behavior. We studied the modification, the wrinkle recovery angle and flexural rigidity. The results of each sample have been compared with the results of the untreated fabric and, as expected, it could be observed differences in behaviour depending on the concentration used. Results from instrumental techniques, showed that the treated sample with 80 g/L BTCA and 40 g/L* NaH_2PO_2 *is the best effectiveness of all treated fabrics.*

Key words**:** *cotton, BTCA, cosslinking agents, flexural rigidity, wrikle recovery.*

1. INTRODUCTION

Cotton fabrics require several functional finishes to make them confortable during wear. Dimensional stability, feel, appearance, wrinkle recovery, flexural rigidity and soil release property are some of the functional areas which require chemical treatment to improvement. Crosslinking of cellulose molecule renders wrinkle resistance, smooth drying and crease retention properties in cotton fabrics. Majority of easy care finishes used by the textile industry are formaldehyde based resin precondensates. Dimethylol dihydroxyethyleneurea (DMDHEU) is popular among them, as it is more efficient and cost effective. However, the health risk associated with formaldehyde emission has caused increasing concern worldwide. [1]

In recent years, extensive efforts have been made to develop polycarboxylic acids as new crosslinking finishing agents for cotton fabrics to replace the traditional reagents [2, 3]. 1,2,3,4-butane tetra carboxylic acid (BTCA) is found to be the most promising polycarboxylic acid for easy care finishing of cotton fabrics [4-6].

In this research BTCA was applied in 20, 40, 60 and 80 g/L concentration with 10, 20, 30, 40 g/L of sodium hypophosphite as catalyst in each case and cured at high temperatures. We evaluated the influence of concentration of BTCA used on the effectiveness crosslinking. For this, flexural rigidity and wrinkle recovery angle of each treated samples were analyzed.

2. EXPERIMENTAL

2.1 Materials

A 100% bleached cotton fabric with the weight of 115 g/m^2 was used.

The fabrics were impregnated with solutions containing the polycarboxylic acid, using 1,2,3,4-butane-tetracarboxilyc acid (BTCA) and sodium hypophosphite monohydrate ($NaH_2PO_2 \cdot H_2O$) (SHP), which was used as catalyst for the reaction of cellulose with BTCA. Different concentrations were used in each treatment.

2.2 Crosslinking Procedure

The formulations with different acids and conditions of crosslinking are shown in Table 1.

Table 1: *The content of the policarboxylic acids in the reaction bath and the conditions of crosslinking.*

Polycarboxilyc acid	BTCA
Concentration acid (g/L)	80, 60, 40, 20
Concentration NaH_2PO_2 (g/L)	40, 30, 20, 10
Cured temperature (ºC)	170

The samples were immersed in the aqueous solution and then were passed through squeeze rolls to give a specified pick-up, we obtained around 70%.

2.3 Instrumental techniques

We evaluated the modification in the flexural rigidity and wrinkle recovery angle (WRA) of the treated cotton fabrics. It was measured according to UNE 40-392-79 and UNE EN 22313, respectively. The results obtained were the average of 10 measurements taken along the warp and weft directions.

3. RESULTS AND DISCUSSION

The table 1 shows the results of the modification on the flexural rigidity of the treated cotton fabrics. The results of each sample have been compared with the results of the untreated fabric where we can see the percentage increase in warp and weft (Rt).

Table 1: Results of flexural rigidity

	Fabric 110 g/m^2					
	Untreated fabric		**Treated fabric**		**Treated and cured fabric**	
	Weft	Warp	Weft	Warp	Weft	Warp
mg/cm	57,39	80,78	65,50	85,55	77,70	124,26
% Increase			**14,13**	**5,90**	**35,40**	**53,82**

These results for every sample are shown in figure 1, where we can see at a glance behaviour modification after the treatment.

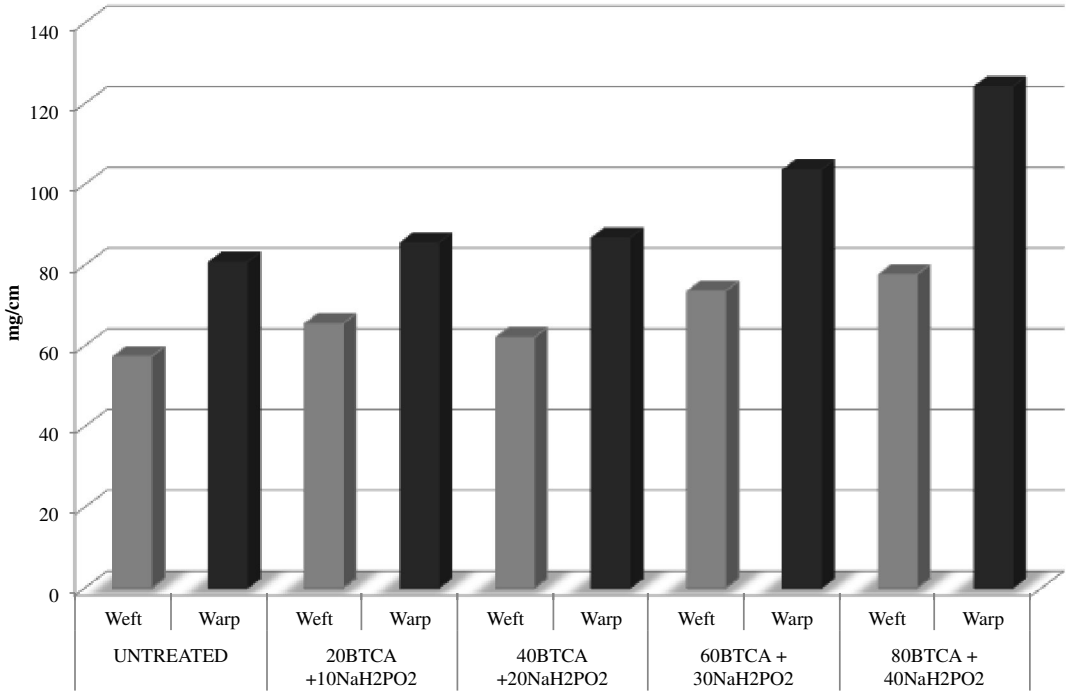

Fig.1: *Flexural rigidity results of samples treated with different BTCA and NaH_2PO_2 concentrations*

The flexural rigidity behavior improves in all of treated sample, as expected, greater amount of BTCA is used, lower flexural stiffness show the cotton fabric.

The figure 2 shows the results of the modification on the wrinkle recovery angle of the treated cotton fabrics. The results of each sample have been compared with the results of the untreated fabric.

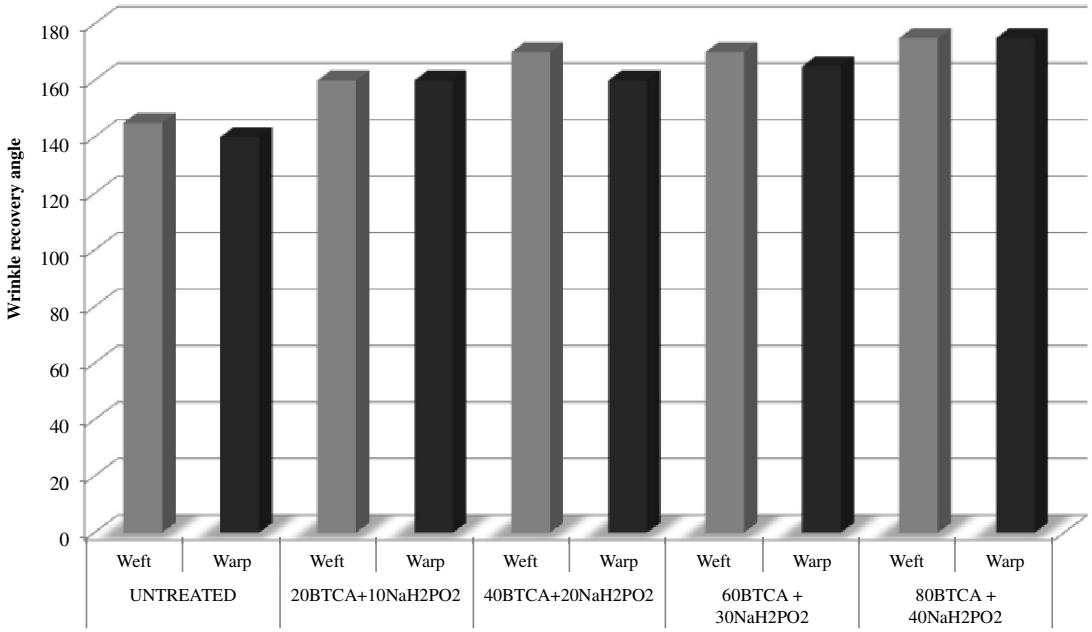

Fig. 2: *Wrinkle recovery results of samples treated with different BTCA and NaH_2PO_2 concentrations.*

The figure shows the results of the modification on the wrinkle recovery angle of the treated

cotton fabrics using different BTCA concentration. The results of each sample have been compared with the results of the untreated fabric where we can see the increase in warp and weft.

It could be observed differences in behavior depending on the concentration used. The samples of lower amount of BTCA obtain less wrinkle recovery angle in warp and weft. In all of these fabrics the results are better than untreated sample.

4. CONCLUSIONS

In this work we have impregnated with BTCA cotton fabrics, and we dried the samples at 85ºC, then these fabrics were cured at high temperature. We obtained different behaviour depending on the crosslinking agent concentration have been used.

In this study the influence of polycarboxylic acid concentration on crosslinking efficiency of cotton cellulose crosslinked with 1,2,3,4 buthanetetracarboxylic acid (BTCA) was evaluated. In order to get those evidences, we studied the modification the wrinkle recovery angle and flexural rigidity. The results of each sample have been compared with the results of the untreated fabric and, as expected, it could be observed differences in behaviour depending on the concentration used. In both instrumental techniques, the treated sample with 80 g/L BTCA and 40 g/L NaH_2PO_2 is the best effectiveness of all treated fabrics.

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