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INFLUENCE OF THE SIZE OF TOURMALINE PARTICLES APPLIED ON POLYESTER FABRIC ON THE RELEASE OF NEGATIVE IONS

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***Abstract**: There are some scientific papers that verify that the generation of negative ions in the air have positive consequences on people's mood and health. In this work is intended to increase the generation of negative ions from polyester fabrics to achieve an increase in well-being and comfort through the realize of negative ions. To improve the negative ion release ability on different substrates there have been many studies which have considered silicates as a good particle with these characteristics. Polyester fabrics were treated using padding system with different tourmaline microparticles in order to modify the surface behavior when rubbed and demonstrating that it is possible to modify the number of negative ions generated. Two types of tourmaline microparticles with different size particles, 3 and 30 μm, were studied and applied on the samples with and without an acrylic resin to get a better fixation. To determine the quantity of negative ions released, an ion counter was used, testing each sample. Finally, the results were studied, analyzing the different parameters that influence them, as the concentration, the addition of resin or the kind of the particle. The best results were obtained with the Tourmaline with 30 μm at 50 g/L concentration and without the addition of the acrylic resin.*

***Key words:** Acrylic resin, padding, microparticles, finishing, silicates*

1. INTRODUCTION

Since long ago, it is known the influence of air ions on the subjective wellness [1]. This kind of ions are plentifully located in different natural environments as waterfalls or forest and it has been demonstrated that have positive effects on people health unlike positive ions which have been related with aggressive, stressful and agitated states [2].

Negative ions in the air are able to evoke a wide range of responses in humans, there is evidence that negative ions are able to influence the mood, behavior and performance of certain tasks [3]. One of their health benefits is the reduction of the stress and anxiety on computer workers [4] since they behave as a relaxing of the nervous system.

To improve the negative ion release ability on different substrates there have been many studies which have considered silicates as a good particle with these characteristics [5].

Tourmaline belongs to this group and have a rhombohedral structure with an intermediate complexity, which is made up of rings of six tetrahedra. Because all tetrahedrons point in the same direction, there is a lack of central symmetry, which gives it a polar character and electrical properties, both piezoelectric and pyroelectric [6].

Its capacity to generate negative ions is also remarkable and it comes from its chemical structure, thanks to which its application in various sectors is being studied, such as its use in plantation grown, water treatment or applications in conventional textiles.

This last application has been studied to improve the release of negative ions in conventional fabrics of polyester via the addition of different kinds of tourmaline with different particle size (3 and 30 μm), in order to increase the comfort of the PES textiles garments.

2. EXPERIMENTAL

2.1 Materials

A polyester (PES) fabric has been used as a sample with a plain weave structure formed with PES multifilament and 160 g/m^2. The samples have been treated with various types of tourmaline, T3 and T30, with a different size of particle, 3 and 30 μm, respectively. These particules were supplied by Innovatec SL. In order to fix the particles on the fiber in some cases an acrylic resin, Color Center STK-100 (Color Center, Spain), was employed.

2.2 Methods

The tourmaline was applied by padding which was done with a horizontal foulard of 40 cm (2608 TEPA), applying a strain of 1,5 Kg/cm at 2 m/min speed. The samples were padded with two different concentrations of each tourmaline. After this process, the samples achieve a 80 % pick-up, approximately, and they were dried during 10 minutes at 60 ºC and cured during 1 minute at 120 ºC. In table 1 is shown the formulation of each bath prepared.

Table 1: *Formulation of each bath prepared for the polyester treatments*

	T3 (g/L)	T30 (g/L)	Acrylic Resin (g/L)
T3 20 g/L	20	-	-
T3 50 g/L	50	-	-
T3 20 g/L_R	20	-	5
T3 50 g/L_R	50	-	5
T30 20 g/L	-	20	-
T30 50 g/L	-	50	-
T30 20 g/L_R	-	20	5
T30 50 g/L_R	-	50	5

The capacity to release negative ions was tested in each sample with the ionometer Air Ion Counter COM-3200Pro from COM System. To ease this action a friction was applied on the fabric with a magnetic stirrer at 1000 rpm and a magnetic fly of 3 cm. This test had a duration of 15 minutes and it is made on 3 different zones of the sample to obtain the arithmetic mean [7].

3. RESULTS AND DISCUSSION

Treated fabrics with different size of tourmaline particles, T3 and T30, and using different concentration were analized with the iometer following the procedure described previously. In table 2 number of negative ions realeased from each fabric are shown.

Table 2: *Ions released by each sample*

Samples	**T3** 20 g/L	**T3** 50 g/L	**T30** 20 g/L	**T30** 50 g/L
Negative Ions/cc	62	91	43	226

For the 20 g/L concentration the amount of ions released by the two samples is very similar but if the tourmaline concentration is increased until 50 g/L, the difference is bigger, being the amount of negative ions released by the tourmaline T30 of 226 anions/ cc, approximately, more than double of T3.

Also the influence of the resin used in the treatment was studied, results of negative ions released are shown in Fig. 1.

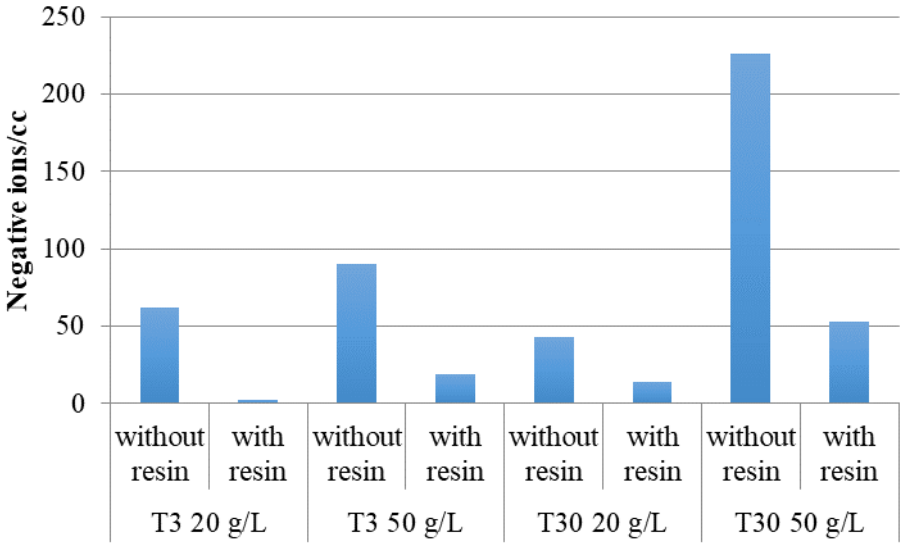

Fig 1. *Effect of the resin in the ions release*

The application of the acrylic resin has supposed the decrease of the negative ions released in both cases, tourmaline T3 and tourmaline T30, and in both concentrations.

Maybe, the addition of the resin difficult the friction between the particles and, therefore, the release of the negative ions.

Finally, the concentration of the tourmaline particles has an important influence over the ions released. When the concentration is bigger the number of negative ions released is increased, especially in the case of the tourmaline T30, which experiments an increase of more than 400%.

5. CONCLUSIONS

In this paper, a method to improve the comfort and the experience of conventional fabrics of polyester has been proposed, using different kinds of silicates that allow increase the negative ions released by this fabric.

Tourmaline T3 (3 μm in diameter) and T30 (30 um in diameter) were used in the test, obtaining the best results with the T30 tourmaline in big concentrations (50 g/L) and without incorporate any acrylic resin,considering that this decrease the ions liberated.

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