“TECHNICAL UNIVERSITY OF NORTH”

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CAREER OF TEXTILE ENGINEERING

TRABAJO DE GRADO PREVIA A LA OBTENCIÓN DEL TÍTULO DE INGENIERÍA TEXTIL

TOPIC:

USE OF NATURAL SISAL FIBER TEMPLATE FOR PREPARATION TO THE IMPLEMENTATION OF ANTIBACTERIAL COPPER SULFATE

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1._Problem.

One of the problems we face on a daily basis is the use of synthetic fibers in the shoe, the characteristics that these have, affect the health because deteriorate. Climate changes and external situation of each person are variables to be considered in the care of our feet as they are paramount in our health.

Currently the natural fibers are losing ground in the market as important for Sustainable Development and Environmental Protection elements.

2._Summary.

The aim of this work is to use natural fiber sisal to make templates with specific characteristics being these antibacterial , in order to offer users a new product that provides convenience and comfort in addition to the health benefits of the feet, using thereof, based on the use of copper sulphate in textile finishing.

Chapter I. - describes the origin, obtaining, characteristics, classification, uses and applications of natural fiber sisal, which is the raw material for the production of templates.

Chapter II contains the fundamental principles of tissues, concepts, a small classification of knitwear and woven fabrics.

Chapter III specifies the definition, classification, uses and applications of nonwoven. In addition all possible types of processes for obtaining detailed nonwovens.

In the IV chapter is very extensive discusses the antibacterial substances focusing on medical, also focuses on the features, uses, properties, applications of copper sulfate as it is the primary substance used in textile finishing, taking into consideration the recommendations and measures necessary assistance.

Chapter VI. - With regard to the experimental phase, sisal fiber was used in state of fiber for making templates nonwoven as yarn for knitting manually templates as fabric for the production of already woven templates, making these templates raw material needed to manufacture the textile finishing.

Regarding the antibacterial just was reached to determine the appropriate concentration is 5g / l of copper which provides greater efficiency sulfate and decreases lot temperature., And also found

that the template without any antibacterial finish It is permitting and facilitating the emergence and growth of bacteria

This research project will provide a solution to the deterioration of our health with reference to the care of our feet, because in most of the footwear we use daily are made from synthetic fiber which makes our feet are affected as the lack of convenience, comfort and appearance of some bacteria, excessive sweating and odor. Which if not controlled in time can cause health disorders or deeper skin conditions.

The core of this research project is the use of natural fiber sisal developing templates for everyday use, with an aim to offer users a new product that allows us to improve the quality of life of the community and the environment.

The development of these antibacterial insoles is a new product that provides great benefits can be used in all areas because they do not possess any restriction on its use and because the materials used are standard templates that help themselves and You are currently used but with other features and in turn look for alternatives responsible with the environment and human health.

3._ Process of preparation and development.

This research was carried out two stages in the city of Ibarra, Imbabura province.

In the experiment evaluating 4 concentrations of copper sulfate in 100 % sisal templates it combined to assess their antibacterial effect. Note that there will be three types of templates.

The research aimed at using natural sisal fiber for making templates with an antibacterial effect to prevent the emergence or spread of bacteria or pathogenic organisms; while it intended as a viable alternative by reducing pollution to the environment and foot care.

4._ Experimental process

This chapter describes the processes necessary for the development of different types of templates with their respective antibacterial finish described. The factors studied and testing templates to be used, allow contribute to meeting the initial goals.

Studied factors
- Sisal.
- Copper sulfate.
- Fabrics
- Nonwovens.

It is essential to use gloves, mask and apron to avoid any contamination. Before starting the process of antibacterial finish, prepare materials and laboratory equipment listed below:

5._ Application materials.

- Or fiber and templates: (100 % agave).
- Or substances: copper sulfate, micro silicone emulsion, glycerol, sodium bicarbonate, water.
- Or instruments: Pots high capacity laser thermometer, measuring cup in milliliters, stirring bar, gas stove, stopwatch, measuring containers for chemicals.
- Or other materials : pH paper , needle, scissors, thread , sisal , needles , plastic bags , mask , gloves , apron.

6._ Making process templates Sisal.

Developing templates sisal is essential because it is the main implement to be used in practice

6.1_ Raw material purchase.

- Sisal fiber.
- Thin thread of twine.
- Sisal fabric

6.1.1_ Nonwoven templates

6.1.1.1._ Process Description.

These supports based on sewing method, which involves placing the fibers in longitudinal, vertical and diagonal between two layers of paper form, then proceed to take a template mold to place the edge above and drawing. Later on the inside of a seam rhomboidal is performed using the sewing machine line , once the template is cut and the paper is adhered to this , Finally with the use of overlook machine is eliminated occurs seam to clamping edges to give fibers

6.1.2_ Woven templates (Taffeta)

6.1.2.1._ Process Description.

The development of such templates is to place two layers of woven sisal, then a mold template is positioned and the border is drawn, then the template is cut. Finally with the use of overlook machine stitching on the edges it is carried out in order to provide extra support fibers.

6.1.1_ Manually woven templates

With the use of a shoelace we proceed to develop templates manually, then steps:

a. Purchase of the raw material (sisal twine) and a shoelace .
b. Then it proceeds to make 15 chains.
c. Semicircular three laps around the fabric is made.
d. Perform three midpoints in each corner.
e. Upon completion of the three laps we proceed to perform 12 chains for a size 36, should be a larger size make the necessary strings in the bottom of the tissue.
f. Finally it follows the process to achieve the required size of the workforce.
g. finished template

6.2._ Recommendation to use Templates

Place the template in the shoe, once it used on the day it is necessary to remove and place in a cool place template in order to remove moisture.

7._ Treatments

It works with 4 concentrations of copper sulfate in three types of templates, 12 treatments and two replications; also it is taken into account sample values witnesses

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TREATMENTS	MATERIAL	CONCENTRATIONS				APLLICATION TIME
		GLYCERIN mg /ml	COPPER SULPHATE g/l	MICRO SILICONE EMULSION %	SODIUM BICARBONATE %	DAYS
T1	TAFETAS/FABRIC	0	0	0	0	15
T2	TAFETAS/FABRIC	0	0	0	0	15
T3	NONWOVEN	0	0	0	0	15
T4	NONWOVEN	0	0	0	0	15
T5	TEJIUDO MANUALLY	0	0	0	0	15
T6	TEJIUDO MANUALLY	0	0	0	0	15
.....		.....	.....	.....	.....	.....
T7	.....	0.5	3	80	1.5	15
T8	TAFETAS/FABRIC	0.5	3	80	1.5	15
T9	TAFETAS/FABRIC	0.5	3	80	1.5	15
T10	NONWOVEN	0.5	3	80	1.5	15
T11	NONWOVEN	0.5	3	80	1.5	15
T12	TEJIUDO MANUALLY	0.5	3	80	1.5	15
.....	TEJIUDO MANUALLY					
T13	.....	0.5	4	80	2	15
T14	TAFETAS/FABRIC	0.5	4	80	2	15
T15	TAFETAS/FABRIC	0.5	4	80	2	15
T16	NONWOVEN	0.5	4	80	2	15
T17	NONWOVEN	0.5	4	80	2	15
T18	TEJIUDO MANUALLY	0.5	4	80	2	15
.....	TEJIUDO MANUALLY	.....	.....	.....	.....	.....
T19	.....	0.5	5	80	2,5	15
T20	TAFETAS/FABRIC	0.5	5	80	2,5	15
T21	TAFETAS/FABRIC	0.5	5	80	2,5	15
T22	NONWOVEN	0.5	5	80	2,5	15
T23	NONWOVEN	0.5	5	80	2,5	15
T24	TEJIUDO MANUALLY	0.5	5	80	2,5	15
	TEJIUDO MANUALLY	0.5	5	80	2,5	15

For the impregnation process of copper sulfate to give an antibacterial property sisal templates, has developed a spreadsheet or consumption pattern where there are processes performed, the textile used and other information.

7.1._ Antibacterial Finishing Process.

Within this experimental research, to give antibacterial properties templates is logically follow each of the steps necessary to perform a process of micro encapsulation of copper sulphate in the different types of templates sisal .

7.2._ Process scheme Antibacterial Textiles

LEAF CONSUMER

Sample #	4
Material	Sisal
Type	Hand/weaving
Weight	12,8789 g
Equipment	Open
R/B	1/30
g/l	5
MI	386,367
Ph	6.5

ANTIBACTERIAL FINISH

PROCESSES:

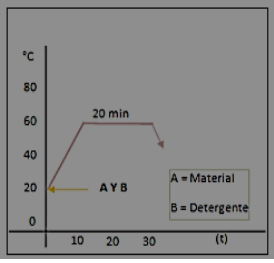
WASH

Product	mg/ml	%	mg	gr	Kg	Cost	Subtotal
Detergent	1		386,367	0,386367	0,00038637	2,5	0,000965918
TOTAL							0,000965918

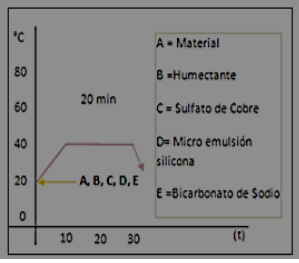
ANTIBACTERIAL FINISH

Products	mg/ml	%	mg	gr	Kg	Cost	Subtotal
Humectant	0,5		193,1835	0,1931835	0,00019318	6	0,001159101
Cooper sulfate	5		1931,835	1,931835	0,00193184	8	0,01545468
Silicone microemulsion		80	10303,12	10,30312	0,01030312	8	0,08242496
Sodium Bicarbonate		2,5	321,9725	0,3219725	0,00032197	4	0,00128789
TOTAL							0,100326631

WASHOUT CURVE



ANTIBACTERIAL FINISHING CURVE



8._ Efficiency Evaluation Antibacterial Finishing temperature and the types of templates

8.1._ Temperature decrease.

I used a table to control the results in consideration of the temperature decrease. Also shows the comparative average values of each type of template with the copper sulfate concentration.

Table 23. General average results of the collected evidence.

TREATMENT (Tests)	CONCENTRAN COOPER SULFATE - g/l	TYPES OF ROSTER					
		TISSUE (tafetán)		NONWOVEN		MANUALLY TISSUE	
		ROSTER SISAL °C	ROSTER °C	ROSTER SISAL °C	ROSTER °C	ROSTER SISAL °C	ROSTER °C
T1	0	30,51	30,81	26,49	26,41	27,9467	28,4467
T2	0	26,79	27,19	24,8	24,83	32,2433	32,6433
T3	3	27,5	28,1	28,59	28,79	29,54	30,64
T4	3	29,1	29,8	27,42	27,52	27,81	28,71
T5	4	27,53	28,43	31,09	31,39	27,2	28,5
T6	4	31,28	32,38	27,84	28,44	29,52	31,02
T7	5	27,34	28,84	28,5	29,2	33,1	35,1
T8	5	28,32	29,82	23,31	24,21	26,1167	27,8167
T9	Witness	33,3	33,4	28,33	28,38	26,9	26,7
T10	Witness	25,3	25,3	26,2	26,7	32,3	32,39
Promedio	———	28,697	29,387	27,257	27,587	29,26767	30,19667

8.2._ Microbiological Analysis

Is to perform analysis using a 1 cm2 segment of each sample using the technique of bio- peptone solution in water, then poured in a Petri dish with PCA agar. It is left to incubate for 24 h at 37 ° C ± 1. Finally a count of colony forming units is performed.

Table 39. Microbiological analysis sisal template with antibacterial finish and unfinished.

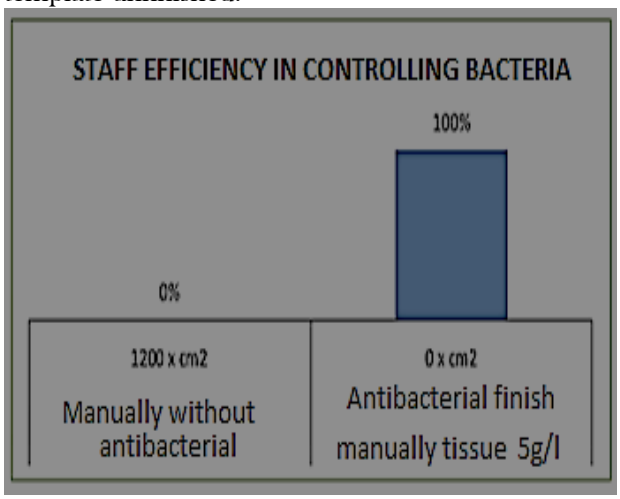
ANÁLISIS MICROBIOLÓGICO

Number	TYPE TEMPLATESSISAL	Analyzed Parameters	Result	Test method	% Effectiveness
1	TISSUE MANUALLY (WITHOUT ANTIBACTERIAL FINISH)	Mesophile aerobic count	12000 x cm2	AOAC 989,10	0%
2	TISSUE MANUALLY (ANTIBACTERIAL FINISH 5g/l)		0 x cm2		100%

9._ Interpretation of results.

After evaluation of the antibacterial action templates application for 30 days results that allowed me to differentiate the efficiency of each substance concentration it was determined antibacterial.

Figure 9. % efficiency in controlling bacteria in consideration of the template with antibacterial finish of concentration 5g / l with respect to the template unfinished.



10. - Data Analysis and Graphics.

39. Table contains the parameters and values of microbiological testing was performed woven sisal template manually with antibacterial finish 5 g / l concentration with respect to the template manually without antibacterial sisal woven finish.

8. Graphical representation is Table 39, which indicates the effectiveness in percentage comparison between the two templates.

Graphical Interpretation

Figure 8 indicates that the template manually woven sisal has a 100 % efficiency compared to control colonies forming units indicating aerobic mesophilic that exists in each sample.

Figure 9. % efficiency in controlling bacteria in consideration of the template with antibacterial finish of concentration 5g / l with respect to the template unfinished

10._ Unit Price

The price of each antibacterial template was calculated using the cost of each product for processing. As they are (raw materials , utilities and labor .

The unit price varies according to the concentration of copper sulfate used and the type of template.

DATA	Description		PLANTILLA - PNT#3		
	product		Sisal fabric		
	concentration		5 g/l		
RAW MATERIAL	concept	units	quantity	price USD	price TOTAL USD
	Sisal fabric	m^2	1	0,5	0,5
	detergent	kg	0,00038637	2,5	0,000965918
	moisturizer	Lt	0,00019318	6	0,001159101
	Copper sulfate	kg	0,00193184	8	0,01545468
	Micro silicone emulsion	Lt	0,01030312	8	0,08242496
	sodium bicarbonate	kg	0,00032197	4	0,00128789
	SUBTOTAL 1				0,601292549
BASIC SERVICE	CONCEPTO				
	Gas	Skg	kg usados	kg	
		0,1888	0,13	1	0,021658
	light	Skw	SAM	min /h	
		0,08	0	60	0
	water	Sm^3	used	m^3	
		0,51	0,000772734	1	0,000394094
	SUBTOTAL 2				0,022052094
LABOR	concept	SALARY	min/mes	SAM	
	operator	450	10560	120,5	5,134943182
	SUBTOTAL 3				5,134943182
	UNIT COST				5,758287825

11._ Conclusions:

Sisal woven templates (Taffeta) and nonwoven, through use or in later washing procedures, undergo deformations changing the physical structure (stretching too much or unraveling), becoming disposable and unsuitable for further use. However sisal templates made manually have an increased shelf life in consideration of the other templates as these will not be damaged (deformed) by the use or in subsequent washing processes.

The result of decreased temperature of each template corresponds to: a value tissue templates of 0.8625 ° C, nonwoven templates a value of 0.4125 ° C and hand woven templates which

provided good results at the other templates as these they indicate that reduce 1.161125 ° C with respect to the other templates being the highest temperature value.

Inversely representation indicates the effectiveness of the product, i.e. highest average temperature decreased greatest benefit is obtained. Therefore manually woven template temperature decreases 1.16125 ° C, with 100% effectiveness

Sisal templates without antibacterial finishing process reduces foot temperature in consideration of the shoe insoles.

It is concluded that the substance that has been used in appropriate concentrations do not cause dangerous reactions when in contact on the skin of humans

Tests low performance were those with no concentration of copper sulfate, ie not possess any antibacterial finish, as these contributed to the emergence or growth of bacteria and allowing present odor indicating a range of 12000 bacteria cm2.

By microbiological analysis to the template manually woven sisal of 5 g / l concentration of copper sulfate it was determined that copper sulfate has antibacterial properties which helps these inhibit the growth and in turn prevent the growth of bacteria indicating that this template does not have any bacteria.

The bath should have a pH of 6.5 for that an adequate exhaust micro silicone emulsion. Furthermore it should be dried at 100 degrees centigrade for 2 minutes to change from liquid to solid, and coat the inside and outside of the fiber in order to allow the antibacterial and more durable finish is not lost with the processes later washing.

Through analysis of the results for each concentration of copper sulfate used it is concluded that the woven templates manually 5g / l concentration of copper sulfate is optimal because they allow the foot is free of possible growth of bacteria, it produces subtle tingling, cooling sensation.

In analyzing unit costs sisal templates nonwoven have a value of: 3.59 dollars template 3g / l, 3.59 dollars template 4g / l and 3.60 dollars template 5g / l.

In analyzing unit costs woven sisal templates have a value of: 2.93 dollars template 3g / l, 2.96 dollars template 4g / l and 2.99 dollars template 5g / l.

In unit costs analysis templates manually woven sisal have a value of: 5.76 dollars template 3g / l, 5.75 dollars template 4g / l and 5.76 dollars template 5g / l.

Table analysis unit costs of each type of template without a process of antibacterial finish, we can see that the value of each of the templates is: USD 2.26 nonwoven template USD 1.61 woven template, being the 4.38 dollars cheaper and woven manually template has a high price in consideration of other templates.

According to research at the level of the testimonies of patients we found that templates antibacterial sisal because some different sensations that took into account in controlling such sensations as tingling, freshness, cushioning, and exfoliation when not used average, tickle and light massage.

The value of textile finishing is 0.62 cents a template that is a relatively economic value in terms of the cost of medicines or products used in the prevention or treatment of pathogenic microorganisms in the feet.

Antibacterial insoles take on a blue color due to the pigmentation of copper sulfate according to the applied concentration, however this is being eliminated with the washing processes.

The washing process influences the duration of antibacterial finish and physical condition of the template; do durability time ratio of 6 washes in a washing process every 15 days of continuous use and in the case of every month would not 12 washed in frequent use.

12._ Recommended

Avoid changing the concentrations of the substances used as process curve antibacterial finish.

We recommend using distinctive for each of the templates and to avoid confusion in each sample.

It is recommended to work in a suitable laboratory for textile finishes properly equipped with the necessary tools and materials, in order to ensure processes.

It is recommended to follow safety rules, use protective equipment for the use of different substances in the manufacture of textile finishing; the use of mask, apron and gloves prevent direct contact with the products, we also help our health care.

We recommend using distinctive for each of the templates and to avoid confusion in each sample.

It is recommended to continue the investigation with the highest positive concentration is 5g / l in other commodities such as templates cotton, wool, etc. In order to improve the presentation and image and seek new options for innovation.

Applying the templates manually woven sisal concentration 5g / l of copper sulfate should be in a longer period of time in order to evaluate the durability of antibacterial product on the template in consideration of the subsequent washing process as in this research was conducted in two months.

It should take into account the cost of production (labor) to be industrialized decreases as this value is considered only on the basis of the development of a single antibacterial template.

The antibacterial template to be a textile article outside the footwear causes an adjustment between the foot and footwear, therefore it is necessary to use a size smaller than that used or turn remove the template itself shoe and replace it with the template antibacterial sisal.

You must place the template in the shoe, once used on the day it is necessary to remove and place in a cool place template in order to remove moisture.

The washing process of the templates must be done manually without the use of a washing brush in order to delay the finish time of resistance and durability of the template.

For making temperature values using a laser thermometer it recommended because this tool was used in order to obtain an accurate temperature value in research.

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