International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Use of Aqueous Crosslinker in Obtaining Reechato Leather

Cortez, A [1], Ruíz, H[2], Torres, R[3]

[1]Universidad Técnica Estatal de Quevedo, Quevedo, Ecuador

[2] Escuela Superior Politécnica de Chimborazo, Chimborazo, Ecuador

[3]Universidad Técnica Estatal de Quevedo, Quevedo, Ecuador

Abstract: ***This research was carried out at the Polytechnic School of Chimborazo in the tanning laboratory, with 42 skins of criollo sheep with similar characteristics, distributed in 3 treatments with different levels of aqueous crosslinking agent 30g 40g and 50g respectively, with 14 replicates, for A physical evaluation was carried out, where wet strength, dry rub resistance, and tensile strength were determined. Sensory evaluation, where it was determined: power of coverage, softness, brilliance. The correlation between variables was evaluated. Economic evaluation in which the cost of production and profitability were established. Working with 50 g of aqueous crosslinking agent, the best sensorial evaluations were obtained: covering power (4.86 points), softness (4.86 points) and brightness (4.71 points), over 5 reference points and with excellent ratings according to the Sensorial scale proposed by Puente, C. (2011)***

Keywords: Crosslinker, leather, reechato, aqueous

1. Introduction

The production of hides and their manufactures begins with the raising of cattle of different species (cattle, goats, sheep and camelids), considering that raw hides are a byproduct of the slaughtering of animals, the leather chain comprises four links: Dressing and marketing of raw and salted hides, the tannery for the production of semi-finished leather (wetblue) and leather and other finished products (sole, drumstick, nobuc, etc.), the manufacture of leather articles: clothing, footwear and articles Leather goods and leather goods and, finally, the commercialization of all the final products where the producers themselves, wholesale and retail intermediaries and transport services intervene. Its objective is to cover the surface of the skin, to highlight its natural beauty or to hide the damages that Originate as much in the places of aging, as in the houses of trail, the technician in finishes in our country must act with much imagination to obtain. The dry finishing processes have the desired result, since the skins have low classification. To obtain a smooth finish, most of the fine leather is treated with a mixture of materials such as synthetic resins, dyes, pigments and high-coverage lacquers, thanks to the presence of different levels of aqueous crosslinking agents or to the solvent. Mirror appearance, typical of a leather reechato, the polish confers to the grain a very polished surface, the characteristic brightness of the reechato is obtained after the application of several layers of a thick covering finish. A glossy surface finish made by the application of sizing layers, pigmented or unpigmented based on linseed oil, nitrocellulose, polyurethane or other more crosslinked synthetic resins.

2. Importance

The realization of this investigation is justified to know that the finish type reechato is applied on rectified leathers, frosted leather and sawdust; But also on full-blown low-grade hides. It consists of applying on them a thick layer of polyurethanes that cover the faults and damages of the skins of low classification and that provides the typical brightness of this article. This type of finish is used for insoles of footwear and leather goods, given its excellent characteristics such as raising the classification of the skin, good durability, resistance to scratching and ease of cleaning. However, trends in fashion, technology, legislation and the cost of labor have led to many changes in the leather industry, affecting manufacturers of fur at each and every stage of production of the leather. Leather retanning, from retanning, dyeing and lubrication to dry finishing because there is no systematization in production. Since fashion today has a greater influence of shades, surface, textures and effects, such as metallic and reechato of high or low gloss, imitation velvet as well as different types of touch, are requirements that vary constantly. The anticipated knowledge of these changes is important to face an inevitable change in demand, but as leather products follow the fashion trend in wool and textiles, the industry has more time to react.

3. Methodology

The number of experimental units that composed the experimental work was 42 skins of criollo sheep, the same ones that were acquired in the Camal Municipal of Riobamba.

3.1. Treatment and experimental design

In order to evaluate the physical and sensory characteristics of the reechato type sheep leather, the experimental results were modeled under a Fully Random Design (DCA), with a two-way arrangement where factor A comprises the levels of cross-linking agent and factor B tests To which they were subjected to the following statistical analyzes:

- Analysis of variance (ADEVA), for the different variables.
- Separation of means by Tukey (P <0.05), for variables that present significance.
- Kruskal-Wallis test, for sensory variables.
- Analysis of Regression and Correlation.

For the determination of the significance of the sensorial variables, the Kruskall - Wallis test was used, whose mathematical model was the following:

$$H = \frac{21}{nT(nT+1)} = + \frac{\sum RT1^2}{nRT_1} + \frac{\sum RT2^2}{nRT_2} + \frac{\sum RT3^2}{nRT_3} + 2(nT+1)$$

Where:
H = Comparison value calculated with the K-W test.
NT = Total number of observations at each level of pigment.
R = Range identified in each group.

Table 1: Scheme of the experiment

Leves	Code	Rep	TUE	Replica	#Skins
30g	T1R1	7	1	1	7
30g	T1R2	7	1	2	7
40g	T2R1	7	1	1	7
40g	T2R2	7	1	2	7
50g	T3R1	7	1	1	7
50g	T3R2	7	1	2	7
Total sheep skin					42

Table 2: Schematic of the analysis of variance

Source of variation	*Degrees of freedom*
Total	41
Treatments	2
Essays	1
Error	38

3.2. Experimental measurements

Physical
- Distension (mm)
- Wet rub resistance (cycles)
- Dry rub resistance (cycles) Sensory
- Power of coverage (points).
- Softness (points).
- Brilliance (points).

Economic
- Production costs.
- Benefit / Cost.

3.3. Statistical analysis and significance tests

The analyzes were subjected to the following statistical analyzes:
- Analysis of variance (ADEVA), for differences between means.
- Separation of means through the Duncan test (P <0.05), for variables that present significance.
- Kruskal-Wallis test, for sensory variables.
- Regression and Correlation analysis for variables that presented significance.

3.4. Experimental Procedure

For the present investigation, 14 creole sheep skins were used for each of the trials; That is to say, a total of 42 skins for the 3 treatments, acquired in the Municipal Camal, applied the following procedure:

3.4.1. Soaking
- The fresh skins were weighed and, based on this weight, a bath was made with water (H2O), at 200% at room temperature.
- 5 grams of chlorine plus 1 gram of surfactant were dissolved, mixing and 1 hour turning the drum at a speed of 2 rpm, the bath was removed.

3.4.2. Sanding hair
- The skins were again weighed and based on this new weight, the skimmed and depilated pulps were prepared with sodium sulfide (Na2S) in the amount of 2.5 and in combination with 3.5% lime (Ca(OH)2), Dissolved in 5% water (H2O);
- The skins were then weighed without wool to prepare a bath with 100% of water at room temperature, to which 1.5% of sodium sulfide (Na 2 S) and 1% of lime were added and turned. The drum for 3 hours and placing them in rest for a time of 20 hours and the bath was removed.

3.4.3. Offset and rendered
- The skins were washed with 100% clean water (H2O) at 30° C plus 0.2% sodium formate (NaCOOH), rolling the drum for 30 minutes.
- The bath was then discarded and another bath was prepared with 100% water (H2O) at 35 ° C plus 1% sodium bisulfite (NaHSO3) and 1% ammonium formate (NH4COOH), plus 0.2% of Yielding product and the drum was rolled for 90 minutes.
- After this time, the phenohphthalein test was performed and 2 drops were placed on the skin to see if there is or is no presence of lime (Ca (OH) 2), and with a pH of 8.5.
- The bath was finally discarded and the skins washed with 200% water (H2O), at room temperature for 30 minutes and the bath was removed.

3.4.4. Piquelado
- A 60% water (H2O) bath was prepared at room temperature, and 10% white (NaCl) salt was added, rolling 10 minutes to dissolve the salt and then add 1.5% Formic acid (HCOOH); Diluted 10 times its weight and divided into 3 parts.
- Then each part was placed with a time span of 20 minutes. After this time, the pH was monitored to be 2.8-3.2, and allowed to stand for 12 hours.

3.4.5. Tanning and basifying
After standing the drum was rolled for 10 minutes and 7% of tannin was added on a chrome basis, it was turned for 90 minutes, after which time 1% of sodium bicarbonate (NaHCO 3) was added; Diluted 10 times its weight and divided into 3 parts, each part was placed with a time of 1 hour and then rolled the drum for 5 hours.

3.4.6. Neutralized and retanned

- Once the leather was lowered to a thickness of 1.1 mm the leathers were weighed and washed with 200% water (H2O), at room temperature plus 0.2% surfactant and 0.2 formic acid, then the drum was rolled for 20 minutes later to eliminate the bath.
- Then it was retuned with organ-chrome, giving a movement to the hype for 30 minutes to later throw the bath and prepare another bath with 80% water at 40ºC to which was added 1% sodium formate (NaCOOH), to perform Neutralized, the drum was rolled for 40 minutes and 1.5% neutralizing retanning was added and the drum was rolled for 60 minutes, the bath was removed and the leathers washed with 300% water at 40 ° C for 60 minutes.
- Finally the bath was discarded and another one was prepared with 100% water at 50 ° C to which 4% of mimosa, 3% of skirt filling was added, then the drum was rolled for 60 minutes.

3.4.7. Dyeing and lubrication

- To the same bath was added 1% of aniline according to each treatment that was tested and the drum was rolled for 60 minutes, then to increase 100% of water to 70ºC, plus 6% of sulfochlorinated paraffin, plus 2 % Lanolin and 8% ester phosphoric, mixed and diluted by 10 times their weight.
- Rolled for 60 minutes and then 1% formic acid (HO2CCO2H) was added; And rolled for 5 minutes, then 1.5% formic acid (HCOOH), diluted 10 times its weight, divided into 2 parts and each part rolled for 10 minutes, the bath is removed. After the previous process, the leathers were rested for 1 day in shade (stacked), so that they drained and dried for 3 days.

3.4.8 Sawmill, softened and staked

Finally, the leather was moistened a little with a small amount of wet sawdust in order to absorb moisture and better softness throughout the night. The leathers were softened by hand and then stamped along all the edges of the leather with nails, stretching them little by little on a wooden board until the center of the leather had a drum-like appearance, was left a whole day And then we get the nail

3.4.9 Dry Finish

The finishing process was started with a sanding of the frieze and the flower, after which a slight impregnation was carried out, in order to eliminate the flower looseness. Again it was sanded and dusted to apply the layers of background and cover. The sizing consisted of a mixture of polyurethane, proteinaceous binders and the presence of the different levels of crosslinking agents (30, 40 and 50 g) per kilogram of preparation; the leathers were then placed at rest for at least 18 hours; And proceeded to perform the physical and sensory evaluations.

3.5 Evaluation methodology

3.5.1. Sensory analysis

For the sensorial analyzes an evaluation was made through the impact of the senses that are the ones that reveal that characteristics must be presented in each one of the leathers giving a rating of:

- 5 corresponding to excellent;
- 4 corresponding to very good;
- 3 corresponding to good
- 2 corresponding to mala
- 1 corresponding to low;

In terms of power of coverage, softness and brilliance that were valued in points and according to the following criteria:

3.5.2. Laboratory Analysis

a. Distension

To test the ability to mount skins that must withstand a deformation of its surface was used the method IUP 9 based on the lastometer. This instrument contains a clamp to firmly hold a circular shaped leather probe with the flower side outwards, and a mechanism to drive the clamp to a steady speed at a steady steel ball located in the center of the meat side of the probe. The descending action of the clamp gradually deforms the leather, which takes on a cone-like shape, with the flower in increasing tension until the first fissure occurs. At this moment the force exerted by the ball is recorded and the distance in millimeters between the initial position of the clamp and the one that occupies at the moment of the first fissure of the flower, this distance is denominated distension.

b. Wet rub resistance

Rub resistance is one of the most important properties of leather and one of the most difficult to satisfy in wet. Virtually all types of tanned are bound to a certain degree of resistance to rubbing. There are two types of tests to measure resistance to rubbing: Satra and Veslic. In the Satra, a felt material of circular form rotates by rubbing the surface of the leather, while in the Veslic the felt is supported on the skin with a certain load and it is the skin that moves in the form of back and forth. The Satra test has the drawback that the same part of the surface of the leather is always rubbed. The friction produces a heating that can soften the thermoplastic finishes by distorting the results. In addition, the discoloration produced is uneven and the results are more difficult to assess. The Veslic procedure was adopted as method IUF 450, and its use is more widespread than the Satra, where the skin sample is fixed with the face to be tested upwards on a horizontal platform capable of developing a reciprocating movement with a path of 3.5 cm and a frequency of 40 cycles per minute. The sample is drawn 10% of its length in the same direction in which the movement will be triggered. Wool felt and square shape, is applied on the surface of the leather with an adjustable load. The minimum load is 500 g in weight, although this load is only applied in the leather leathers test. The normal load is 1 kg. The number of cycles to be applied depends on the requirements of the specific article.

c. Dry rub resistance

The resistance of the leather to the dry rub is markedly higher than that of the wet, experience shows that in general the leather performs worse in the assessment of the staining than in the degradation of the color itself. Hides are often tested which after 25 wet scuffs show no appreciable defect or variation in their color but which have nevertheless stained the felt. The improvement of the resistance to rubbing comprises physical alternatives such as the increase of the thickness of the finish or the reduction of the

coefficient of friction of the surface, and chemical as to obtain a greater reticulate of the finish, or the use of lacquer in organic solvent instead of the Aqueous emulsions to obviate the hydrophilicity of the emulsifiers. Naturally, the rub resistance also depends on the degree of fixing of the dye, and on the plush ones as the grinding has been carried out.

4. Results

A. Physical evaluation of reheat leather using different levels of aqueous crosslinking agent

1. Wet rub resistance

When analyzing the resistance to wet rubbing of the reechato leather, significant differences (P <0.001) were observed between the different levels (30, 40 and 50 g) of aqueous crosslinking agents, with the responses being reported Higher in the treatment hides T3 (50 g), with a mean of 54.93 cycles and falling to 52.57 cycles in the treatment hides T2 (40 g), whereas the less efficient responses were recorded in The treatment T1 leathers with 51.86 cycles.

In the application of the final size, it can be determined that the optimum level of crosslinking agent is 50 g since it provides the reechato finish with high resistance to wet rubbing, which may be due to Artigas, M. (2004), which indicates that The finishing of a skin consists in the application on the flower side of several layers of preparations followed by the corresponding drying, at the same time that the skins undergo various mechanical operations.

The various requirements can only be met by the application of several layers which, while having affinity with one another, differ in degree or degree from each other and provide special characteristics in each case. The crosslinking systems are virtually indispensable in the aqueous leather finish, and in particular for reheat leather, since an increase in the physical resistance of the finish is necessary, whereby the importance in the application of polymers capable of being crosslinked increases. This applies both to products used in organic media and to those used in aqueous media. As a rule, using reticular agents means using a two component system instead of a single component system, which allows to obtain leathers with high strengths especially when rubbing with wet felt. When confronting the results of resistance to the wet rub of the Present investigation that reports a general average of 53.12 cycles, before observing the cracking of the finish, with the requirements of quality for leathers destined to the manufacture of footwear of the Spanish Association of the Industry of the leather, that infers a minimum of 50 (TUP), it can be stated that with the application of 30, 40 and 50 g of aqueous crosslinker this quality requirement is overcome, but with better results when applying 50 g of crosslinking agent (T3) , In the final sizing. The regression analysis of wet rub resistance shows a highly significant positive linear trend with an equation of y = 46.98 + 0.15x, which shows that starting from an intercept of 46.98 cycles the resistance to rubbing Is raised by 0.15 decimals for each unit of change in the level of aqueous crosslinking applied in the final size with a coefficient of determination R^2 = 73.04%, which is highly significant as well as indicative of a high association Between the two evaluated variables, while the remaining 26.96% depends on other factors not considered in the present investigation, such as the quality of the raw material and the origin of the chemical products.

When evaluating the effect of the tests on wet rub resistance, it can be determined that there are no statistical differences (P <0.23), only numerical superiority is reported in the leathers of the first test with 53.14 cycles and that Descends to 53.10 cycles on the hides of the second test. In the absence of statistical differences, it can be stated that the reheat leather of the two tests has a homogeneous ability to resist rubbing with wet felt before the finishing layer is removed, which may be due mainly to the fact that the Raw material of similar origin, of homogeneous state of conservation were also developed in a controlled environment and following the thesis protocol, with which we can affirm that in the change in the quality of the reechato leather, neither the tests nor the Level of aqueous crosslinker

2. Dry rub resistance

The dry rub resistance variable of the reechato leather recorded significant differences (P <0.03), between the effects of the aqueous crosslinking level applied to the final size, with the most resistant leather being reported in the T3 treatment (50 g), With mean values of 73.0 cycles, whereas the less efficient values were recorded in T1 treatment hides with means of 72.0 cycles, while intermediate values were reported in treatment hides T2 (40 g), with 72.79 cycles.

The above described analysis allows to infer that higher levels of aqueous crosslinking increase the resistance to the dry rub of the leather reechato which may be due according to http://www.cueroovino.com. (2011), that the last layer of finish that receives the skin is known as top, lacquer or sizing and is the one that determines in great way the final appearance of the leather reechato, of this last layer will depend the resistance of the processing treatments Of the final article as they are mainly resistance of the finish to the wet, when rubbing with wet or dry felt, to the ironing, stability, of adhesives, etc. Once the application of the layers of impregnation, bottoms and intermediate layers of the leather finish is achieved, to obtain certain color and leveling characteristics, a final application is needed that protects the previous layers and provides the skin with the desired gloss, feel and solidity , Which is secured with the application of crosslinking agents, which have been used for years, are used, in organic polyurethane sizes, also binders and caseins are crosslinked to improve the physical properties of the re-leather which prevents the rubbing Reechato finish will easily come off or lose its luster with which accelerates the aging.

The experimental results show a general average of 72.60 cycles that are to be compared with the quality requirements for footwear of the Spanish Leather Association, which show a resistance to rubbing with minimum dry felt of 70 cycles according to IUP 20 (2002) It can be seen that in the

three different levels (30,40 and 50 g) of aqueous crosslinker this quality standard is met.

In the analysis of the effect of the tests on the physical characteristic of resistance to the dry rub of the reechato type hides no statistical differences between means were reported, however, a certain numerical superiority was registered in the hides of the first test with means of 72, 67 cycles and descending slightly to 72.52 cycles in the hides of the second test. In this sense it is necessary to take into account that there is no statistical difference, it can be affirmed that the conditions of production of reechato leather were quite similar and that the appearance of these can only be due to the quality of the raw material that is the only aspect Which can't be controlled within the production process since the origin and the preservation of the skin are not known, it can slightly vary the resistance to rub with dry felt but that does not influence the quality of the skin nor the destination for which It will be used that for our case is the shoe making, in which when polishing the shoe with a dry cloth can cause discoloration and especially the loss of the gloss of the leather, when the process of transformation of leather into leather and Especially in the finishing phase has not been done correctly.

In the regression analysis a highly significant positive linear trend can be determined, with a dry rub resistance equation = 70.60 + 0.05x, which shows that starting from an intercept of 70.60 cycles, the resistance to rub Is increased by 0.05 cycles per unit change in the level of the aqueous crosslinker applied to the finishing formulation of the reechato leathers since the protein sizing is customary to modify its resistance to the felt by adding small amounts of one Wax emulsion, and an aqueous crosslinker.

In addition, it was established with a coefficient of determination R^2 of 65.18% between the two evaluated variables while the remaining 34.82% depends on other factors not considered in the present investigation as they are time and precision both in the roll of the drums Of tanning and of hair that are the ones that determine the appearance of the faults of the skin and that are covered with the application of the finish reechato

3. Distension

When evaluating the variable distension of the leather reechato, highly significant differences (P <0.001) were reported, between the different levels of aqueous crosslinking applied to the final size, generally identifying three types of articles, polished as in the case of reechato , Polishing imitation and thermoplastic finishes.

In addition, the great majority of the reechato is produced from grain in corrected crust, the reason being that, to get a completely soft and "plastic" surface, the grain has to be eliminated completely. The high gloss level also means that any defect in the leather surface needs to be minimized by grinding the leather prior to finishing. Thereafter, the surface has to be much impregnated and covered with pigmented base layers prior to the application of the final gloss layer. Achieving a high level of physical performance of the finished leather is essential to prevent the film from cracking or peeling with the use, which is why it is essential to apply the optimum level of aqueous crosslinking agent. When re-leather is made it is necessary to achieve a good adhesion of the finish, the various layers of the individual finishing hands applied individually, flexibility of the film and resistance to rubbing, especially with dry felt. A leather in crustbien prepared, produces strong finishing formulations and procedures of applications are indispensable requirements for the manufacture of a product of high quality.

By means of the regression analysis, a highly significant positive linear trend was determined with an equation of distension = 5.56 + 0.057x, which shows that, starting from an intercept of 5.56 mm, the distension increases by 0.057 mm, for each unit of Change in the level of aqueous crosslinking applied to the formulation of the ovine skins finishing to obtain reechato leather, with a coefficient of determination R2 of 75.03%, which deduces a highly significant association between the dependent variable as a function of the independent .

When evaluating the distension of reechato leathers, there were no highly significant differences (P <0.60), as a result of the tests; However, a certain superiority was identified numerically in the hides of the second test with 7.92 mm and falling to 7.78 mm in the hides of the first test. As mentioned above, the best responses in T3 treatment leather (50 g), with a mean of 8.51 mm and the least efficient treatment leather T1 (30), with distensions of 7.36 Mm, while intermediate values were reported on T2 treated leathers (40 g). The values reported to be compared to the quality requirements of the Spanish Leather Association that infers in its technical standard IUF 450 at least 7 mm, it can be seen that with the application of 50 g of crosslinker (T3), it is exceeded widely with This requirement of quality for leather intended for the manufacture of footwear in which the performance demands a material that when making the footwear takes the form of the shoe last without suffering changes in the change from flat to spatial.

The use of high levels of aqueous crosslinking as can be observed elevates the distension of the leather reechato assertions that may be due to the manifested by Portavella, M. (1995), who indicates that the final sizing that is constituted by aqueous crosslinking and that applies to A finish should not be considered in isolation, but the foregoing layers should be taken into account so that they are related and thus generate good anchorage and good distension. In general the term sizing is used when it is a protein-like layer. This type of sizing is very important when the touch and the distension are priority factors against any other solidity. It is generally applied to three types of articles, brightened as it is the case of reechato, polishing imitation and thermoplastic finishes.

By means of the regression analysis, a highly significant positive linear trend was determined with a relaxation equation = 5.56 + 0.057x, which shows that, starting from an intercept of 5.56 mm, the distension increases by 0.057 mm for each unit Of change in the level of aqueous crosslinking applied to the formulation of the ovine skins finishing to

obtain reechato leather, with a coefficient of determination R2 of 75.03%, which deduces a highly significant association between the dependent variable as a function of Independent.

When evaluating the distension of reechato leathers, there were no highly significant differences (P <0.60), as a result of the tests; However, a certain superiority was identified numerically in the hides of the second test with 7.92 mm and falling to 7.78 mm in the hides of the first test. As mentioned previously, no numerical differences can be observed, it can be stated that the effect of the tests did not directly influence the physical quality of the leather only the numerical differences could be due to effects that can not be controlled within the process, Each of the processes that must maintain a speed standard but for reasons of maintenance it happens that it does not meet the required revolutions and that slightly lower the distension between one and another stop of leather.

B. Sensory evaluation of re-leather with the use of different levels of aqueous crosslinking agent

1. Power of coverage

The sensorial valuation of hedge power registered highly significant differences. (P <0.001), between the different levels (30, 40 and 50 g), of aqueous crosslinking agent, with the highest coverage in finished leather with 50 g of crosslinker (T3), with a score of 4.86 Points and condition Excellent, in the scale proposed by Puente, C. (2011), and that descends to 3.57 points and very good qualification in the reechato leathers of the treatment T2 (40 g), whereas the lower qualifications were Registered in the hides of the treatment T1 (30 g), with 2.50 points and good valuation according to the aforementioned scale. In interpreting the results, it can be clearly identified that higher levels of aqueous crosslinking increases the coverage power of re-leather, which may be due to Artigas, M. (2004), that leather is not an artificial product but totally natural, Matured with all its characteristics and natural, genuine nuances. Each skin has its own living structure, its own pattern of scars and bends. This is why each skin is unique and original and is easily observed thanks to the greater transparency that presents the finish on the surface of a warm piece of leather that has in common with all natural products: it becomes more beautiful with the passage of the Years and that acquires a very special luster so it is necessary to know the ways of without changing it completely embellish it for what is used the finishing process which consists of coating the surface of the grain of the skin with a finished product many bases with a Base of aqueous crosslinking that allows to cover all imperfections of the skin. In fine leathers this surface is polished or sanded to correct imperfections of the skin, and raise its covering power. To obtain a smooth finish, most fine leather is treated with a mixture of materials such as waxes, shellac or synthetic resin emulsions, dyes and pigments. The latter are used in moderation to avoid a painted appearance, the polish gives the grain a very polished surface.

The evaluation of the sensorial characteristic of power of coverage did not report statistical differences (P <0.90) between means by the effect of the tests, with only a certain numerical superiority in the hides of the second test with 3.76 points and that descends to 3 , 52 points on the leathers of the first trial. Asserting that there is no statistical difference between the hides have similar sensory qualities between trials, which may be due to the fact that the working conditions were homogeneous, which allows us to assert that as the tests were developed, accuracy is acquired In the formulation of the tanning and especially in the finishing of the leather reechato, to achieve the best sensorial benefits of covering power that are indispensable for the presentation of the final product, which even allows to correct many faults of the skin.

In the regression analysis between the two variables under study, where a highly significant negative linear trend is observed with a coverage power equation = 1.07 - 0.12x; Which means that, as the levels of aqueous crosslinking agent in the reechato type goat leather finish increase, the coverage power decreases, since for each level of crosslinker application the coating on the leather decreases by 0.06 Mm, so that it can be stated that they are statistically related (P <0.01) in addition to relying on a R^2 = 81.63%, of the percentage of aqueous crosslinking applied to the formulation of the reheat finish.

2. Softness

Sensory evaluation of soft leather reechato recorded highly significant differences (P <0.001) between the means of the treatments due to the effect of the aqueous crosslinking level applied to the final size. In the illustration of graph 9, the highest responses were reported with the application of 50 g of crosslinker with a mean of 4.86 points and excellent rating according to the scale proposed by Puente, C. (2011), while the less efficient softness was Reported in finished leather with low levels of crosslinking agent (30 g), with 3.07 points and a low condition, ie hides rather hard and with little fall that can cause discomfort to the user since the leather is destined to the shoe making that is A garment that has a prolonged use and is in direct contact with the skin. The greater softness of the reheat leather of the present investigation was reached by applying higher levels of aqueous crosslinking agent (50 g), which may be due according to http://www.cueronet.com. (2011), that when we take into account the softness of leather is based on the premise that customers acquire products based on the stimuli they perceive through the senses. The first sense that the leather stimulates is the sight, thanks to the color, the brilliance or the maticity of the same and especially depending on the type of finish that takes after this the artisan slides the leather slightly on its buds and qualifies the degree of smoothness and Fall, the sensation of hardness or stiffness is a parameter of total rejection of the leather. All these elements as a whole show us the image and personality of the product on the one hand are the sensory properties of leather so linked to our own bodies, including the smoothness and temperature of continuous and undulating surfaces, such as olfactory, since leather Emanates complex fragrances that are personalized by mixing with the aroma of its carriers.

The effect of the tests on the sensorial characteristic of softness did not report statistical differences between means,

(P <0.75), however numerically registered superiority in the reechato leathers of the second test with 3.76 points and that descends to 3.71 Points in the leathers of the first trial, establishing a very good rating in each of the trials according to the scale proposed by Puente, C. (2011); That is to say, leather with a good softness and fall that are ideal for the making of footwear and in addition the results reflect that when the transformation of leather into leather was achieved the standardization in the quality of the leather that is not easy to get since it is Works with skins that have a different performance but that when processed according to the strict protocol can control the effects that can affect the quality of the leather specifically on the softness.

3. Bright

The registered means of rezato leather brilliance registered highly significant differences (P <0.002), according to Kruskall Wallis, due to the effect of different levels of aqueous crosslinking, with a general average of 4.10 points and a coefficient of variation of 3.70 %, With the best results in the leathers to which 50 g of aqueous crosslinker (T3) was applied, with a mean of 4.71 points and excellent condition according to the scale proposed by Puente, C. (2011), in comparison Of the leathers to which 30 grams of aqueous crosslinking agent (T1) were applied, which registered the lowest grades with 3.50 points and good condition, while intermediate grades were reported for the leathers to which 40 grams of lacquer was applied with 4.07 points and rating.

What determines that a greater amount of aqueous crosslinking improves the brightness of the sheepskin with reechato finish, which according to http://www.finalidaddelacabado.com (2009), that when carrying out the sensorial evaluation of a product a very Important to take into account is the visual since it characterizes the qualities and is what is usually defined as quality. The expression "first impression enters the eyes" is very valid for leathers, it is very important the size, shape, brightness, color and absence of visual defects, among others, polished leathers have certain characteristics as they are : Excellent gloss and transparency, natural appearance, smooth pore and good dry rub resistance, solvents and heat, in order to obtain these benefits it is necessary to apply aqueous crosslinking agents which are virtually indispensable in the aqueous leather finishing, For reechato leathers. Aqueous-based products are currently available to produce what are called "wet-looking" finishes. These products are relatively easy and safe to apply and overcome many of the difficulties and risks associated with proven solvent based systems. However, such systems remain a little short in terms of transparency depth and glossy brightness level compared to solvent based systems. While the final coat applied to the leather is what determines its sheen, there are many additional factors that determine the quality, physical performance, consistency and appearance of the leather.

The behavior of the experimental measurements of the sensorial qualification of brilliance shown in figure 12, allows to estimate a highly significant positive linear trend (P <0.01), with a brightness regression = 1.67 + 0.06x, which indicates That starting from an intercept of 1.67 points, the brightness rises by 0.06 points for each unit of change in the level of aqueous crosslinking, with a coefficient of determination of 69.10% between the two interrelated variables, The remaining 30.9% depends on other factors not considered in the present investigation, and they are mainly related to the quality of the raw material, the origin of the chemicals, the precision in the formulation, among others.

C. Matrix of simple correlation between variables

In order to determine if the correlation is or is not significant between the physical and sensory study variables with the levels of aqueous crosslinking, the Pearson correlation matrix indicated in the following table is evaluated, where its can deduce that:

The correlation between the level of aqueous crosslinking agent and the wet rub resistance of the reheat leather establishes a high positive relationship with a degree of association r = 0.86, which indicates that as the level of the aqueous crosslinker increases , The resistance to wet rubbing tends to increase significantly (P <.001).

Table 3: Analysis of correlation between variables

	A	B	C	D	E	F	G
A	1	**	*	**	**	**	**
B	0.86	1	*	**	**	**	**
C	0.39	0.37	1			*	*
D	0.87	0.78	0.20	1	**	**	**
E	0.90	0.82	0.28	0.82	1	**	**
F	0.82	0.71	0.42	0.67	0.77	1	**
G	0.69	0.60	0.46	0.53	0.70	0.56	1

A: Levels of aqueous crosslinking agent
B: Wet Rub Resistance
C: Dry rub resistance
D: Distinction
E: Power of coverage
F: Bright
G: Softness

The degree of association of resistance to dry rub resistance is r = 0.39 ** which indicates that as the level of aqueous crosslinker increases the resistance to dry rubbing also rises, in a highly Significant. (P <.01).

In the same way, the degree of association of r = 0.87 ** between the aqueous crosslinking level and the detente infers a positive and highly significant relationship, that is to say, as the level of the aqueous crosslinker is increased Distension also increases (P <.01).

For the case of the sensorial variable power of coverage a high ascent is observed with a coefficient of determination of r = 0.90 **, which is highly significant, which shows that as the level of the aqueous crosslinker increases, Tends to rise significantly (P <.001).

The degree of association between brilliance and the level of aqueous crosslinking establishes a highly significant positive correlation (r = 0.82), which allows us to estimate that as the level of aqueous crosslinking increases, the brightness tends to increase progressively (P <.01).

Finally, the correlation between the acid dye level and the sensorial softness variable of the leather reechate determines a high positive association, with a correlation coefficient r = 0.69, which indicates that the softness rises as the level increases of aqueous crosslinking agent (P <0.01).

D. Economic evaluation

When performing the economic analysis of the benefit / cost of the application of different levels of aqueous crosslinking agent (30,40 and 50 g), applied to the final sizing for reechato leather, which is shown in table 10. Taking into account the expenses caused by the purchase of sheep skins, chemical products, mechanical processes, machinery rental, among others, we report values of $ 138.75 for T1 treatment leathers; $ 140.25 for treatment leathers T2 and finally $ 140.95 for treatment leathers T3 and as proceeds from the sale of surplus leather and final products the following values were reported $ 157.5; $ 175.0 and $ 189.5 for the leathers of the treatments T1, T2 and T3 respectively; With which, we can obtain the greatest cost benefit and that corresponds to the leathers to which 50 g of aqueous crosslinking agent (T3), with a nominal value of 1.34 or what is the same to say that for each dollar Inverted, a profit of 34% is expected and falls to 1.25 in hides to which 40 g of aqueous crosslinking agent (T2) was applied, whereas the lowest yield and corresponding to 1,14; Was recorded on the leathers to which 30 g of aqueous crosslinker.

In the evaluation of the profitability of re-leather applied to the final sizing different levels of aqueous cross-linking, and having as reference the commercial cost of leather in the markets of the center of the country, we can indicate that these profit margins are high, in addition, if Considers that the time spent in riparian, tanning, retanning and dry finishing processes are relatively short since they do not go beyond 3 months and that knowledge of the most appropriate techniques for the application of this type of finishing is owned Of a few people, we will achieve an economic recovery that exceeds the investment of commercial banking, which currently stands between 10 and 12%. Considering this commercial activity quite new and innovative and as it is a fairly resistant product and with good sensory performances it is easy to commercialize even reaching to occupy an important place in international markets, since it uses raw material that is of low quality and little demand.

Table 4. Economic analysis

CONTENIDO	NIVELES DE RETICULANTE ACUOSO		
	30 g	40 g	50 g
Numbers of sheep skins	14	14	14
Unit cost per sheepskin	5	5	5
Total cost of ovine skin	70	70	70
Shore Chemicals	8	8	8
Chemicals for tanning	7,25	7,25	7,25
Recovered chemicals	6	6	6
Products for the application of the final sizing	9	10,5	11,2
Cost of renting the machine	8,5	8,5	8,5
Preparation of 2 articles / treatment	30	30	30
TOTAL EXPENSES	138,75	140,25	140,95
Surplus sheep leather surface (ft2)	65	70	73
Cost of ovine skin produced (ft2)	0,47	0,50	0,52
Commercial cost sheep skin (ft2)	1,5	1,5	1,5
Sale of leather surplus	97,5	105	109,5
Sale of final items	60	70	80
TOTAL INCOME	157,5	175	189,5
B/C	1,14	1,25	1,34

5. Conclusions

After analyzing the results, the following conclusions would be reached:

1. In the analysis of physical characteristics of reheat leather of wet rub resistance (54.93 cycles), resistance to dry rub (73.0 cycles) and distension (8.51 mm), there were highly significant differences (P <0.05), between treatments. It was reported that the best results were obtained by applying higher levels of aqueous crosslinking agent (50 g) to the final sizing.

2. When working with 50 g of aqueous crosslinking agent (T2), the highest sensory evaluations were obtained in the production of re-leather from sheep skins: covering power (4.86 points), softness (4.86 points) and brightness (4.71 points)), On 5 benchmarks and with excellent ratings according to the sensorial scale proposed by Puente, C. (2011); That is to say, leathers that with high power of covering of the faults, very pleasant to the touch, quite soft and fallen and very brilliant characteristics indispensable for articles of high quality.

3. The effect of the tests on both the physical and sensory characteristics did not report statistical differences between means, which shows that the quality of the material produced is homogeneous since the more than consecutive tests were performed in a controlled and According to the thesis director's protocol.

4. With the analysis of the cost benefit, it can be stated that when using 50 g of aqueous crosslinking agent (T3 treatment) in the final finishing of the sheep skin finishing to obtain a reechato finish, the yield was higher, with a nominal value of 1.34 ; That is, that for each dollar invested a profit of 34 cents is expected, whereas the lowest profitability was registered in the finished leather with lower levels of aqueous crosslinking agent (30 g), ie a cost benefit of B 1.14.

6. Recommendations

Following the above conclusions, the following recommendations are made:

1. Use high levels of aqueous crosslinking agent (50 g), as they increase the resistance to rubbing with both wet and dry felt of the leather, as well as good stretching or stretching that are indicative of leathers that meet the requirements of Quality for the manufacture of footwear, and that adapts to the conditions of the user.

2. To achieve sensorial characteristics with the highest qualifications as far as coverage, softness and brilliance are concerned, it is recommended to use high levels of water-based crosslinking agent that the visual beauty of the leather allows a greater acceptance by the consumer.

3. To manufacture reechato leather from sheep skins, with the aim of giving a greater added value to a by-product of the meat industry and in that way open new branches that allow to industrialize this type of production, especially for the elaboration of footwear already That leather has the highest physical and sensory performance that can cover skin defects and that the finish is presented with high gloss.

References

[1] ADZET J. 1995. Química Técnica de Tenería. España. 1ª ed. Igualada, España. Edit. Romanya-Valls. pp. 105,199 – 215.
[2] ASOCIACIÓN QUÍMICA ESPAÑOLA DE LA INDUSTRIA DEL CUERO. AQEIC.1988 Ponencias de curtiembre y acabado del cuero-Curso-Taller. 1a ed. Barcelona España. sl. pp. 15 – 29.
[3] ARTIGAS, M.2004. Manual de Curtiembre. Avances en la Curtición de pieles. 2a ed. Barcelona-España. Edit. Latinoamericana. pp. 12, 24, 87,96.
[4] ESPAÑA, ASOCIACIÓN QUÍMICA ESPAÑOLA DE LA INDUSTRIA DEL CUERO. 2001. Norma Técnica IUP 450. Distención.
[5] ESPAÑA, ASOCIACIÓN QUÍMICA ESPAÑOLA DE LA INDUSTRIA DEL CUERO 2001. Norma Técnica IUP 6. Resistencia al frote en húmedo.
[6] ESPAÑA, ASOCIACIÓN QUÍMICA ESPAÑOLA DE LA INDUSTRIA DEL CUERO. 2001. Norma Técnica IUP 9. Resistencia al frote en seco.
[7] HIDALGO, L. 2004. Texto básico de Curtición de pieles. sn. Riobamba, Ecuador. Edit. ESPOCH. pp. 10 – 56.
[8] HIDALGO, L. 2010. Escala de calificación sensorial de cuero ovino aplicando diferentes niveles de pigmento para la elaboración de calzado. Riobamba, Ecuador.
[9] http://www.ovinocultura.com. 2011. Agraz, G. Hábitos y costumbres de los ovinos de nuestra serranía.
[10] http://www.cueroovino.com. 2011. Agraz, G. Necesidades de conservación de los cueros ovinos.
[11] http://www.cueronet.com. 2011. Batallas, M. Desollado y conservación de pieles ovinas.
[12] http://www.ovinos.com. 2011. Luna, P. Características de las pieles ovinas de baja clasificación.
[13] JURAN, J. 1999. Los ligantes y su utilización. s.n. Barcelona, España. Edit. ALBATROS. pp. 56-96.
[14] LA CASA QUÍMICA BAYER. 2008. Curtir, teñir, acabar. 1a ed. Munich, Alemania. Edit. BAYER pp 11 – 110.
[15] LACERCA, M. 1993. Curtición de Cueros y Pieles. 1a ed. Buenos Aires, Argentina. Edit. Albatros. pp 1, 5,6,8,9,10.
[16] LIBREROS, J. 2003. Manual de Tecnología del cuero. 1a ed. Edit. EUETII. Igualada, España. pp. 13 – 24, 56, 72.
[17] PUENTE, C. Escala Sensorial (2011)
[18] SALMERON, J. 1993. Resistencia al frote del acabado del cuero. 2 a ed. Asunción, Paraguay. Edit. IMANAL. pp. 19 – 52.
[19] SOLER, J. 2008. Procesos de Curtido. sn. Barcelona, España. Edit CETI. pp. 12, 45, 97, 98.

Author Profile

Cortez Andrea Graduated in Engineer in Livestock Industry at the Polytechnic Superior School of Chimborazo, Master's Degree in Food Processing at the Agrarian University of Ecuador, Professor of the Quevedo State Technical University at the Faculty of Engineering Sciences

Ruiz Hernan. Graduated in Engineer in Livestock Industry at the Polytechnic Superior School of Chimborazo, Master in Livestock Industries Mention Meat Industries in High School Polytechnic of Chimborazo

Torres Ruth. Graduated from Agroindustrial Engineering at Technological University Equinoccial, Master in Safety and Prevention of Work Risks at University Technological Equinoccial, Professor of the Quevedo State Technical University in the Faculty of Engineering Sciences

.