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APPLICATION OF SOME UNTRADITIONAL METHODS FOR SKIN PRESERVATION IN SOME DESERT AREAS

Azzam, A.H.
Department of Wool Production and Technology, Desert Research Center, Mataria, Cairo, Egypt.

ABSTRACT

This experimental work was carried out at Halieb and El-Shalaten region, where the skins were collected at marketing age of male Abu-Dleek breed of sheep. After slaughtering in El-Shaltein slaughterhouse the skins were preserved using different methods {1- Salt (SA), 2-Dry sea sand (SS), 3-Sea water (SW) 4-*Acacia arabica* fruits (AA) and 5-Solar (sun) rays (SU)}. Each skin was identified. Skins were sent to a tannery for skin processing (tanning) and after that were sent to footwear and leather industry service center (FLISC) for evaluating and testing of some leather physical properties.

From the results encouncerted, it was evident that, with the exception of SW and SU methods, there were very little differences among other methods of preservation with regard to the quality of leather produced from their skins. Skins from all methods with the exception of SW and SU methods are well suited to be processed into clothing leather. The skins produced from SS and AA methods would be investigated in preservation methods and considered as new method of preservation.

Keywords: preservation, tanning processes, leather physical properties.

INTRODUCTION

El-Shalteen-Halaib triangle region has a vital and strategic importance to Egypt. This region is a mountainous desert with several valleys dissecting mountains; the source of income of most inhabitants depends mainly on range animals. According to the last recent official statistics of the Agriculture Department of the Red Sea Governorate (1997), the number of sheep, goats and camels were 137357, 55213 and 20312 head, respectively, in El-Salateen- Halaib triangle region. The Abu-Dleek sheep is the most common breed in this region.

Skins contribute significantly to the value of slaughtered animals. It is therefore essential that the true value of the skins of different species is known to ensure that producers receive the optimum remuneration for their product.

Hides and skins are valuable co-products, but holding them untreated at 25°C for one working day will cause serious and costly damage to the surface or grain of the final leather.

One of the major factors in determining the quality and value of leather is the early treatment of hides and skins. If there is a delay between removal and further processing of hides and skins which means staying too warm for too long would suffer temperature abuse. These conditions can encourage hides and skins to be digested through a process called autolysis. They would also be subject to bacterial degradation.

Successful "green" processing (conversion of the raw items into part-processed stock), is time and temperature dependent. Delays before hides and skins preservation (salting, chilling and other chemical preservation) may cause varying degrees of damage depending on the extent to which autolysis and bacterial degradation proceed.

The need for a nonsalt preservation of hides and skins has been previously established. Pollution control regulations around the world, as well as effluent treatment methods, recognize the need to lower the soluble solids content of tannery and packinghouse effluents. Stanley *et. al.* (1973) suggested that elimination of salt in skin preservation is the only way these standards can be met. Soluble solids in tannery effluents remain the most difficult and expensive pollution problem to treat. The best solution is not to add them in the first place. Krishnamurthi *et. al.* (1977) reported that using sodium chloride in the curing of raw skin is one of major pollutants in the tanning industry, which affects the bio-fauna of the environment.

Various nonsalt methods of preservation have been proposed. A number of commercial materials are available which are claimed to provide temporary skin preservation. Each method has potential as well as limitations.

A material or a process that replaces salt must confirm to many of the conditions met by salt. It must be reliable to bring the fresh skin to a stable condition. It should be low in cost, nonpolluting, and relatively easy to apply.

Most of all, it must not have an adverse effect on the quality of leather produced from the preserved skins.

This study aimed at comparing different treatment of skin preservation with the traditional salting method. Physical properties of leather were also evaluated.

MATERILS AND METHODS

The experimental work was carried out at Halieb and El-Shalaten region, the skins were collected at marketing age being 1.5-2 years of male Abu-Dleek sheep after slaughtering in El-Shaltein slaughterhouse and the skins were preserved with different methods. The preservation treatment in this study were Sea sand, Seawater, Direct (solar) sunrays and local plant (*Acacia arabica* fruits), controlled with traditional method (salting), which is been widely used in Egypt and Middle East. Each skin was identified. Skins were sent to skin processing (tanning) and after that were sent to Footwear and Leather Industry Service Center lab. (FLISC) for evaluating and testing the leather physical properties.

The preservation methods used were:-

1. Salt (SA):

1- Remove all flesh and fat from skin.

2-Lay skin down flat on the ground and flesh side up in dry and shaded place.

3-Spread (one-third weight of skin salt) on the flesh side and squeezed with skin.

4-Allow skins to be dehydrated.

2- Dry sea sand (SS):

The same previous method except using dry sea sand instead of salt and squeezed with skin and change every 3 hours at day during three days.

3- Seâ water (SW):

Soaking the skin in 1 m^3 pool filled with seawater for three days.

4- *Acacia arabica* fruits (AA):

The same previous method except putting 200 grams of *Acacia arabica* fruits (as powder) on the flesh side of the skin and spread water every two hours in the first day to allow the skin to absorb the solution.

5-Solar (sun) rays (SU):

The same previous method except that the skin was left to dry by direct exposure to the sun for three days in summer season (average temperature reached in summer 45°C and solar radiation 65°C).

Skin tanning:

The dried skins were chrome tanned following standard methods and techniques (Saphouse, 1971). The processing procedures were applied in Al-Ahlia tannery.

Sampling and evaluation:

Five skins from each method were tanned for final testing and visual evaluation.

Samples for testing some physical properties of skins were taken seven inches from root of tail and two inches down from backbone (Kotb 1987). Physical measurements were carried out according to the International Union of Leather Chemist Associations (I.U.P.) methods and the Egyptian Standards (E.S.122).

Physical testing methods have been used to determine the properties of the leather that are required in satisfactory control program (Kanagy, 1977).

Measurements of Bally Flax Resistance of upper material using Bally Flexometer machine according to IUP(garment) at liment (50000 cycle without cracking), Finish Resistance according to ISO 11644 (garment) at Minimum 2N/Cm using Testometric machine and Tensile Strength IUP6(garment) at minimum 1200N/Cm2 and Elongation using the same machine (Testometric machine) in accordance with standard methods and techniques (Mudd,1965; Kanagy,1977).

After processing of the skins, they were dyed and five skins from each method were sampled from the butt area region and some physical tests were carried out on the samples. The samples were taken to measure Bally Flax Resistance of upper material, Finish Resistance, Tensile Strength and Elongation %.

RESULTS AND DISCUSSION

Some skin characteristics and physical leather properties of Abu-Dleek sheep:

The least squares means of live body weight, raw and dry skins, average thickness of fresh and dry skins and the percentage of skin weight by body weight of Abu-Dleek sheep skin salt cured as a control group is presented in (Table 1). The least squares mean of raw skin thickness is lower than those reported in Rahmany and Barki sheep by Abdelsalam *et. al.* (1993) as 1.6 and

1.49 mm respectively and the salt cured skin was lower than salt cured skin thickness as 1.4 and 1.3mm in the same breeds, respectively (Kotob; 1987).

Table (1). Least squares means of body weight, raw skin thickness, dry skin thickness, raw skin weight, Dry skin weight, moisture% and percentage of skin w eight/ body weight of Abu-Dleek sheep.

Method	Body Weight (kg)	Average skin thickness (mm)		Average skin weight (kg)			Skin W/ Body W %
		Raw skin	Dry skin	Raw skin	Dry skin	Moisture %	
Salt	26.4	1.20	0.84	1.84	1.14	38.25	6.98
Sea sand	27	1.58	1.50	1.65	1.04	36.97	6.11
Acacia arabica	26	1.62	1.15	1.62	1.18	37.36	6.22
Sun rays	27.4	1.44	1.15	1.86	1.10	40.77	6.77

It is shown in Table (2) and Fig. (1) the averages of BFR., FR., TS. and Elon. in control group (salt cured). Abdelsalam *et. al.* (1993) found that the average tensile strength was 293.25, 262.25 and 267.75 kg/cm² of Rahmany, Barki and first cross (RxB) sheep respectively, while values of tensile strength were 175.5 and 147.7 kg/cm² in Rahmany and Barki sheep, respectively (Kotob; 1987).

Table (2): Least squares means (mean ± SE) of Bally Flax Resistance of upper material, finish Resistance, tensile strength, and elongation% of Abu-Dleek sheep leather.

Method	BFR. (50000Cycle) Mean ± SE	FR. (N/Cm) Mean ± SE	TS. (N/Cm²) Mean ± SE	Elon. % Mean± SE
Salt	7.8 ± 0.46a	2.64±0.08a	1580.0±103a	34.0±1.39a
Sea sand	7.2 ± 0.46ab	2.46 ±0.08a	1500.0±103a	33.0±1.39a
Acacia arabica	6.0 ± 0.46b	2.18 ±0.08a	1240.0±103a	27.2±1.39b
Sun rays	6.6 ± 0.46ab	0.94 ±0.08a	720.0±103b	10.8±1.39c

Where: BFR.= Bally Flax Resistance of upper material, FR.= Finish Resistance, TS. = Tensile Strength and Elon.%= Elongation %.
a, b, c : Means in the same column with different superscripts significantly differ at P <0.05 and P <0.01.

The least squares mean of Elongation is lower than those reported in Rahmany sheep by Kotob (1987) as 59.6% and Abdelsalam *et. al.* (1993) as 55.65% and in Barki sheep by Kotob (1987) as 72.4% and Abdelsalam *et. al.* (1993) as 67.95%.

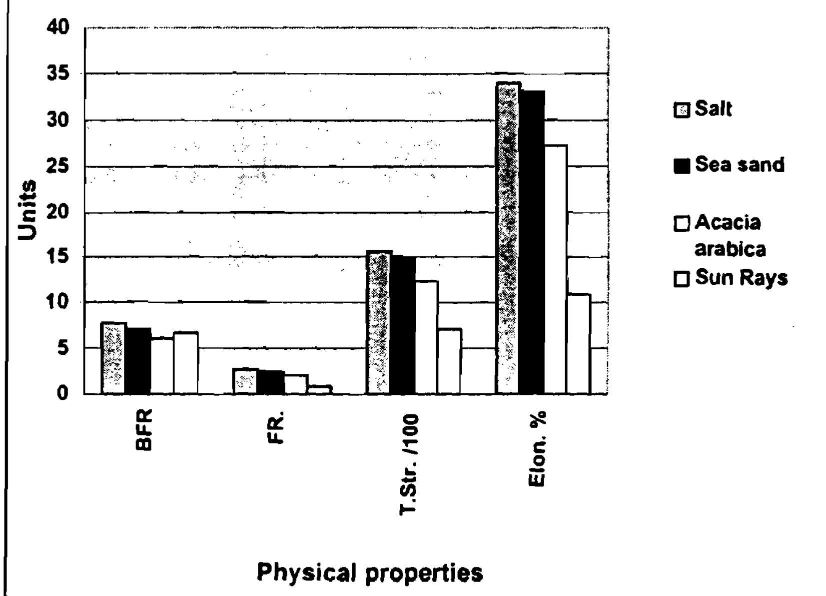
Comparison between alternative methods:

Salted cured method (SA): As shown in Table (2) and Fig. (1) it is evident that salted cured (SA) method performed significantly stronger than other alternative methods. Jackson-Mass *et. al.* (2000) reported that a salt cured skin should contain less than 50% moisture and this moisture should be at least 85% saturated with salt, giving an ash to mixture ratio in the skin as

30:100. Values of ténsile strength and elongation were higher than that of the minimum standard (Stress peak 15-20 N/mm² and Strain peak 30%) these results showed that skin produced (SA) method was strongest and could be stretched the furthest.

Sea sand cured (SS): This method allows the moisture in the skin to be absorbed by dry sand and the salt, which was mixed with sand, stopped bacteria action of skin autolysis. It is shown from Table (2) and Fig. (1) that the results of the above traits and leather physical properties produced from this method were close to method (SA). Sivaparvathis, *et. al.* (1976) found that the skin curing by two preservatives {soduim pentachlorophenate and sodium silicofluoride (05%)}, which inhibit bacterial action but not autolytic enzyme action, that the treatments were not able to prevent histological changes in skin and he stated that in order to preserve skin quality in a better way, a preservative which is effective against both the bacterial and autolytic enzymes is to be employed.

Fig. 1. Physical properties of Abu-Dleek leather produced from different methods of preservation



BFR.= Bally Flax Resistance of Upper Material, FR.= Finish Resistance, TS. = Tensile Strength and Elon.%= Elongation %.

Sea water cured (SW): The observation of carrying out this method was a swollen skin and an increase in thickness after two days and produced contaminated skin with bad smell and this method failed for curing and preservation. The skin samples from this method were unsuitable to test or evaluate any parameter because of failure to be cured.

Acacia arabica fruits (AA): It is known that some of the components of certain plants like *Acacia arabica* possesses tanning properties. The percentage of tannins in four common *Acacia* species, *Acacia berlandieri*, *Acacia. farnesiana*, *Acacia greggii* and *Acacia rigidula* were 69.6, 63.1, 45.8 and 68.9 respectively (Seigler *et. al.* 2000). As such it was thought worthwhile to explore the possibility of using such substances in curing by the drying methods to overcome some of the drawbacks of conventional method of drying (Krishnamurthi *et. al.*, 1977). Because of the widespread distribution and abundance of these plants, they may have potential as sources for commercial skin preservation. The results (Tables 2&3 and Fig.1) showed that there were no significant differences between physical properties of leather produced from (AA) method and physical properties tests carried out for any of either methods (SA) or (SS). Krishnamurthi *et. al.*, (1977) reported that a new method of curing raw hides and skins with mixture of organic compounds obtained from neem oil with salt. The number of protolytic bacteria in the treated group with neem oil was less than control group.

Table (3): Analysis of variance for preservation methods affecting dry thic, Miosture%, BFR., FR., TS. and Elon. % of Abo-Daleek sheep

S.O.V.	df	Miosture %	BFR.	FR.	TS.	Elon. %
Method	3	14.60	3.00	2.3618**	658137.1**	575.383**
Residual						
df	16					
MS		70.75	1.050	0.030	53797.700	9.600

Dry thic=Dry thickness, Mio%=Moisture, BFR.=Bally Flax Resistance of upper material, FR.=Finish Resistance, TS.=Tensile Strength and Elon.%= Elongation percentage.

Solar (sun) rays (SU): In tropical countries drying seems to be an ideal method overcoming the pollution problem. It is interesting to note that the results differed significantly between tests done on samples of leather produced from method (SU) and other methods. The poorer and weaker of leather properties in this method may be due to strong sun rays and high temperature in this region and it may become less weak and poor when putting in shed area (Table 2&3 and Fig.1). This may be due to autolytic enzymes, which are active after the inhibition of bacterial action. Sivaparvathi *et. al.* (1976) showed that even though some of the bacteria are killed by sun exposure during other bacteria and the spores deposited by bacteria only become dormant and will be activated upon rehydration. Bacteria indiscriminately attack the hide substance by secreting enzymes. Both bacterial and autolytic enzymes affect skin structure but in case of preservative treated skin the bacterial action is completely inhibited leaving the autolytic enzymes to be active. Tancous (1970) reported the deteriorating effect of autolysis on hide and leather quality. Hides subjected to autolysis, produced stretchy and pipey leather with poor break. Leather yield was also found to be affected in such cases. Krishnamurthi *et. al.* (1977) stated that drying by sun rays suffers from the defects of improper curing by drying until the material is soaked and liming carried out apart from the deficiency in proper wetting back of the skins and direct heat or exposure to the sun can cause gelatinization and cause hardening. The water-soluble glues and fats become insoluble. This is seen when hides get a hard yellow appearance on the fresh side.

Comparison between some physical leather properties of different methods of Preservation of Abu-Dleek sheep skin:

Leather physical properties:

The physical test results are summarized in Table (2) for leather produced from skin of Abu-Dleek sheep. Analysis of variance of the effect of preservation methods of each trait tested is presented in Table (3).

Bally Flax Resistance of upper material (BFR): This method is intended to determine the resistance of material to cracking or other type of failure at flexing creases. It is important to examine samples before testing as soft clothing leathers will often be dry milled and could already exhibit signs of cracking. The test is run for 20000 cycle and leather show no sign of cracks. This test indicates that the leather would be suited to processing into clothes. From the Tables (2&3) and Fig.(1) there was no significant differences between four preservation methods in this property. Kanagy (1977) reported that physical structure, chemical composition and the mechanical work done on it determine the properties of leather.

Finish Resistance (FR): This test showed the smooth, flexibility and attractive grain surface and leather goods and it is easier to make. From Tables (2&3 and Fig.1) it is evident that sun cured method leather performed significantly poorer in (FR) than the other methods, it means that the leather produced by (SU) method was unsuitable to be processed into clothes. Roddy (1977) stated that flexibility is a natural property of leather due to its unique fibrous composition. The relatively random fibre configuration of leather allows it to flex easily in all directions with no weak links to give way and cause failure. With each element in the fibrous matrix working independently and carrying its share of the load, leather can easily absorb the stress of flexion. While it is common in rigid materials, the ability to resist tearing is rarely found in materials flexible enough to be used in upholstery. Fortunately, there is exception leather's irregular fibre patterns resist penetration and thus contribute to the long enduring life of most leather goods.

Tensile Strength (TS): Tensile strength definition is "the greatest longitudinal stress a substance can bear without tearing apart." It is expressed in Neaten per square centimeter of cross-sectional area (psi). Data presented in Tables (2&3) and Fig. (1) Showed that the methods (SA, SS and AA) were stronger and higher in tensile strength and there were no significant differences between them. The differences between that three methods mentioned bellow and (SU) method was highly significant. Kanagy (1977) stated that salting not only dehydrates the skin but it combines with the proteins and separated the fibres. Jackson-Mass *et. al.* (2000) reported that an unpreserved skin exposed to temperature around 45°C for as little as five hours can actually disintegrate during further processing. This method produced lower leather in tensile strength and elongation, which might be due to less content of moisture remaining in the skin (Table 1). Roddy (1977) reported that the moisture content analysis is critical for quality control, because the tensile strength, flexibility and durability of leather are directly related to its moisture content. The significant differences in these physical properties contribute towards the increased softness, flexibility and durability of the leather, which made it easy to convert into attractive and fashionable goods (Abu-Samra *et. al.* 1999).

Elongation%(Elon%): Elongation refers to a material's ability to lengthen or when stress applied equals the material's tensile strength. Elongation percentage is calculated as the change in length per units original length. Elongation percentage at break change in length X 100/original length. The present results in Tables (2&3 and Fig. 1) showed that the (SA) and (SS) methods were higher in elongation percentage than (AA) and (SU) the differences were highly significant. Olivannan *et. al.* (1977) stated that the value of elongation percentage indicates the stretchiness produced by the finished leather. The percentage of elongation for most of the leather ranges from 30-40%. Abdelsalam *et. al.* (1998) stated that from physiological point of view, elongation is considered to be a function of elasticity in the skin and could be stretched the furthest.

CONCLUSION

From this study it is shown that dry sea sand (SS) and *Acacia arabica* fruits (AA) methods have a great deal of potential as a nonsalt methods of skin preservation. There are very little differences among salting method with regard to the quality of the leather produced from the new methods. The other advantage of the new methods are easily adaptability, less cost, no ill effect of conventional drying methods and no pollution due to salt in curing and soaking operation. Reliability and easy application for the short cure have been demonstrated. The skins produced from SS and AA methods would be investigated in preservation methods and considered as new methods of skin curing.

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استخدام بعض الطرق غير التقليدية لحفظ الجلود فى بعض المناطق الصحراوية

على حسن على عزام

شعبة الإنتاج الحيوانى والدواجن ، قسم إنتاج وتكنولوجيا الصوف ، مركز بحوث الصحراء المطرية القاهرة مصر.

جمعت الجلود من منطقة حلايب والشلاتين من ذكور أغنام أبو دليك على عمر حوالى العام. بعد الذبح فى مجازر الشلاتين وتم حفظ الجلود باستخدام (١- الملح (كلوريد الصوديوم) و ٢-رمال البحر الجافة و٣-مياه البحر و ٤-ثمار شجرة السنط العربى و٥-أشعة الشمس المباشرة). تــم أخذ بعض القياسات على الجلود الخام ثم إرسالها للمدبغة لإجراء عمليات الدباغة عليها ثم إرسالها إلى معامل مركز خدمة صناعة الأحذية والجلود "فليسك" لتقييم الجلود بعد الدبغ وإجراء بعض اختبارات الصفات الطبيعية للجلود.

أظهرت النتائج أنه باستثناء طريقة استخدام مياه البحر وأشعة الشمس المباشرة فى الحفظ فانه لا توجد فروق معنوية بين الطرق الأخرى للحفظ من حيث نوعية الجلود الناتجة ومدى صلاحيتها فى تصنيع الملابس والمصنوعات الجلدية ونوصى باستخدام طريقتى رمال البحر الجافة وثمار نبات السنط فى حفظ الجلود الخام.