

Manufacturing of Novelty Leather from Sheep Stomach

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ABSTRACT: *The aim of this research was to explore the feasibility of converting sheep stomach into new leather and leather products that add value to Leather Park. For this purpose, nine pieces of raw sheep stomach were taken into leather processing operation i.e. soaking, liming, de-liming, bating, pickling, tanning, finishing etc. After that some physical and chemical tests are subsequently performed i.e. tensile strength, tearing strength, stitch tear strength, color fastness, shrinkage temperature etc. The findings of physical tests have been poor in comparison with grain leather because the composition of raw animal and stomach coverings is different. The stomach leathers can be used as novelty leather material for preparing the key case, bracelet, wrist watch band, earring or necklace.*

KEYWORDS: *Novelty Leather, Sheep Stomach, Tanning process, Tensile & Tear strength, Color fastness, Shrinkage temperature.*

1. INTRODUCTION

Leather is a material made of animal hides and skins which is subjected to chemical and mechanical treatment to impart at a required property geared to final application. Whereas novelty leathers are either made from relatively rare animal species or from skin parts of animals that are rarely processed into leather. Hunting and slaughtering rare species are strictly prohibited in Bangladesh and sheep stomach is being used as a substitute because of stringent livestock laws in Bangladesh⁽¹⁾. The sheep stomach defers from monogastrics as they have four chambered stomach whereas the monogastrics has singled chambered stomach. These four chambers are rumen, reticulum, omasum and the abomasum. The rumen is the largest compartment of fore-stomach. The mucosa of the rumen varies regionally, but forms variably pronounced leaf-like papillae. The mucosal surface of the reticulum is composed of long primary and shorter secondary folds that form a grossly apparent honeycomb-like pattern. The omasum also has the leaf-like structures which are called the laminae, the muscular externa extends into the laminae. The true stomach is the abomasum part⁽²⁾. The average capacity of these parts of a mature sheep is almost 5~10 gallons (Rumen), 1.2~2 quarts (Reticulum), 0.5~1 quarts (Omasum), 2~3 gallons (Abomasum).⁽³⁾ Novelty leathers are treated in almost the same manner, however due to peculiar fiber composition and exceptional attractive grain texture they need some special treatment. Sheep stomach leather could be crafted from various kinds of feasible small items and objects, such as key ring,

coin purse, bracelet, wrist watch belt, ornaments. Such goods can be shown to improve the country's economic development by marketing them on the local and international export levels.

2. MATERIALS & METHODS

Nine pieces of raw sheep stomach (Not salted) were collected from Hazaribagh local market in Dhaka, Bangladesh. The net weight is around 3.5 Kg. All the chemicals used in leather processing are based on this weight.

3. PRODUCTION OF NOVELTY LEATHER FROM SHEEP STOMACH

3.1. SOAKING & CLEANING

Raw materials are often dirty and needs to be cleaned. The raw materials are soaked with 500% water in normal temperature, 0.5% wetting agent (Ld-600), 0.3% Soda Ash (Na_2CO_3), 0.5% Bactericide (BUSAN 40L) for 4 hours average. The cleaning was done repeatedly until the dirt was visible and water was cleaned.

3.2. LIMING

With 500 % water at normal temperature, 0.3% wetting agent (LD-600), 10% Lime (in 2 installments)-at first 5% lime was added with the other mentioned chemicals for 30 minutes with regular hand howling. Then the 2nd installment of lime 5% was added into the same bowl and regular hand howling was done in every two hours for 15 minute. Then the bowl is kept for 2 days. The

following day the liquor was drained. The bath was kept for re-liming.

2.3. SCUDDING & RE-LIMING

The scudding and fleshing was done by hand on the opposite side of the honeycomb and the surface was rubbed to remove the grease and fat. The pH was checked which was around 12.8. After that the stomach was re-limed for a day with the same bath which was kept in liming process to get to adjust the grain.

2.4. DE-LIMING & BATING

The stomach was de-limed with 80% water at normal temperature, 3% Ammonium Chloride (NH_4Cl) and 0.5% Meta-Bi Sulfate. This process was carried out for 30 minutes and then 0.8% Bate powder was added to the liquor for bating purpose and run for another 40 minutes. Then the cross-section of the stomach is checked with phenolphthalein which gave a colorless effect. This means the stomachs were ready for next operations.

After the phenolphthalein test was done the stomachs were washed with 300% water and 10% Salt (NaCl). The washing was carried out for 30 minutes.

2.5. PICKLING

The pickling process was done with 100% water in normal temperature, 10% salt (NaCl) for 30 minutes. After 30 minutes 0.5% Formic Acid (HCOOH) was diluted with water (1:10 Dilution) and added to the liquor and run for another 30 minutes. After that 1% Sulfuric Acid (H_2SO_4) was also diluted with water (1:20 Dilution) and added to the bath. The diluted sulfuric acid was added in four installments in every 25 minutes. Finally the bath was left overnight.

The following day, one of the stomachs was checked with the Bromo Cresol Green (BCG) which turns into yellow. This indicated that the pickling process was perfectly done. Finally half of the pickled bath was drained.

2.6. TANNING

The process is related to the conversion of putrescible organic material into stable material that resists putrefaction by spoilage bacteria. For this chrome tanning was used.

Chrome tanning was accomplished by adding 8% Basic Chromium powder (2 installments), 0.5% Hypo, 1% Sodium formate, 2% Glutaraldehyde for an hour in the left pickled bath and then 1% OCS, 2% OS, 2% RWP, 2% Syntan A, 1% RF and 2% Potash

Alum were also added to the same bath and kept for 2 hours with regular howling. Then the bath was kept for 8 hours. After that the chrome penetration was checked.

2.7. BASIFICATION

In the same bath 0.2% Preservatives or Fungicide (BUSAN 30L) added and run for 20 minutes. 0.8% Sodium Bi Carbonate (NaHCO_3) was diluted with water (1:20 Dilution) and added to the same bath in four installments in every 15 minutes. Finally the liquor is drained and the crust is piled for few days.

2.8. TRIMMING

Trimming was done by hand knife to remove the unnecessary side parts. Then trimmed stomachs' weight was taken again which was 2.5 kg. Percentage of all the chemicals was based on this weight for the next steps.

2.9. ACID WASH

Acid wash was accomplished by adding 300% water at 45~50°C, 2% Oxalic Acid (HOOC-COOH) and 0.3% wetting agent (LD-600) in a bowl. This wash was continued for 45 minutes.

2.10. RE-CHROMING

The crusts were kept in 200% Water at normal temperature, 0.3% Formic Acid, 2.5% Derugan 3080 (Modified Aldehyde), 6% Basic chrome sulfate, 4% Chrome formate, 1% Chrome stable fat, 2% RWP, 2% Syntan A, 2% RF (Acrylic Copolymer). The process running time was 2 hours. Then 0.8% Sodium Bi Carbonate was diluted with water (1:20 Dilution) and added to the bath in four installments in every 15 minutes. The leather is left overnight and the following day the liquor was drained.

2.11. NEUTRALIZATION

This is important to remove the protein bound acid. With 100% water at 45°C temperature, 3% neutralizing syntan (PAKS), 1% Sodium formate the leathers were howled for an hour. Then 0.8% Sodium Bi Carbonate was diluted with water (1:20 Dilution) and added to the bath in two installments in every 15 minutes. After that the one of the leathers was checked with BCG. The leather turns into greenish blue in BCG. This indicates that the leather was ready for next operation. Finally the liquor bath was drained and rinsed.

2.12. RE-TANNING & FAT LIQUORING

Although re-tanning and fat liquoring generally carried out separately, but as the stomachs weren't as strengthen as outer coverings, the re-tanning and fat liquoring were carried out together. 100% water at 40~50°C, 3% RE and CP, 6% Mimosa and Quebracho, 3% Chestnut, 4% OS, 2% Neosin N, 3% RWP, 4% Basin Tan AN and Syntan SA (Phenol Sulfonic Acid), 2% Derugan 3080, fat (2% Lipsol BSFR, 2% Perfectol HQ, 1% NFO) and 0.25% Preservatives (BUSAN 30L) were added to the bath with the stomach leather. The processing time was 3 hours. After that 2% Formic Acid was diluted with water (1:3 Dilutions) and added to the same bath and kept for another half an hour. And finally the liquor bath is drained and rinsed.

2.13. DYING

150% Water at 40~45°C, 2% Neosin N, 6% Dye, 1% LDW, 0.2% Preservatives were added to the leather in a bowl and run for 2 hours. 3% Formic Acid was diluted with water (1:10 Dilutions) and added to the same bath and kept for another half an hour. And finally the liquor bath is drained and little washed also with water.

Leathers were taken to dry naturally at normal environment. Then the leathers were piled up for proper ageing.

2.14. STAKING & TRIMMING

Staking was performed with staking machine. Trimming was done as required.

2.15. FINISHING

Finally finishing coat was given for required color.



a. Stomach Leather (Omasum)



b. Stomach Leather (Reticulum)



c. Key Ring made from Reticulum Part



d. Cap for kids



e. Unisex Bracelet

3. RESULTS & DISCUSION

In the study three colored leather samples i.e. Black, Brown and Orange were taken for physical and chemical tests and they were marked as Sample-1, Sample-2 and Sample-3 respectively. At first all the samples were conditioned in standard temperature (25±2°C) and relative humidity (65±2%). For physical tests, IUP-6, SLP-6, DIN Method 53331 and SATRA PM-8, SATRA TM-17 (4)(5)(6)(7)(8) methods were followed and for chemical tests IUC-8, IUC-4, IUC-11 SLC-8, SLC-3, SLC-13(9)(10)(11)(12) methods were followed.

Table 1: Average Parallel and Perpendicular Tensile Strength

Observed Sample	Tensile Strength in Omasum (kg/cm ²)	Tensile Strength in Reticulum (kg/cm ²)	Standard Tensile Strength (kg/cm ²)
Sample 1	19	21	100
Sample 2	18	20.8	
Sample 3	18.5	20.8	

Table 2: Average Stitch Tear Strength

Observed Sample	Stitch Tear Strength in Omasum (kg/cm)	Stitch Tear Strength in Omasum (kg/cm)	Standard Stitch Tear Strength (kg/cm)
Sample 1	8	11	60
Sample 2	8.5	10	
Sample 3	8.5	10	

Table 3: Average Tearing Strength

Observed	Tearing	Tearing	Standard
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Sample	Strength in Omasum (kg/cm)	Strength in Omasum (kg/cm)	Tearing Strength (kg/cm)
Sample 1	7	9	30
Sample 2	6	8.5	
Sample 3	7.5	8	

Table 4: Average Color Fastness

Sample	Avg. Gray scale rating in Omasum	Avg. Gray scale rating in Reticulum	Std. Grey Scale Rating
Sample 1	4	4/5	3
Sample 2	4	5	
Sample 3	5	5	

Table 5: Average Shrinkage Temperature

Obs. Sample	Shrinkage Temperature in Omasum (°C)	Shrinkage Temperature in Reticulum (°C)	Std. Value (°C)
Sample 1	98	100	80~100
Sample 2	95	98	
Sample 3	98	100	

Table 5: The amount of Chromic oxide, pH and Fat Content

Obs. Sample	% of Chromic Oxide	pH Value	% of Fat Content
Sample 1	1.98	4.1	11.78
Sample 2	2.19	3.9	13.22
Sample 3	2.62	4.2	13.02

*All the standard values represented here are based on the combination tanned bag leather (below 2 mm thickness).

For physical tests, Table 1, 2 and 3 represents that the obtained results are much below than the standard value although the Table 4 and 5 represents the color fastness and the shrinkage temperature are in between the standard range. Also Table 5 represents the

chemical tests taken. No separate tests were taken for omasum and reticulum. The P^H value is good, the percentage of chromic oxide in between 1.98~2.62 and also the fat content is in between 11.78~13.22. To withstand the boil test, at least 2.5% chromic oxide must be present. So, it can be said that only sample 3 has the sufficient chromic oxide. Furthermore, all the leathers have sufficient fat content as the standard value is 3~12% for bag upper leather.

4. CONCLUSION

Most of the sheep slaughtered here in Bangladesh during the period of EID UL ADHA and for consuming meat. A vast number of sheep stomachs can be collected in that period. But unawareness makes them unusable. Proper knowledge, production and commitment can transfer the potential into a new leather park of trendy fashion accessories. Generally this membrane (byproduct of slaughterhouse) is either incorporated into poultry feed or thrown away as solid waste which creates pollution. So this could also help in resolving the pollution problem by reducing the solid wastes and improve the economic growth. This alternative raw material supply has been transformed into desirable, cheap and modern leather in this research. The reticulum portion is more appealing and heavier than the other (omasum) section of the stomach, so that we can rely on it more by inventing new ways and patterns of production processes.

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