

Manufacturing Of Novelty Leather From Cattle Stomach

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Abstract: The objective of this study was to investigate the feasibility of turning cattle stomach into novelty leather and then leather product which would add value to end of cattle. Four pieces of green buffalo stomachs were taken through soaking, liming, deliming, pickling, tanning, neutralization, retanning, dyeing and fat liquoring operation. Then mechanical operations like drying and staking operations were also done. Some physical (tensile strength, stitch tear strength and colour rub fastness) and chemical (chromic oxide content, fat content and pH) tests were accomplished. The results of physical tests were poor compared to the grain leather as the composition of raw outer coverings of animals and their stomachs are different. The stomach leathers could be used for making coin purse, key case, bracelet, wrist watch belt, ear-ring, necklace, hair band, iPod case etc. as novelty leather product item.

Index Terms: Tensile strength, stitch tear strength, soaking liming, pickling, staking, tanning process, cattle stomach.

1 INTRODUCTION

LEATHER manufactured from the outer coverings (hides and skins) of rare species of animals and other parts of animals that are not normally used for making leather are known as novelty or exotic leather e.g. rabbit skin, leg skin, cattle stomach skin, lizard skin, tiger skin, deer skin, crocodile and alligator skin etc. novelty leathers are processed almost same manner as cattle hide but because of their unique fiber structure, types of uses and having extra ordinary lucrative grain surface, they have to give some special treatments. There are four compartments of a cow stomach. These are the abomasums, omasum, rumen and reticulum. The abomasum is the main diction and absorption compartment of the stomach. Rumen, the bulk of the cow's stomach, constantly mixes, turns and digests the food. The inside of the rumen is lined with fingerlike structure called papilla. The papilla helps to increase digestion by moving the food around inside the rumen. The omasum is made up of many folds. It does much of the digestion and takes a log of the water out of the food. The reticulum looks like a honeycomb^[2]. The reticulorumen represents the first chamber in the alimentary canal of ruminant animals^[3].

It is formed of the rumen and reticulum. The reticulum differs from the rumen regarding to the texture of its lining. The rumen wall is covered in small finger-like projections called papillae, which are flattened, approximately 0.5 cm in length and 0.3cm wide in cattle. The reticulum is lined with ridges that form a hexagonal honeycomb pattern. The ridges are approximately 0.1-0.2mm wide and are raised 0.5 cm above the reticulum wall. The hexagons in the reticulum are approximately 2-5 cm wide in cattle. Despite the differences in the texture of the lining of the two parts of the reticulorumen, it represents one functional space^[4]. The Omasum and Reticulum part of cow stomach had been processed.

2 MATERIALS AND METHODS

The stomachs were collected from Hazaribagh located in Dhaka and the chemicals used for leather processing were of commercial grade.

3 PRODUCTION OF NOVELTY LEATHER FROM OMASUM PART OF STOMACH

3.1 Cleaning

With 400% water at normal temperature and 0.5% wetting agent, the stomachs were washed thoroughly and drained. The cleaning was done repeatedly until the dirt was visible and the water was cleaned.

3.2 Liming

Stomachs were treated with 200% water at normal temperature and 8% lime (in two installments) for 24 hours and hand houlung was done for 15(' represents minute) for every two hours. pH was 13. The next day liquor was drained and hand scudding was done on the opposite of the honeycomb side and rubbing was done to pull up the grease on the surface as much as possible. The cleaning was done with water.

3.3 Reliming 1

Omasum was treated with 200% water and 6% lime(in two installments) for 6 hours. Hand houlung was done in every 2 hours for 15'. Then 0.2% masking agent (NaOH) solubilized with some water was mixed to the liquor in three installments within 45' and houlung was continued.

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3.4 Reliming 2

Reliming 2 was done same as Reliming 1.

3.5 Deliming

150% water at normal temperature and 2% ammonium sulphate were added with stomach and hand houlung was done for 1 hour. Cross section was checked by phenolphthalein (colorless). Then washing was done for 10.

3.6 Pickling

Pickling of stomach was accomplished with mixtures of 150% water, 10% NaCl, 0.8% formic acid 1% sulphuric acid and houlung was done for 2 hours. [Formic and sulfuric acid should be diluted in (1: 10) solution and added in three installments]. Checked pH was 3.0.

3.7 Chrome tanning

This step was done in the same bath of pickling. 3.5% Basic chromium sulphate was added and run for 60'. Again 3.5% Basic chromium sulphate was added and run for 60'. 0.25% fungicide was mixed and run for 10'.

3.8 Basification

In the same bath 2% Sodium bicarbonate (1:10 solution) was added in three equal installments and run for 30', 30', 60' respectively. Checked pH was 3.7. Then the liquor was drained and piled up for 4 days. Now all the bunches of the part was cut into single pieces and their weight was taken for the chemical measurement of the next steps.

3.9 Acid wash

Basified leather was treated with 100% water and 0.5% acetic acid for 30'. Checked pH was 3.2. The liquor was drained and rinsed.

3.10 Rechroming

Rechroming was done with 150% water, 0.5% acetic acid and 3% basic chromium sulfate for 60'. Again 3% basic chromium sulfate was added and run for 60'.

3.11 Basification

In the same bath 2% sodium bicarbonate (1:10 solution) was added in 3 equal installments and run for 30', 30' and 60' respectively. Liquor was drained and leather was piled for 4 days. [If the leather feels to be over dried, then wet- back is needed, otherwise we can go straightly for neutralization.]

3.12 Wet back

150% water was added with leather and houlung was done for 50'. Then 0.5% wetting agent (LD 600) and 1% sodium formate was added to the leather and houlung was done for 30'.

3.13 Neutralisation

Leather was treated with 150% water and 1.5% neutralizing syntan (Neosyn BS 3) and run for 180'. Then 0.5% sodium bicarbonate (1:10 solution) was added in two installments and run for 60'. Checked pH was 4.9. The liquor was drained.

3.14 Retanning and Dyeing

150% water at 45°C, 0.2% Relugan RE (Acrylic Resin Syntan), 3% Tanigon OS (Replacement Syntan) was added with leather and run for 60'. Then 3% Baysyntan (AN) was added and run for 30'. Again 3% Paramel P 100 (Resin Syntan), 2% Mimosa

was added with leather and run for 30'. Leather was then treated with 3% Dye and run for 60'. Penetration of chemicals was checked and left overnight.

3.15 Fatliquoring

50% water at 55°C, 4% synthetic oil (Remsol B40), 4% semi-synthetic oil SLP, 1% sulphited oil blend (Trisul ML) and 2% preservative was added with leather and run for 60'. All fats were emulsified well in hot water at around 60-70°C. Then 2% Relugan RE was added and run 30'. 0.5% aldehyde tanning agent (Relugan GTW) was added and run for 30'. Finally 1.5% formic acid (1:10 solution) was added in two installments (30'+20') and run 45' more. Then the liquor was drained and leather was washed well.

3.16 Drying

Leathers were taken to dry naturally at normal environment. Then these were nailed with sufficient tension on clean wooden board to get increased area.

3.17 Staking

Staking was done by pulling with two hands to soften the leather.

3.18 Trimming

The extra parts at the border were trimmed (if necessary).

4 PRODUCTION OF NOVELTY LEATHER FROM RETICULUM PART OF STOMACH

3 Pieces of green reticulum part of stomach were taken whose weight was = 3.9 Kg. The percentages of chemicals were based on this weight.

4.1 Cleaning

Stomachs were treated with 400% water and 0.5% wetting agent (LD 600). Houlung was done for 30'. Then intensive washing was accomplished repeatedly until the washed water was clean. Then the reticulums were put in 4% NaCl solution for 1 hour and then in normal water for 2 hours.

4.2 Liming

Reticulums were treated with 200% water and 10% lime (in two installments) and kept for 48 hours with regular hand houlung in every hour for 15'. Checked pH was 13.00. Then the water was drained and the reticulums were scudded by hand on the muscle side and rubbed on honeycomb side to pull up the grease on the surface as much as possible. Then cleaning was done with normal water. The weight of limed was taken 2.0 Kg. The percentage (%) of chemical of the following processes was based on this weight.

4.3 Reliming 1

200% water and 8% lime (in two installments) was used with reticulum and kept for 6 hours on regular hand houlung in every two hours for 15'. Then 0.2% masking agent (NaOH) solubilized with some water was mixed to the liquor by dropping in three installments within 45'.

4.4 Reliming 2

The above liquor was drained and the reticulums were washed well. With them 200% water and 6% lime (in two installments) were added and kept for 6 hours on regular hand houlung in every two hours for 15'. Then 0.2% NaOH solubilised with

some water was mixed to the liquor in three installments by dropping in three installments within 45'.

4.5 Deliming

Reticulums were treated with 150% water and 2% ammonium sulphate and hand houlung was done for 1 hour. Checked cross section of reticulum by phenolphthalein was colourless. The washing was done for 10'.

4.6 Pickling

Pickling of stomach was done with mixtures of 150% water, 10% NaCl, 0.8% formic acid 1% sulphuric acid and houlung was done for 2 hours. [Formic and sulfuric acid should be diluted in (1: 10) solution and mixed in three installments]. Checked pH was 3.0.

4.7 Chrome Tanning

In the pickle bath 3.5% basic chromium sulphate (BCS) was added and houlung was done for 60'. Again 3.5% (BCS) was added and agitation was done for 60'. Fungicide (0.25%) was added and run for 10'.

4.8 Basification

In the same bath, 1.5% Sodium bicarbonate (1:10) solution was added in three installments and run for 30', 30' and 60' respectively. Again in the same bath 1.5% Sodium bicarbonate (1:10 solution) was added with leather (in two installments) and run for 60'. Checked pH was 3.8. Then the leather was piled up for 5 days.

4.9 Trimming

Trimming of leather was done by hand knife and then weight was taken for the 3 reticulum part individually. All the chemicals needed for the next step was based on this weight.

4.10 Acid wash

Leather was treated with 100% water and 0.55% acetic acid and run for 60'. Checked pH was 3.2. The water was drained and leather was rinsed.

4.11 Rechroming

150% water, 0.5% acetic acid and 3% basic chromium sulphate was added and run for 60'. Then again 3% basic chromium sulphate was added and run for 60'.

4.12 Neutralisation

150% water at normal temperature, 1.5% Neutralising syntan (Neosyn BS3) was added and run for 60'. Then 0.5% sodium bicarbonate (1:10) solution was added and run for 60'. The checked pH was 4.9. Now three pieces of reticulum parts were separated and the subsequent chemical processes were carried out in three separate buckets for dyeing with three different dyes (colours).

4.13 Retanning and Dyeing

Leather was treated with 150% water at 45°, 0.2% Relugan RE and 3% Tanigon OS and run for 60'. Then 3% Baysyntan AN (Non bleaching syntan) was added and run for 30'. Again 3% Paramel P-100, 2% Quebracho was added and run for 30'. Then 3% Dye was added and run for 60'. Penetration of dye was checked and left for overnight.

4.14 Fatliquoring

The leather was treated with 50% water at 55°C, 4% synthetic oil (Remsol B-40) and 4% semi-synthetic oil SLP was added and run for 60'. Then 1% sulphated oil blend Trisol ML, 0.2% preservative and 2% Relugan RE was added and run for 30'. Then 0.5% Aldehyde Tanning Agent (Relugan GTW) was mixed and run for 30'. Then 1.5% formic acid (1:10 solution) was added in two installments and run for 50' (30'+20'). The liquor was drained and leather was washed and piled up for next day.

4.15 Drying

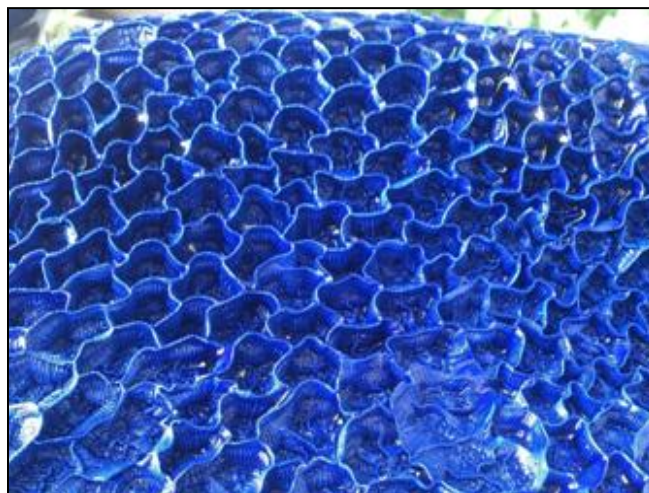
Leathers were taken to dry naturally at normal environment. Then these were nailed with sufficient tension on clean wooden board to get increased area.

4.16 Staking

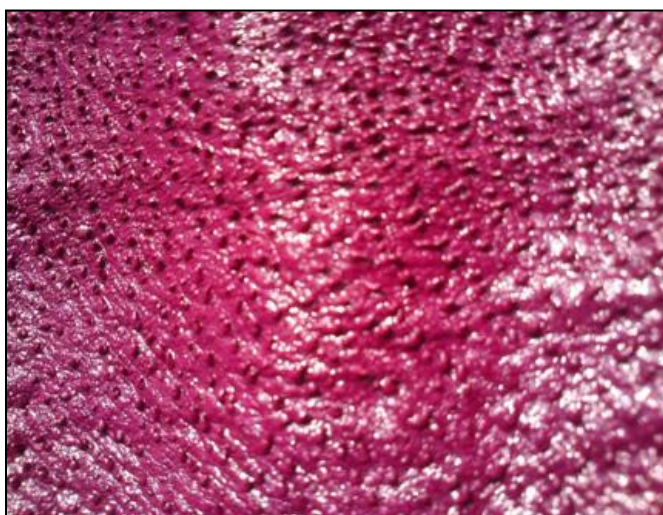
Staking was performed with staking machine.

4.17 Trimming

The leather was trimmed (if necessary).



a. stomach leather (Reticulum part)



b. stomach leather (Omasum part)



c. stomach leather(Omasum Part)



d. Wrist watch belt with reticulam part stomach leather

5 RESULTS AND DISCUSSION

Specimens were conditioned at 20°C and 65% RH for 2 hours. Mechanical properties such as Tensile Strength, Stitch Tear Strength and Colour Rub Fastness were examined as per the standard procedure [5,6,7]. The chemical tests (Chromic oxide content, fat content and pH) of specimen were carried out as per the standard procedure [8,9,10,11]. The results of physical and chemical tests of Omasum part had been reported in the following Table 1 and 2 respectively. And the results of same kinds of Reticulum part were shown in the Table 3 and 4 respectively

TABLE 1

Sample ID	Average(parallel & perpendicular) Tensile Strength(kg/cm ²)		Stitch Tear Strength(kg/cm)		Colour Rub Fastness (dry) After 50 cycles	
	For Sample	Standard value(Min) for bag upper grain leather ^[12]	For Sample	Standard value(Min) for bag upper grain leather ^[12]	For Sample	Standard value(Min) for bag upper grain leather ^[12]
Sample No. 1	50.5	100	23	30	3	
Sample No. 2	48.0	100	22	30	3	Min. rating 3
Sample No. 3	35.0	100	21	30	3	

TABLE 2

Sample ID	Chromic Oxide content (%)		Fat content (%)		pH	
	For sample	Standard value ^[12]	For sample	Standard value ^[12]	For sample	Standard value ^[12]
Sample No1	4.7		6.7		3.6	
Sample No2	4.2	Min. 0.8	7.2	3-12	4.0	Min. 3.5
Sample No3	3.7		6.9		4.2	

TABLE 3

Sample ID	Average(parallel & perpendicular) Tensile Strength(kg/cm ²)		Stitch Tear Strength(kg/cm)		Colour Rub Fastness (dry) After 50 cycles	
	For Sample	Standard value(Min) for bag upper grain leather	For Sample	Standard value(Min)for bag upper grain leather	For Sample	Standard value(Min) for bag upper grain leather
Sample No.1	51.9		37		3	
Sample No.2	45.6		36		3	
Sample No.3	42	100	41.2	30	3	Min. rating 3
Sample No.4	55.5		40		3	
Sample No.5	52		37.5		3	

Table 4

Sample ID	Chromic Oxide(%)content		Fat content (%)		p ^H	
	For sample	Standard value	For sample	Standard value	For sample	Standard value
Sample 1	4.2		10.2		4.5	
Sample 2	5.3		12.0		3.9	
Sample 3	4.8	Min. 2.5	12.8	5-11	3.6	Min. 3.5
Sample 4	4.2		9.0		4.0	
Sample 5	4.0		8.0		4.6	

*All the standard values represent the combination tanned bag leather (below 2 mm thickness).

Table 1 showed that the results of physical tests of samples are much lower than the standard values, because the composition of raw stomachs (Omasum) were not same as the raw hide. But Table 2 showed that chemical test reports met the standard values. From the above Table 3 it was observed

that the physical test values of sample were lower than the standard values due to the variation of composition in raw stomachs (Reticulum) and raw hides. But Table 4 showed that reports of physical tests satisfied the standard values.

6 CONCLUSION

As a Muslim country during the Festival of Eid-UI-Azha, most of the cattle are slaughtered for meat in Bangladesh. So there is possibility to get the source of raw material to manufacture exotic leather from stomach. Novelty leathers had been produced from the internal membrane of buffalo. Generally this membrane (byproduct of slaughterhouse) is either incorporated into poultry feed or thrown away as solid waste which creates pollution. So, if we could make this membrane as leather and then leather products (fancy hand bags, purses etc.), there is a bright prospect to meet the local demand as well as to earn the foreign exchange.

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