ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 07, pp. 5156-5160, July, 2019

DOI: https://doi.org/10.24941/ijcr.35767.07.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

MANUFACTURING OF NOVELTY LEATHER FROM GOAT STOMACH

***Md. Farhad Ali, Adiba Farah, Umme Habiba Bodrun Naher and Kawsar Akhtar**

Institute of Leather Engineering and Technology, University of Dhaka, Dhaka-1209, Bangladesh

ARTICLE INFO

Article History:
Received 03rd April, 2019
Received in revised form
26th May, 2019
Accepted 08th June, 2019
Published online 25th July, 2019

Key Words:

Tensile strength,
Stitch tear strength,
Goat stomach, Fat content.

**Corresponding author:*
Md. Farhad Ali

ABSTRACT

This paper aims to study the viability of converting a putrescible goat stomach into novelty leather in order to produce small leather goods adding value to the waste of goat. In this study, eight pieces of goat stomach were taken which were turned into leather through the stages done in general leather processing such as soaking, liming, de-liming, bating, pickling, tanning, dyeing, finishing etc. After that some physical (tensile strength, stitch tear strength, tearing strength and colour rub fastness) and chemical tests (chromic oxide content, fat content and pH) were performed. Comparing the results of physical tests with the grain leather of goat it has been found that the goat stomach leather has poorer strength due to the different composition of raw hides or skin and the stomach of animals. The results of different chemical tests revealed that pH and fat content (%) were good enough compared to standard value but chromic oxide content (%) was lower than the standard value. However, the goat stomach leather can be used as novelty leather to manufacture fancy leather products, key ring, hair clip, bracelet, watch belt, purse etc.

***Citation: Md. Farhad Ali, Adiba Farah, Umme Habiba Bodrun Naher and Kawsar Akhtar,* 2019.** "Manufacturing of novelty leather from goat stomach", *International Journal of Current Research*, 11, (07), 5156-5160.

INTRODUCTION

Exotic or novelty leather is distinctly different leather which are produced from hides or skins of wild or rare animals (alligator skin, lizard skin, chicken skin, snake skin) or from other parts of domestic animals that usually not used or regarded as waste (cow stomach, goat stomach) (Naher *et al.,* 2015). For the past many years the domestic novelty leather industry in Bangladesh has been in danger of existence due to unavailability of proper raw materials. Because of strict animal law and enforcement all types of animals hides and skins cannot be used for manufacturing exotic leathers or novelty leathers. In this case, cattle or goat stomach can be utilized as cheap and available raw materials in making novelty leather. Cattle stomach can be converted to novelty leather and similarly in this study it has been tried to manufacture novelty leather from goat stomach. Although this kind of leather is manufactured from stomach in the same process as used for cattle hide leather, due to having unique fibre structure and composition some extra treatments have to be taken. The four main chambers of goat stomach are the rumen, reticulum, omasum and abomasum. Food mainly passes first into the rumen, then reticulum, omasum and finally into abomasums. The rumen is the largest chamber of goat stomach functioning as storage part which helps in microbial fermentation of food. The mucosa of the rumen can be different regionally, but forms variably having leaf-like papillae. The rumen does not contain a muscularis mucosa and its non-glandular mucosa is composed of keratinizing stratified squamous epithelium (Jennings and Premanandan, 2017). Reticulum which is also known as hardware stomach has a honeycomb type structure and is located just below the entrance of the oesophagus into the stomach. The reticulum is part of the rumen separated only by an overflow connection, the "rumino-reticular fold". This reticular honey comb appearance is found from the reticular epithelium that is thrown into folds that make polygonal cells. The capacity of the reticulum of goats is from 0.25 to 0.50 gallons (animalcorner.co.uk). Omasum also known as 'manyplies' consist of many folds on layers of tissue that grind up food ingesta and remove some of the water from feed. The inside of the omasum has ample longitudinal folds which are finely packed with finely ground ingesta. The capacity of goat omasum is approximately 0.25 gallons (theodysseyonline. com). Abomasum is often considered the true stomach of ruminant animals. It functions similarly to human stomachs. The mucosa of the fundus contains parietal cells, which secrete hydrochloric acid, and chief cells, which secrete the enzyme pepsin. Pepsin is responsible for breaking down feed proteins before they enter the small intestine. The pylorus, which is the terminal portion of the abomasum, is characterized by secretions that are largely mucous. The capacity of the abomasum of goats is approximately 1 gallon (Correa, 2016). Different kinds of feasible small products and articles can be made from goat stomach leather. These products can be proved as helpful in boosting the economical growth of our country through selling them in the local and global market through export. We can attain small articles from goat stomach such as key ring, coin purse, bracelet, wrist watch belt, ornaments,

luggage tag, mobile case, pen cover, hair band, show pieces etc.

MATERIALS AND METHODS

Eight pieces of goat stomachs (not salted) were collected from Hazaribagh market located in Dhaka, Bangladesh. Total weight of these pieces of stomach was 4.5 kilograms. The percentages of all the chemicals were measured based on this weight.

Operations for the production of novelty leather from raw goat stomach: The followings are the stages that were carried out in manufacturing of the leather from goat stomach.

Presoaking/Cleaning: The stomachs were kept in the bucket with 300% water at normal temperature, 0.25% wetting agent, 0.5% soda ash, 6% salt (NaCl) to wash thoroughly and then drained. After that the washing and cleaning was repeatedly done with hand for several times until all the dirt are removed and the stomachs and water look clean.

Liming: With 300 % water at normal temperature, 0.25% wetting agent (LD 600), 0.5% Soda ash, 8% lime (in 2 installments), 0.5% lime auxiliary the stomachs were treated. At first 4% lime (1st installment) was added with the other mentioned chemicals for 30 minutes with regular hand howling. Then the 2nd installment of lime (4%) was added into the same bucket and regular hand howling was done in every two hours for 15 minute. The next day the liqour was drained. Then the scudding was done on the opposite side of the honeycomb and the surface was rubbed to remove the grease and fat. The pH was checked which was 13.

Reliming: The limed stomach was immersed in 200% water at normal temperature in which 4% lime, 0.5% soda ash and 2.5% degreasing agent were mixed and run for 6 hours with regular hand howling in every 2 hours for 15 minute.

Deliming and bating: With 100% water at normal temperature, 4% ammonium chloride (NH_4Cl), 0.5% meta-bisulphate the stomach parts were immersed in a bucket and hand howling was run for 60 minutes. Then 0.5% bate powder and 0.5% degreasing agent were added to the liqour. The cross section of the delimed stomach was checked by phenolphthalein (colorless) and then the liqour was drained and again washed well for 10 minutes.

Pickling: The reticulum and omasum parts of stomach were treated with 150% water, 10% NaCl, 1% Formic acid (1:10 dilute solution) and 1% Sulphuric acid (1:10 dilute solution) for 2 hours in total. Sulphuric acid and formic acid were added in two installments. 0.5% was added carefully as 1st installment and run for 30 minutes. Again 0.5% is added and run for another 30 minutes. After that 0.5% Potash Alum and 0.5% Hypo were added to the mixture and run for 60 minutes. The pH was checked and it was below 2.9. The stomachs were left in the bath for overnight.

Chrome Tanning: Next day in the same bath chrome tanning was done and at first the half of the pickle bath was drained. 4% Chrome powder was mixed to the bath and run for 60 minutes. Then again 4% Chrome powder was added and run for 30 minute. After that 1% Sodium formate and 1% Ramsol OCS were mixed into the bath and agitation was done for 60 minutes. Adding 0.5% Tan Base (Magnesium Oxide) the howling was run for 8 hours and then the penetration was checked.

Basification: In the same bath, 1.5% Sodium-bi-Carbonate (1:10 dilute solution) was added and run in 3 installments each for 30 minutes. Then 0.2% Preservative (Bushan 30L) was added and run for 15 minutes. Checked pH was near 3.6. The liqour was drained and the stomachs were piled up for 3 days.

Trimming: Trimming was done by hand knife to remove the unnecessary side parts. Then trimmed stomachs' weight was taken again which was 3 kg (Percentage of all the chemicals were based on this weight for the next steps).

Acid wash: The trimmed stomach was immersed in 100% water at normal temperature with 1% Oxalic acid and run 30 minutes. Checked pH was near 3.2. The bath was drained.

Rechroming: The stomachs were kept in 150% water in which 0.3% Formic Acid, 6% Chrome powder, 4% Chrome Syntan, 1% Sodium Formate, 1% Cationic Fat, 1% Remsol OCS were mixed and the bath was run for 1 hour and 20 minutes (Chrome powder was added in two installments). After that 2% Gluteraldyhyde, 1.5% Relugan GTW were added and run for 30 minutes.

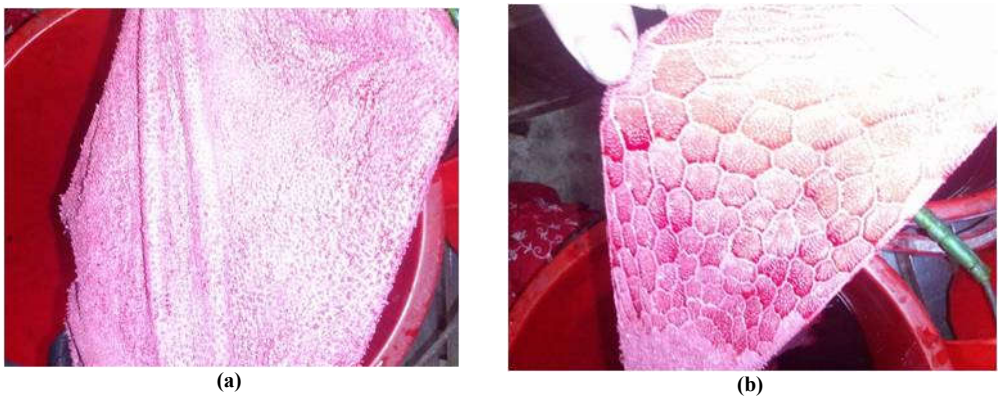
Basification: In the rechromed bath, 1% Sodium -Bi-Carbonate (1:10 dilute solution) was added in three installments and agitation was done for 1 hour. Checked pH was 3.8 and the liquor was drained and the stomachs were piled up for 3 days.

Wet Back: With 150% water, the leather was washed for 1 hour. Then 0.5% wetting agent (LD 600) and 1% sodium formate was added to the stomach and howling was done for 30 minutes.

Neutralization: With 200% water at normal temperature, 2% sodium formate, 2% Neosyn BS3 (Neutralizing syntan) the stomachs were howled for 60 minutes. Then 0.5% $NaHCO_3$ (1:10 dilute solution), 1% Remsol C2 were added and run 1 hour. The checked pH was 5.3. Now the 8 stomachs were separated in three different bowls for dyeing. 4 stomachs were in one bowl and other fours in 2 separate bowls. So, all the subsequent chemical processes were carried out in three separate bowls.

Retanning and dyeing: The neutralized stomach was treated with 200% water at 45□ C temperature, 2% Paramel PA, 1% Ramsol C2, 2% DLE, 2% Neosyn RWP, 2% Tannigan OS and agitated for 30 minutes. Then 6% Mimosa and 2% Neosyn N were mixed and run 45 minutes. After that 4% dye was added and run for 1 hour. The penetration of dye was checked. The liquor was drained and the stomachs were piled up for overnight. The dyeing is shown in Figure 1and 2.

Fatliqouring: After dyeing the omasum and reticulum part of stomach leather were treated with 100% Water at 55□ C, 4% Ramsol B40 (synthetic oil), 4% Ramsol C2, 2% Trisul ML (Fish oil), 2% LLSAF, 0.5% Synthol O and run for 1 hour, then 1% gluteraldehyde added and run for 20 minutes. Again 0.5% MSG and 2% preservative (Bushan 30L).Then 1.5% formic acid (1:10 dilute solution) was added in two installments (30 minutes + 20 minutes) and again then 45 minutes more. Then the liquor was drained and the stomachs were washed well.



(a) (b)

Figure 1: Dyeing of goat stomach (a) omasum part and (b) reticulum part with cherry-red colored dye

a b

Figure 2: Dyeing of goat stomach (a) reticulum part and (b) omasum part with blue colored dye

(a) (b) (c)

Figure 3: (a) Key ring (b)wrist watch belt and (c) hair clip made from goat stomach novelty leather

Nail Drying: For goat stomachs nail drying is more preferable to get an increase and even area. The stomachs were nailed on a wooden board under the scorching sun with the grain side open to the air and the flesh side in contact with the wooden board for almost 4 hours.

Staking: Because of the delicate and fragile structure of the stomachs hand staking was done to soften the leather.

Finishing: Finishing coat was given for cherry red, scarlet and blue color to the stomach leather.

RESULTS AND DISCUSSION

In this study three samples of blue, cherry red and scarlet color had been taken which were marked as sample-1, sample-2 and sample-3 respectively. The samples were conditioned at 20^0 C temperatures and 65% relative humidity for 48 hours. After that some physical and chemical tests had been performed for omasum and reticulum part of the stomach converted to novelty leather. For examining some mechanical properties such as tensile strength, stitch tear strength and color rub fastness the standard methods were followed (IUP/6, SLP 6, 1996, DIN Method 53331 and SATRA PM-8). Similarly, chemical tests were performed as per standard method (IUC/ 8, SLC 8, IUC4, SLC 4 and IUC/ 11, SLC 13, 1996). The leather has been used to make key ring, wrist watch belt and hair clip illustated in Figure 3. Standard value of tensile strength for combination/tanned bag/upper leather is 100 kg/cm^2 (below 2 mm thickness) (Sasanka Sekhar Dutta, 1990). The observed result of goat stomach for tensile strength for both reticulum and omasum was much lower than the standard value shown in Table 1. So, this leather could be used for making light products like ornaments or key rings. Standard value of stitch tearing strength for combination/tanned bag/upper leather is 30 kg/cm

Table 1. Results of tensile strength

Observation Number	Omasum	Reticulum
	Average Tensile Strength (kg/cm^2)	Average Tensile Strength (kg/cm^2)
Sample-1 (Blue)	19.13	24.57
Sample-2 (Cherry red)	18.52	22.21
Sample-3(Scarlet)	16.21	18.19

Table 2: Result of stitch tear strength of the leather

	Omasum part	Reticulum part
No	Average Stitch Tear Strength (Kg/cm^2)	Average Stitch Tear Strength (kg/Cm^2)
Sample-1	16.21	17.53
Sample-2	15.33	16.91
Sample-3	11.75	13.45

Table 3. Result of Tearing Strength

	Omasum part	Reticulum part
No	Average Tearing Strength (Kg/Cm)	Average Tearing Strength (Kg/Cm)
Sample-1	13.53	19.83
Sample-2	12.21	18.95
Sample-3	9.61	14.35

Table 4. Result for dry color rub fastness test for blue sample

		Omasum		Reticulum	
Sample (Blue)	No of revolution	Gray scale rating Color change on leather	Gray scale rating Staining on felt	Gray scale rating Color change on leather	Gray scale rating Staining on felt
1	64	4/5	4	4/5	4/5
2	128	4	4	4/5	4/5
3	256	4	3 /4	4/5	4
4	512	3 /4	3 /4	4	4
5	1024	3	3	3/4	3

Table 5. The amount of chromic oxide, pH value and fat content in stomach leather

Sample No	Observed chromic oxide content	pH value	Observed fat content
Sample 1 (Blue)	1.53%	4.5	9.53%
Sample 2 (Cherry red)	1.93%	4.2	13.24%
Sample 3 (Scarlet)	1.81%	4.7	14.12%

(below 2 mm thickness) (Sasanka Sekhar Dutta, 1990) which was much greater than the observed result of the sample shown in Table 2. Similarly the observed value shown in table 3 was lower than the standard value for the tearing strength which is 30 kg/cm (Sasanka Sekhar Dutta, 1990). That's why the stomach leather could be used for making light products. Standard value for dry rub fastness of fancy leather after 50 cycles and wet rub fastness after 20 cycles is minimum rating 3. In case of both omasum and reticulum part the observed value met the standard value shown in Table 4.

Chemical tests result

As per standard procedure some chemical tests like chromic oxide content (%), fat content(%) and pH were carried out for the 3 samples . No separate tests were done for omasum and reticulum part. The results for chromic oxide, fat content and pH in stomach leather have been given in Table 7, 8 and 9 respectively. To withstand boil test leather must contain 2.5% of chromic oxide which was not met by the three samples (Table 5). Again for bag upper leather standard value of fat content is 3-12%. This value was met by all the three samples (Table 5). And standard pH value of leather is minimum 3.5. All the stomach leather met this pH value (Table 5).

CONCLUSION

Goat stomachs are often considered basically unclean, unnecessary and end up being wasted and discarded because of misinformation and unawareness of people. They sometimes are used as poultry feed creating mass pollution and sometimes people cook them as well. Since goats are slaughtered every year during Eid and meat eating purpose there are plenty of sources of raw materials for producing goat stomach novelty leather. Better understanding, exploitation and contribution of people will develop the skill of converting goat stomach into novelty leather for making fashionable leather products .It will also help in resolving the pollution problem by decreasing the solid wastes and boost the economical state both locally and globally. In this study, this potential source of raw material has been converted into appealing and affordable novelty leather. As the reticulum part looks more attractive and has higher strength than the other part (omasum) of the stomach we can concentrate more on that part by inventing new ways and trends of production process.

ACKNOWLEDGEMENT: The authors would like to give special thanks to Institute of Leather Engineering and Technology, University of Dhaka for providing required facilities for this research work.

REFERENCES

Naher, U.H.B., Ali, M.F., Hasan, M.M., Rahman, M. R., Hasan, M.M. 2015. Manufacturing of Novelty Leather From Cattle Stomach, *Int. J. Sci. Technol. Res.,* 4, 12, 40-44

Ryan Jennings, R., Christopher Premanandan, C., Veterinary Histology, The Ohio State University, Columbus, 2017,116

https://animalcorner.co.uk/goat-anatomy/

https://www.theodysseyonline.com/anatomy-goat

Julio E. Correa, J.E., Digestive Systems of Goats, Alabama A&M University and Auburn University, Alabama cooperative extension system archive UNP-0060, 2016, 2

Measurement of tensile strength and percentage of elongation, IUP/6, SLP 6, Official method of analysis, The Society of Leather Technologists and Chemists, Northampton, 1996

Measurement of Stitch Tear Strength, DIN Method 53331.

Determination of color fastness to rubbing, Shoe and Allied Traders Research Association, SATRA PM-8.

Determination of Chrome content, IUC/ 8, SLC 8, Official method of analysis, The Society of Leather Technologists and Chemists, Northampton, 1996

Determination of substances (fats and other solubles) soluble in Dichloromethane, IUC4, SLC 4, Official method of analysis, The Society of Leather Technologists and Chemists, Northampton, 1996

Determination of pH of hide powder, IUC/ 11, SLC 13, Official method of analysis, The Society of Leather Technologists and Chemists, Northampton, 1996

Sasanka Sekhar Dutta, S. S. "An Introduction to the Principles of Physical Testing of Leather", Indian Leather Technologists' Association, Calcutta, 1990, 184.

****