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Impact of Aluminium Tanning on the Internal Membrane of Bovine Stomach for Novelty Leather

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Internal membrane of bovine stomach is a by-product of slaughter house. Employing masked alum tannage on the delimed and well-bated membranes, they have been converted successfully into cream coloured novelty leather. The leather was found fit to fabricate ladies hand bags, jewellery boxes, wallets, purses etc. The stomach leather was light weight (168-465 g) with adequate percent elongation at break (43.8 - 112. 3% longitudinally and 16 - 110% laterally) and has shrinkage temperature between 73 - 77°C. The tensile strength of the leather (100.6 N/cm^2-423 N/cm^2 longitudinally and 102.9 N/cm^2-405 N/cm^2 laterally) was within the range of light weight fancy leathers. It bears good resistance to repeated flexing (20,000 flexes, dry). Its has moderate resistance to washing in solution of neutral detergents. Thickness of the leather (0.6 - 1.3 mm) is also suitable for making the fancy leather products.

Key words: Novelty leather, Masked alum tannage, Bovine stomach.

Introduction

Internal membranes of stomachs of large animals such as cow, buffalo etc. are either incorporated into poultry feed or discarded as solid waste having practically no application.

Exotic grain chamois leather can be manufactured from the internal membranes of bovine stomachs (Khan 1997). Exotic semi-aniline finished leather can also be manufactured from these membranes (Jafri 1998).

Literature survey however shows that aluminium tanning has not been tried to tan the stomach membranes, though it is less toxic and hence environment friendly tanning.

Work at laboratory scale on the bovine stomach membranes shows that alum tannage of delimed and bated membrane yields a cream coloured fancy leather with villis (finger like projections), pertaining to fullness, softness and nice appearance. This leather was found suitable for making fancy ladies hand bags, wallets, purses etc.

Materials and Methods

The internal membranes of bovine stomachs were collected from a slaughter house. Tensile strength and precent elongation at break of sample were tested as per IUP/6 along the length as well as in lateral position. Shrinkage temperature (Ts) was also noted. Resistance to repeated flexing was determined according to IUP/20. To determine fastness to washing of the leather, IUF/423 was adopted. The pH values were noted according to IUC/11.

Delimed and bated internal membranes of the bovine stomachs were drummed in the following tawing mixture for 90 min at the start, and then 10 min after every 6 h for 40 h. All the following percentage were based on pelt weight of the membranes:

8% white flour, pasted with water (20°C); 2% egg yolk and 2% olive oil emulsified in water (20 °C); 8% sodium chloride; 8% alum dissolved in minimum water by boiling, cooled, basified with sodium carbonate till first turbidity was observed. The solution was masked by addin 3% sodium formate calculated on weight of alum and 100% water (20°C).

The membranes were then piled up overnight. They were hanged the next day for drying. The room temperature was maintained between 35-38°C. After aging for 30 days, the alum tanned membranes were wetted back in a drum as follows:

600% water (20 °C) on dry weight of leather; 2.0 g l^{-1} nonionic detergent; 8.0 g l^{-1} sodium chloride.

Drumming was continued for 1 h. The membranes were then left in the same bath without any movement for the next 48 h in order to wet back them properly. They were then treated in a drum for 2 h in the following mixture. Percentages were based on the drained weight of thoroughly wetted back membranes.

2% white flour, pasted with water; 5% egg yolk and 6% olive oil, emulsified in water (20 °C); 5% salt; 1% alum; 150% water (30 °C).

The membranes were left overnight in the same bath and drummed for 30 min the nest day. Piled up and hanged to air

dry the next morning. Finally the leather was staked, dry drummed for 4 h and restaked.

Results and Discussion

In order to compensate the adverse effects of aluminium tanning such as tightening of fiber structure and hardening of leather; the delimed membranes were thoroughly bated (1.5% pancreatic bate on pelt weight) for 60 min.

Aluminium sulphate $Al_2 (SO_4)_3$; the only tanning material in alum was masked with sodium format to moderate reactivity of the aluminium complex to collagen so that a uniform reaction might progress.

On washing the freshly alum tanned stomach leather with plain water; it was observed that it dried out pelty due to the removal of tanning during washing. However, when the leather was left for aging at room temperature for a period of 30 days and then washed with water; it did not dry out pelty. It shows that the aluminium sulphate was well bound to collagen during aging. The physico-chemical characteristics of the leather have been presented in Table1.

The stomach leather attained cream colour and has satifactory softness after re-egging, milling and staking. But it was found that the degree of softness acquired was less in comparison with the alum tanned leathers: manufactured from coventional sources of leather. It may be due to peculiar fiber structure of the membranes.

Aluminium tanned leather has hydro-thermal stability in the range of 75-85 °C (Bienkiewicz Krysztof 1983). Ts values of the stomach leather given in Table 1 range between 73-77°C which are not very different from the values of alum tanned leather manufactured from conventional sources.

The values of tensile strength and percent elongation at break of leather reported in Table 1 indicate that the alum tanned novelty leather has reasonable degree of strength and stretch both in longitudinal and in lateral positions.

No marked damage of grain was observed during repeated flexing. Only slight wrinkling of grain was observed.

Free acidity is the main cause of damaging the leather fibers. Low pH difference values mentioned in the Table 1 show that the leater does not contain any free strong acid.

Formate and acetate masked aluminium tannins are stable and possess good washable properties (Herfeld, 1990). No stain on woolen or textile cloth was observed after washing the leather in a solution of a neutral detergent. However the colour of the leather was slightly lightened after drying. No appreciable shrinkage in surface area of leather was noted. The moderate fastness to washing was attributed to masked aluminium sulphate used in manufacturing the leather; as ordinary alum tanned leather has poor fastness to washing.

Conclusion

Internal membranes of bovine stomach have been used to manufacture fancy alum tanned leather. The leather was soft and has pronounced villis on grain. It has cream colour with attractive appearance.

Alum tanning is not a new kind of tannage. But studying the impacts of alum tanning on the non-conventional source of leather to produce a novelty leather; suitable for ladies hand bags, wallets, jellwery boxes etc. may be new.

Low cost of raw material and elimination of certain mechanical steps such as fleshing, scudding, splitting, sammying, shaving and buffing considerably reduce the production cost of the stomach leather. It is expected that the leather produced

Table 1

Physico-chemical properties attained by the alum tanned internal membranes of bovine stomachs

Sample No.	Average thickness of leather (mm)	Surface area of leather (sq.ft)	Tensile strength (N/cm^2)		Elongation at break (%)		Ts of leather (°C)	Weight of leather (g)	pH difference value	Resistance to repeated flexing 20,000 dry	Resistance to washing
			Longi tudinal	Lateral	Longi udinal	Lateral					
1	1.3	3.5	365.8	405.0	55.2	16.0	73	194.0	0.2	Good	Moderate
2	0.8	2.9	423.0	305.8	69.5	32.0	77	168.0	0.5	Good	Moderate
3	0.8	4.7	248.6	180.3	112.3	28.7	76	320.0	0.3	Good	Moderate
4	1.1	5.2	256.7	391.8	50.2	36.0	73	330.0	0.2	Good	Moderate
5	0.7	10.8	100.6	138.4	72.0	110.0	77	465.0	0.3	Good	Moderate
6	0.8	4.8	205.8	491.3	43.8	72.9	75	316.0	0.4	Good	Moderate
7	0.6	3.9	180.0	132.4	78.5	36.5	76	217.0	0.3	Good	Moderate
8	0.7	5.6	150.0	102.9	64.7	65.0	76	349.0	0.3	Good	Moderate

will find potential market in Pakistan as the waste has been utilized beneficially in a developing country.

It is evident that the tannage involved in the processing is chrome free which is an added advantage in term of environment.

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