An Investigation on the Properties of Rabbit Leather from Different Tannages

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An Investigation on the Properties of Rabbit Leather from Different Tannages

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ABSTRACT

The non-conventional sources of raw materials, i.e. exotic skins are skins obtained from animals such as crocodiles, alligators, snakes and rabbits. Rabbit farming in Kenya has emerged as a good source of supply of raw materials to the exotic leather industry. However, there lacks detailed knowledge on the structural and physical properties of rabbit leather and specifically from different tannages. The knowledge would be of benefit to tanners in designing their processes as well as leather goods designers in designing products to meet the desired end-use. For this reason, a study was undertaken to analyse the structural and physical properties of the rabbit leather tanned using chrome and mimosa. The skins were collected from a local slaughterhouse and subjected to standard pre-tanning beamhouse processes followed by the respective different tanning processes. Physical properties of the crust leathers from the two tannages were analysed by determining the thickness, shrinkage temperature, tensile strength, tear strength, ball burst and flex endurance in accordance with IUP official methods. The statistical results for the two tannages were analysed using excel. From the study, the average shrinkage temperature of mimosa tanned leather was 83°C and chrome was 100°C. Notably, chrome tanned leather recorded higher tear strength value (37.4 N) than that of mimosa tanned leather (28 N). The other physical parameters were comparable for both tannages. Based on the results both tannages produced leather with physical properties that can be used in production of lining as well as fancy products such as watch strap

Key words: Exotic skins, rabbit skin, tannages.

INTRODCUTION

Exotic leather production refers to the tanning of skins of animals like; crocodiles, alligators, lizards, cobras, pythons, rabbits and fish. The exotic leathers are usually preferred because of their natural patterns, colour and unique structures[1]. The use of exotic skins dates back to the early man. The hunting and the gathering community used skins from reptiles, birds, fish and amphibians for adornments to their clothing or for their head-dresses as well as for covering articles such as drums[2]. The skins were made less resistant to putrefaction by drying, they were made supple by fleshing and applying animal oils. Different animals have different features that provide leather with varying properties and these have resulted to the increased demand of various leather products in the market[1].

The Kenyan leather industry is mainly based on the livestock population which has provided vast growth of the leather industries[3]. Other than the conventional sources of raw material such as cattle, sheep and goat, there exists new emerging supply of raw materials such as donkeys, horses, fish and rabbits[4,5]. According to Ministry of Agriculture, Livestock and Fisheries report (2015), it is estimated that there are at least 600, 000 rabbits[6,7]. The number has increased as a result of the extensive research that has been done on breeding aspects as well as management of the breeding of rabbits[8,9].

Rabbits in Kenya are mainly for meat production[10] and their skin by products from the slaughterhouse[11]. The skins are disposed and there has been a challenge to dispose them[12]. Rabbit skins in Kenya are being considered as a new source of raw materials for leather production[13]. Despite this, their application in leather production has not been fully exploited[12]. Knowledge of the physical properties of rabbit leather could be a welcome boost to their use. This study aimed at understanding the physical properties of chrome and mimosa tanned rabbit leather.

EXPERIMENTAL PROCEDURE

Materials

30 pieces of wet salted rabbit skins were obtained from a local rabbit slaughterhouse. Commercial tannery grade chemicals were purchased from Pryann Enterprise (Kenya).

Beamhouse processes

The pre-tanning processes were carried out as presented in Table 1

Table 1
Process for pre-tanning of the rabbit skins

Process	Chemicals	Percentage	Time duration	Remarks

Soaking	Water Wetting agent Soaking enzyme	300% 1% 1%	2 hrs.	3times
Fleshing				
Paste Liming and Hair save Unhairing	Water Lime Sodium sulphide	20% 8-10% 1.5-2%		Piled overnight. Next-day emove the hair by knife
Re-liming	Water Lime Sodium sulphide	200% 5% 0.5%	4 hr.	pH≥ 12.0
De-liming	Water Ammonium Sulphate	150% 2%	1 hr.	Clear to phenolphthalein pH 8.0-8.2
Bating	Water Bate	100% 1%	1 hr.	pH 8-8.5 Drain, wash and drain
Degreasing	Water Degreasing agent	200% 4%	1 hr.	Drain, wash and drain

Tanning

After the pre-tanning processes the skins were separated into three groups which were subjected to different tannages as in tables 2 and 3.

Table 2
Chrome Tannage

Pickling	Water Salt Formic acid Sulphuric acid	100% 8% 1% 1.5%	20min 2*10 + 30 3*10+ 30,	Check pH 2.8-3.2
Tanning	Basic chromium sulphate	5%	2hrs	
Add	Basic chromium sulphate	3%	Leave overnight	
Basification	Sodium formate Sodium bicarbonate	2% 2%	45 1hr.	pH 3.8-4.0 Drain, wash and drain
Drain, wash and drain Leave overnight for aging				
Neutralization	Water Sodium bicarbonate	100% 2%	1hr.	pH 4.8-5.0
Re-tanning, Dyeing and Fatliquoring	Water Re-tanning Syntans Dye Fatliquor Add Formic acid	100% 8% 3% 3% 1%	1 hr. 1 hr. 1 hr. 30 min 30 min	pH 3.5-4.2 Drain wash and Drain
pile it, hooking to drying, stacking, mollisa, buffing and dry drumming if necessary				

Table 3
Mimosa tannage

Tanning – Vegetable Tanning	Water Mimosa	100% 5%	5 hrs.	
Add	Mimosa Formic acid	5% 1%	5hrs / leave overnight 1hr.	pH4.6 pH 3.5
Drain, wash and drain Leave overnight for aging				
Re-tanning Dyeing and Fatliquoring	Water Re-tanning Syntans Dye red Fatliquor Formic acid Formic acid	100% 8% 3% 3% 0.5% 0.5%	1 hr. 1 hr. 1 hr. 30 min 30 min	pH 3.5 Drain wash Drain
pile it, hooking to drying and dry drumming				

PHYSICAL TESTING

Sampling and sample preparation

The leathers were sampled in accordance with the official method IUP 2, (2001). The samples were cut in triplicate both in parallel and perpendicular direction for the belly and butt region. The samples were then conditioned at a standard atmosphere of temperature 25±2°C and relative humidity of 65%±2% for at least 48 hours and this was done in accordance with IUP 3, (2001).

Analysis of physical properties

The physical properties of the leather analysed were: Shrinkage temperature; IUP 16, (2001), Thickness; IUP 4, (2001), Tensile strength; IUP 6, (2001), Tear strength; IUP 8, (2001), Distension and strength of the grain measurement; IUP 9, (2001), Flex resistance measurement IUP 20, (2001).

RESULTS AND DISCUSSION

1. Shrinkage temperature

Fig. 1 shows the hydrothermal stability of the rabbit leather from different tannages for both the belly and backbone region. Shrinkage temperature is parameter used to determine the resistance of the leather to wet heat [14]. It gives the characteristic thermal stability of leather and this is usually indicated by the point at which the leather shrinks over the heating media [15].The higher the shrinkage temperature the higher the number the number of crosslinks that have been formed between the tanning agent and the pelt [16]. .

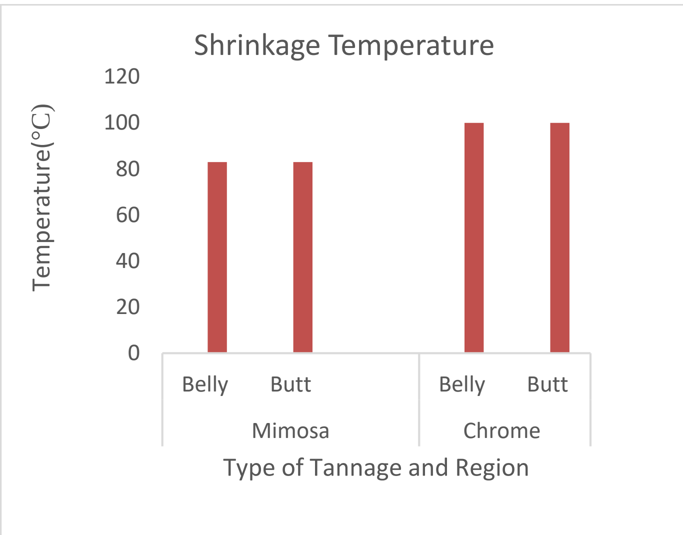
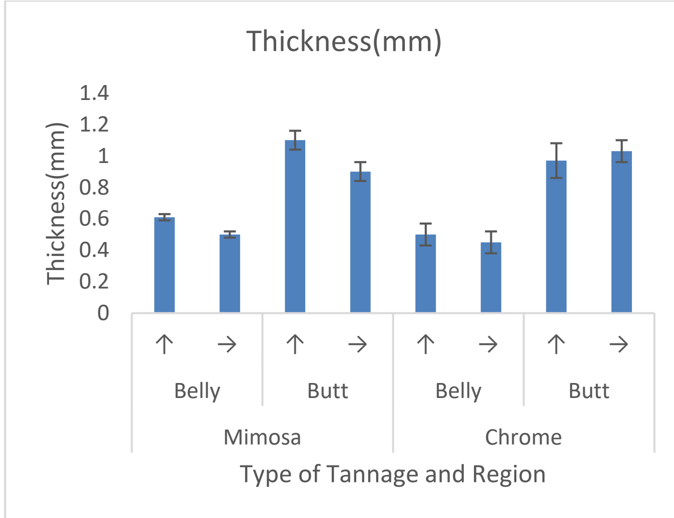


Figure 1: Shrinkage Temperature results

From the results, chrome tanned leather had the highest shrinkage temperature of 100°C both at the belly and the butt region. Mimosa tanned leather had a shrinkage temperature of 83°C and this agreed with other studies[16]. There was no observable difference in shrinkage temperatures in either parallel or perpendicular direction. From literature, we note that chrome tanning imparts more stabilization as it forms strong crosslinks with the collagen fibres than any other tannage[17]. High stabilization of the collagen can be associated by the ability of chromium being able to form complexes with the collagen[18].

2. Thickness of the different leathers

Fig. 2 shows the thickness of the rabbit leather from different tannages for both the belly and butt region.



Key ↑ Samples obtained in the parallel direction
→ Samples obtained in the perpendicular direction

Figure 2: Thickness test results

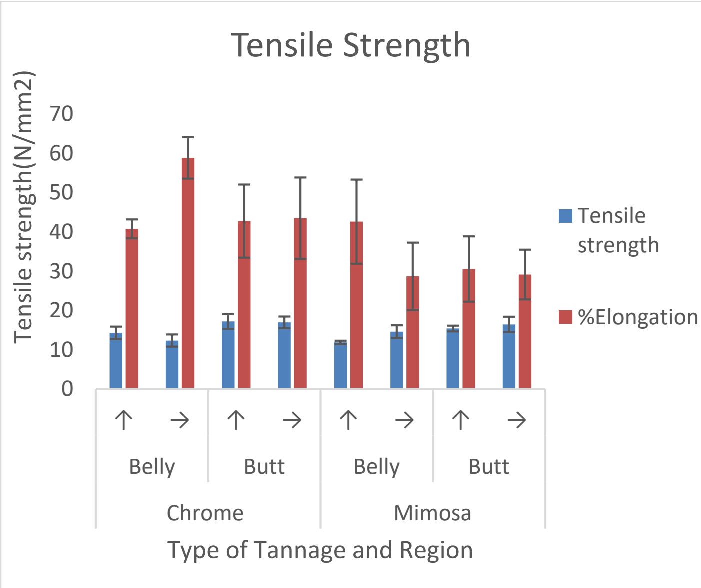
From the results, the belly region of mimosa tanned leather had the highest thickness compared to chrome tanned leather. At the butt region mimosa tanned leather also had the highest thickness compared to mimosa tanned leather. There existed variation in thickness at the butt region in relation to direction. The variation could be as a result fibre orientation as well as structure[19]. The variation could also be as a result of the aggregation of the of the collagen fibes in the leather which affects the degree of orientation.[20]

In relation to region, the butt region had the highest thickness compared to the samples from the belly region for the two tannages. The thickness from the butt region was almost twice the thickness from the belly region. This could be as a result of dense packing of the fibre structure at backbone region compared to the belly region[21]. The variation could also be as a result of degree of fullness where vegetable tanned leathers are known to have the highest degree of fullness compared to the other tannages[17]. Vegetable tannins are known to contain tannins and non-tannins[15] where the tannins are used to crosslink the fibre structure of the leather where the non-tannins are known to provide some degree of fullness. The chrome tanned leather could have a greater thickness because of using syntans which are known to increase the degree of fullness of chrome tanned leather[22]. The values for this study agreed with the values found by Taha et al., (2017) where he found New Zeeland breed to have a thickness 1.12mm[23].

3. Tensile strength and %Elongation

Tensile strength of the leather is the maximum force that is required to fracture the leather [24]. Elongation is known to be degree at which the leather is stretched before failure[25]. Fig. 3

shows the tensile strength and percentage elongation for the leather from the different tannages



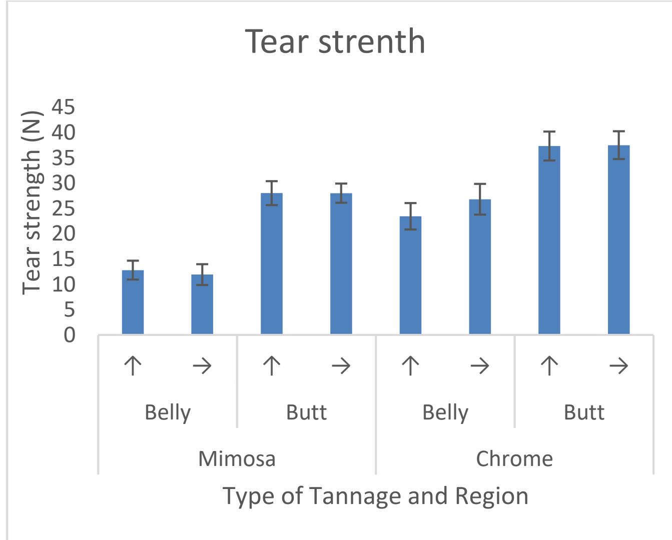
Key ↑ Samples obtained in the parallel direction
→ Samples obtained in the perpendicular direction

Figure 3: Tensile strength and % elongation

From the results, butt region had the highest tensile strength for both tannages compared to the belly region. However, the strength differed with respect to the direction. This variation could be as a result of leather having difference in fibre weave[23]. The angle of weave usually distresses the degree of stretch[19].
Tensile strength is equal to the number of fibres oriented in that direction and thus it is usually higher in the in the parallel direction as the force is usually applied to a more oriented network of fibres[26]. Parallel orientation of fibers causes minimal friction damage of the fibres and this usually results to an increase in the tensile strength[27]. On the other hand, perpendicular orientation of fibers cause more frictional damage to the fibres and this usually results to a decrease in the tensile strength of the leather[28].
The results for tensile strength were 15.93N/mm^2 and 17.09N/mm^2 for mimosa and chrome tanned leather respectively. This values were higher than is reported in literature[23]. This could be attributed to variations in thickness and processing recipe.

4. Tear strength

Tear strength is the measure of the material to resist tearing force[29]. For tear strength, when the samples are obtained in the direction parallel to the backbone, the tearing is usually done in the perpendicular direction[26]. Fig 4. Shows the tear strength of the rabbit leather for chrome and mimosa tannage



Key ↑ Samples obtained in the parallel direction
→ Samples obtained in a perpendicular direction

Figure 4: Tear strength results

Tear strength for mimosa tanned leather was lower when sampled from the belly region and in perpendicular direction. Conversely, the butt region of the mimosa tanned leather tear strength was almost similar in both directions.
The tear strength of the chrome tanned leather at the belly region was lower compared to the butt region. These differences were also observed with respect to direction. Samples obtained perpendicularly to the butt showed high tear strength compared to the parallel direction. However, the tear strength at the butt in both directions were almost the same.
The average tear strength for the two different tannages showed that chrome tanned leather (37.4 N/mm^2) was significantly higher than that of mimosa tanned leather (28 N/mm^2). The variation in tear strength for the different direction are as a result of angle of weave of the leather fibres in the fibre bundles[19]. The higher tear strength for the samples obtained perpendicularly can be associated with the orientation when performing tensile strength where their samples are usually in the parallel direction and vice versa[26].

5. Ball burst

Ball burst is a test used to determine the resistance of the leather to crack when force is applied[30]. Fig. 5 shows the results for grain crack and grain burst for chrome and mimosa tanned leather for both the belly and butt region

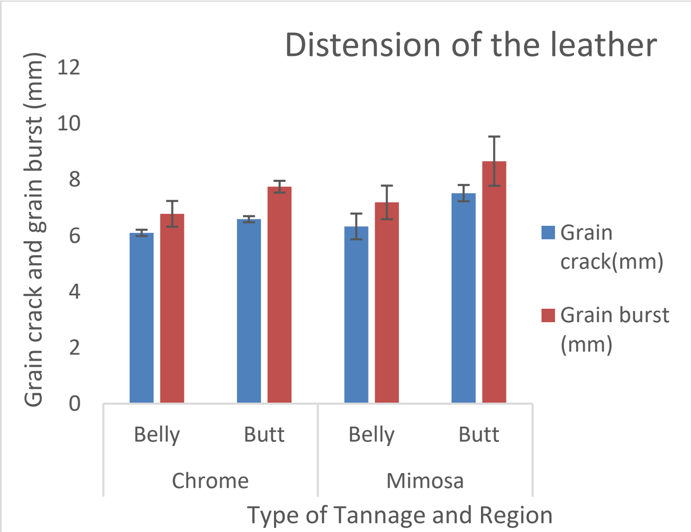


Figure 5: Ball burst results

From the results, the extension of the leather at the belly region for the two tannages is low compared to its extension at the butt region. This can be attributed to the tight packing of fibre structure at the butt region. Mimosa tanned leather showed higher value for the grain crack and grain burst at the belly region compared to chrome tanned leathers. This could be attributed to fullness[31], a property imparted by mimosa tanned leather compared to chrome tanned leather.

6. Flex Test

Flex test is a test carried to determine the number of cycles that leather can withstand without having any deformation. The test determines the resistance of the materials to form creases and the resistance of the leather to crack[16]. The test is usually carried out for leathers prone to flexes when in use. In this case all the leather from the three tannages were able to withstand 100, 000 flexes without any deformation.
Flexibility of the leather shows that the material is able to stretch when force is applied. The factors that affect the flex of the leather are the type of tannage and re-tannage. In flex test the defects which are usually considered are; the greying, cracking, shading and detaching of the finish from the leather[15].

CONCLUSION

The results of the study showed that overall chrome tanned rabbit leather offered good physical properties compared to mimosa tanned leather. Despite this, the rabbit leather can be produced by either tannage with good physical properties. The butt region for all leathers provided the best physical properties compared to the belly. This is an indication of the anisotropic property of rabbit skins. It would be good that future studies focus on the combination tannages as well as structural properties of rabbit leather.

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