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Experimentation of Sheep/Goat Leather as Raw Material for the Production of Symbolic Curtains and Blinds in Ghana

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Abstract: In this study, we experimented with sheep and goat skins as raw materials to be integrated with fabrics to produce Ghanaian symbolic curtains and blinds that will project Ghanaian cultural identity. The study employed a studio-based and descriptive research design. Raw leather of sheep and goats' skins was the sample for this study. The data collection instruments were tests and observations. The study found that leather from sheep and goats can be processed and integrated with fabrics to produce curtains and blinds that can promote Ghanaian cultural identity. The study also found that the degree of hardness is determined by the temperature levels of the medium used for the manipulations, which is also found in the purpose of the article involved. The leather from sheep and goats can be finished by polishing, painting, or spraying. Leather and fabric artisans should grab this innovative technique in producing symbolic curtains and blinds so as to expand their scope, and explore other techniques to provide a wide range of variety of Ghanaian symbolic curtains and blinds. Art teachers, lecturers, students, and companies must be encouraged to integrate non-conventional techniques and materials to produce innovative artefacts that would enhance the development of the art industry. Further studies should be conducted on how to resolve the shrinkage parts of the skins that are difficult to use for fashion products.

Keywords: Ghanaian symbolic, toughness, workability, shrinkage, and condition /state of hardening.

1 Introduction

Leather is an animal's skin or hide that has been treated to make it flexible and tough enough to be converted to other products. Leather is produced by subjecting animal skins or hides to a process called tanning, which utilises various substances, including vegetable-based materials [1]. Tanning converts animal skins or hides as a material susceptible to biodegradation, into leathers as a non-degradable material, stable thermally, and resilient to abrasion that can be used in the production of numerous leather products [2].

Vegetable tanning was the only known tanning process for the years. However, with the evolution of engineering, additional tanning methods have been discovered, such as chrome tanning, which is currently widespread in the world. Although mineral tanning has various advantages compared to vegetable tanning, solid and liquid production wastes of this industry have exposed several harmful effects on plants, animals, and human health [3], which promoted a return to vegetable tanning as an eco-friendly tanning method [4].

In the olden days, vegetable tanning was performed using three main techniques (pit, vat & bag tanning) depending on the size of animal skins or hides. The tanning in pits (large tanks set on the ground) was a slow and static process mostly reserved for the treatment of large animal skins and to produce heavy and strong leathers for shoe soles, belting, or harness. Succinctly, hides were set in horizontal layers inside the pits (or layaways) with the ground vegetable material, one layer of hide, another layer of crushed barks or leaves. Water or oozes were then added to the pits until all the skins were immersed and left for about 6 to 12 months [5].

The vat tanning of small to medium hides was mostly performed in wooden or clay containers where they were put together with the vegetable material, or an aqueous liquor of these materials, and stirred together for a few weeks until the required amount of tanning material had been absorbed. The bag tanning, mostly used in the south of Europe, was a faster process since it took only two to three weeks to complete. This method was used to produce light and fancy leathers that were then applied to lavish items such as jewelry and case coverings, etc. To obtain these exquisite leathers, the skins were folded, sewn like a small bag, and filled with water and with the ground vegetable material inside. Then, "bags" were immersed in an identical infusion or liquors used to fill them and shaken to speed up the process of tanning [5].



In the modern production of vegetable-tanned leather, the leather hides are cured by immersion in a salt solution to protect it from deterioration and to preserve them for future use. The hides are then trimmed and soaked to remove salt and other solids and to restore moisture lost during curing. Following the soaking, the hides are fleshed to remove the excess tissue, to impart uniform thickness, and to remove muscles or fat adhering to the hide.

Hides are then dehaired to ensure that the grain is clean and the hair follicles are free of hair roots. Liming is the most common method of hair removal, but thermal, oxidative, and chemical methods also exist. The normal procedure for liming is to use a series of pits or drums containing lime liquors (calcium hydroxide) and sharpening agents. Following liming, the hides are dehaired by scraping or by machine [6]. Deliming is then performed to make the skins receptive to the vegetable tanning. Bating, an enzymatic action for the removal of unwanted hide components after liming, is performed to impart softness, stretch, and flexibility to the leather. Bating and deliming are usually performed together by placing the hides in an aqueous solution of an ammonium salt and proteolytic enzymes at 27E to 32EC (80E to 90EF) [7].

Pickling may also be performed by treating the hide with a brine solution and sulfuric acid to adjust the acidity for preservation or tanning. In the vegetable tanning process, the concentration of the tanning materials starts low and is gradually increased as the tannage proceeds. It usually takes 3 weeks for the tanning material to penetrate to the center of the hide. The skins or hides are then wrung and may be cropped or split; heavy hides may be retanned and scrubbed [8]. For sole leather, the hides are commonly dipped in vats or drums containing sodium bicarbonate or sulfuric acid for bleaching and removal of surface tannins. Materials such as lignosulfate, corn sugar, oils, and specialty chemicals may be added to the leather. The leather is then set out to smooth and dry, and may then undergo further finishing steps. However, a high percentage of vegetable-tanned leathers do not undergo retanning, coloring, fatliquoring, or finishing.

Chrome-tanned leather tends to be softer and more pliable than vegetable-tanned leather, has higher thermal stability, is very stable in water, and takes less time to produce than vegetable-tanned leather. Almost all leather made from lighter-weight cattle hides and from the skin of sheep, lambs, goats, and pigs is chrome tanned. The first steps of the process (soaking, fleshing, liming/dehairing, deliming, bating, and pickling) and the drying/finishing steps are essentially the same as in vegetable tanning. However, in chrome tanning, the additional processes of retanning, dyeing, and fatliquoring are usually performed to produce usable leathers, and a preliminary degreasing step may be necessary when using animal skins, such as sheepskin.

Chrome tanning in the United States is performed using a one-bath process that is based on the reaction between the hide and a trivalent chromium salt, usually a basic chromium sulfate. In the typical one-bath process, the hides are in a pickled state at a pH of 3 or lower, the chrome tanning materials are introduced, and the pH is raised. Following tanning, the chrome-tanned leather is piled down, wrung, and graded for thickness and quality, split into flesh and grain layers, and shaved to the desired thickness.

The grain leathers from the shaving machine are then separated for retanning, dyeing, and fat liquoring. Leather that is not subject to scuffs and scratches can be dyed on the surface only. For other types of leather (i.e., shoe leather), the dye must penetrate further into the leather. Typical dyestuffs are aniline-based compounds that combine with the skin to form an insoluble compound. Fat liquoring is the process of introducing oil into the skin before the leather is dried to replace the natural oils lost in the beamhouse and tanyard processes. Fat liquoring is usually performed in a drum using an oil emulsion at temperatures of about 60E to 66EC (140E°F to 150EF) for 30 to 40 minutes. After fat liquoring, the leather is wrung, set out, dried, and finished. The finishing process refers to all the steps that are carried out after drying.

Curtains and blinds play important roles such as ornamentation, concealment, protection, and promotion of the cultural values of a nation. It has been observed that most curtains and blinds on the Ghanaian market are imported. Accordingly, the motifs in the designs project the culture and ideologies of countries from which they are imported, with no Ghanaian meanings. Meanwhile, Ghana is well-endowed with raw materials, symbols, and elements that can be incorporated with various techniques to produce curtains and blinds that project the Ghanaian cultural identity and positively impact tourism. This study sought to experiment with sheep and goat skins as raw materials for producing Ghanaian symbolic curtains and blinds that should project Ghanaian cultural identity.

2. Objectives of the Study

- i. To test for toughness, workability, shrinkage, state of hardening, and finishing of local sheep and goat leathers as raw materials for producing Ghanaian symbolic curtains and blinds.
- ii. To determine the finishing methods suitable for local sheep and goat leathers.

3. Methodology

This study employed a studio-based and descriptive research design. The studio-based design was employed because it

involves an original investigation undertaken to gain knowledge and understanding. It includes the invention of ideas, images, performances, and artefacts, including design, where these lead to new or substantially improved insights in the field of practice [8]. Also, studio or practice-based research is research where some of the resulting knowledge is embodied in the artefact. Studio-based research uses a more focused approach to the processes performed in visual art studios that align with their theory and practice [10].

As artists and researchers, we start with the art to develop thesis questions to be explored in studio-based research [11]. She [11] examines three methods that are particularly suited for studio-based research: 1. Aesthetico-action research is a cyclic, open-ended, active process that involves observing, planning, action, observing, and reflecting: 2. Hermeneutic phenomenology is a method that uses observation, description of the art and art processes to determine underlying structures. and 3. Thematic analysis is a process during which we attempt to discern patterns that connect in both process and creative projects or events.

A descriptive survey was used to describe the results of the experiment. The terminology of descriptive survey research is designed to obtain pertinent and precise information concerning the existing status of phenomena and, whenever possible, to draw valid generalizations for the facts discovered without making any interference or control over the situation.

This research was conducted in the Integrated Rural Art and the MFA Textile studios of the Kwame Nkrumah University of Science and Technology. Raw leather of sheep and goats was the sample of this study because they are common in Ghana and can be easily obtained. The data collection instrument was observation. The observation was used to enable the researchers to see the proceedings of the experiments. There are many types of observation. However, due to the nature of this study, the researchers used a specimen records type of observation. This type of observation is used to describe behaviour in its natural context and in its original sequence.

3.1 Data collection

To collect data for this study, a visual inspection was conducted to select suitable leather for the experiment. Sheep and goat leathers were selected. The selected samples were prepared by sanding and soaking in a lime solution to remove the spongy fibre and the unpleasant scent that characterises untreated leather. Different blocks of 'adinkra' patterns were prepared using wood, strawboard, and plywood. Experiments were done by soaking and moulding sampled vegetable-tanned leather from the shoulder, butt, and belly of goat and sheep leather using cold, warm, and hot water to select the best sample of leather for the curtain and blind. The samples were examined in terms of their toughness, workability, shrinkage, and mode of hardening. The moulded leather samples were enhanced by spraying, painting, and polishing to identify the best method of finishing the products. Figures 1, 2, 3, and 4 indicate the results of the experiment.







Fig. 1: Different materials used for molds







Fig. 2: Effect of boiling water on leather









Fig. 3: Molding Processes







Fig. 4: Molded samples after the test

4. Findings

Objective one: To test for toughness, workability, shrinkage, state of hardening, and finishing of local sheep and goat leathers as raw materials for producing Ghanaian symbolic curtains and blinds.

4.1 Studio experiment

In the process of the experiment, leather samples of the same measurement were taken and tested. The samples were taken from (Butt, belly, shoulder) of sheep and goats. Spacemen from the sheep skins were labeled: SA, SB, and SC, representing the sheep's shoulder, sheep's butt, and sheep's belly, respectively. A similar labelling in congruence with the goat skin was done. Thus, GA, GB, and GC refer to the Goat Shoulder, Goat Butt, and Goat Belly, respectively. The spacemen were tested for the following properties: toughness, workability, shrinkage, condition /state of hardening, and Suitable finish.

4.1.1 Test for Leather Toughness

Basically, the toughness test sought for the skin and part of the skin with enough strength and resilience required for leather-fabric integration. No fast rule or apparatus was involved in the search; the spacemen were visually inspected. This involved feeling, waggling, flapping, and stretching. The samples were also treated with water at different temperature levels and molded to establish the most effective leather sample.

4.1.2 Workability Test

This test sought to find out how feasible the various samples of skins can be used for the leather-fabric integration. Three main techniques were identified thus hot wax, glue, and water techniques. However, the water technique was opted for the test. A set of samples was soaked in cold water for 30 minutes and subsequently molded for trials.

4.1.3 Test for Shrinkage

This test sought to find the leather sample with the most resistance to shrinkage. This property in the leather helps to maintain the average size of the leather moulds and the uniformity of the patterns. Initially, the samples were measured; each of them was 5x5 inches, and their initial length between opposite corners, which was used for the calculation, measured 7.4 inches. All of them were placed in warm water of about 50° C for ten minutes. They were removed and allowed to dry for about 24 hours in standard conditions of room temperature. The final measurement of the leather samples was taken, and the percentage of shrinkage was calculated using the formula: Initial length - final length / initial

length x 100 % shrinkage = $IL - FL / IL \times 100$. eg $P.s = 5 - 4 / 5 \times 100 = 1 / 5 \times 100 = 20$ %. Figure 5 shows the test for shrinkage.



Fig. 5: Test for shrinkage

4.1.4 Condition /state of Hardening

Two main methods of hardening the molded leather were executed. Hardening by gradual drying at a standard temperature and hardening facilitated by oven temperature, or better still, hardening by baking.

5. Discussions

Objective one: To test for toughness, workability, shrinkage, state of hardening, and finishing of local sheep and goat leathers as raw materials for producing Ghanaian symbolic curtains and blinds.

5.1 Test for Leather Toughness

The study revealed that between sheep and goat leathers, the goat leather was found to be slightly tougher than the sheep. The shoulder areas were the toughest, followed by the butt and the belly in that order. In relation to the purpose of the study, the results position the butt ahead of the others since the belly felt soft and loose, and the shoulder regions were too hard and rigid.

5.2 Workability Test

The observations made were that generally, all the samples were moldable; however, there were slight differences in the mouldability as far as the sections were concerned. Samples from the belly of both the sheep and goat skins were molded with ease as compared to the butt and shoulder sections. The shoulder parts were more difficult to mold than the butt.

5.3 Test for Shrinkage

This test sought to find the leather sample with the most resistance to shrinkage. This property in the leather helps to maintain the average size of the leather moulds and the uniformity of the patterns. Initially, the samples were measured; each of them was 5x5 inches, and their initial length between opposite corners, which was used for the calculation, measured 7.4 inches. All of them were placed in warm water of about 50° C for ten minutes. They were removed and allowed to dry for about 24 hours in standard conditions of room temperature. The final measurement of the leather samples was taken, and the percentage of shrinkage was calculated using the formula: Initial length - final length / initial length x 100 % shrinkage = $IL - FL / IL \times 100$. eg $P.s = 5 - 4 / 5 \times 100 = 1 / 5 \times 100 = 20$ %. Table 1 indicates the samples, initial length, final length after testing, and percentage shrinkage.

Table 1: The outcome of the test shrinkage

Samples	Initial Length	Final Length	% of Shrink
S.A	7.4	7.0	5.41
S.B	7.4	6.89	6.9
S.C	7.4	6.60	10.81
G.A	7.4	7.10	4.05
G.B	7.4	7.0	5.41
G.C	7.4	6.88	7.03



S-Sheep, G-Goat, A-Shoulder, B-Butt, C-Belly, SA-Sheep Shoulder, SB-Sheep Butt, SC-Sheep Belly, GA-Goat Shoulder, GB-Goat Butt, GC-Goat Belly.

5.4 Condition /state of Hardening

It was observed that hardening facilitated by baking the molded leather in an oven makes the product tough to stitch on fabric. However, hardening through a gradual drying at room temperature makes the product compatible with fabric integration.

Objective two: To determine the finishing methods suitable for local sheep and goat leathers.

5.5 Finishing Methods

The study revealed that finishing with shoe polish was positive; the process was flexible, and the outcome revealed the natural texture of the leather. Thus, the kind of finish would have no adverse effect on the leather. Figure 6 shows the results of the sampled leather polished with liquid polish.



Fig. 6: Polished samples

Studio work by researchers

The study found that it was effective to finish the molded leather with spray painting. However, the paint totally concealed the surface of the leather beyond recognition. One advantage of spray painting is that it can be changed to any color of choice. However, the natural effect of the leather would not be felt due to the total concealment caused by the paint. Figure 7 shows the results of the sampled leather sprayed.



Fig. 7: Sprayed sample

Studio work by researchers

The molded leather was also painted with a brush using acrylic and oil paint. This method also has the advantage of changing the color of the leather to the suit of the designer's choice. However, the effect was not as smooth as the spraying method. Also, the leather pores were blocked, making the surface impervious and consequently hindering perspiration, which is required to keep the leather always dry on the fabric. Figure 8 indicates the results of the sampled leather painted.





Fig. 8: Painted samples

5.6 Blinds and curtains made from the local sheep and goat leathers

After the experiments, sample curtains and blinds were produced. Figure 9 shows the sample curtain and blind.



Fig. 9: Blinds and curtains made from the local sheep and goat leathers

6. Conclusions

Based on the experiment, the study concluded that leather from sheep and goats can be processed and integrated with fabrics. The choice of leather is determined by the kind of article to be produced. The degree of hardness is determined by the temperature levels of the medium used for the manipulations, which is also based on the purpose of the article involved. The articles made through the technique could be finished by any of the techniques suitable for enhancing leather articles; thus, polishing, painting, or spraying.

7. Recommendations

Leather and fabric artisans should grab this innovative technique in producing symbolic curtains and blinds so as to expand their scope, and explore other techniques to provide a wide range of variety of Ghanaian symbolic curtains and blinds. Art students must be encouraged to integrate non-conventional techniques and materials to produce innovative artefacts that would enhance the development of the art industry. Further studies should be conducted on how to resolve the shrinkage parts of the skins that are difficult to use for fashion products.



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Mr. Michael Owiredu Aboagye is a senior high school tutor and currently a PhD candidate of the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. His main study area is Textile Design technology. Mr. Aboagye holds a Master's degree in Fine Arts (Textiles) from the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; a Bachelor of Technology in Industrial Arts (Textiles option) from the Takoradi Polytechnic; a Certificate in Education from the University of Education, Winneba - Kumasi; and a Higher National Diploma from the Takoradi Polytechnic. He attained the above height in education after a successful second cycle of education at the Okuapemman school in the Eastern Region of

Ghana. As an educationist and a Pupil teacher, then, Mr. Aboagye began his career after National service at the Methodist High School (now Methodist Girls' High School - Mamfe) in the Akuapem North District of the Eastern Region of Ghana in 2002. He served in the same institution until 2009, when he moved to his current station, Akuse Methodist Senior High Technical school, in the Lower Manya-Krobo Municipality in the Eastern Region of Ghana. His professional journey has been marked by intermittent pursuit of higher academic credentials. This has greatly honed his skills and knowledge in training numerous young Ghanaians in the field of Textiles. Mr. Owiredu Aboagye's interest in research has been in Sustainable career in textiles, incorporation of unconventional materials for textile productions, including curtains and blinds, strategies for sustaining Ghanaian traditional Textiles_ Branding, Copyright Protection, Market Viability. Mr. Aboagye is poised to join any professional organization, both local and international, that will help him further develop his professional credentials.



Dr. Johnson Kofi Kassah is a senior lecturer in the Department of Fashion Design and Textile, Ho Technical University, Volta Region, Ghana. His area of specialisation is fashion and textiles design. Dr. Kassah is from Dzodze, a town in the Ketu North Municipality of the Volta Region of Ghana. He completed his basic education at Dzodze Central R. C. Junior Secondary School in the year 1997. He then proceeded to Dzodze-Penyi Secondary School and completed in the year 2000. After his secondary education, Dr. Kassah went to Takoradi Polytechnic to read HND Textiles and completed in the year 2005. After his National Service, Dr. Kassah went back to Takoradi Polytechnic to do a top-up and graduated in the year 2009. He then proceeded to University of Education, Winneba Kumasi campus to pursue Master of

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National Service and posting after successful completion at the Sovie Technical and Vocational Institute in Sovie. To further formalize her love for education, Miss Dzidzornu gained admission in the year 2015 to study Textile Ecology in the Department of Textile, Merchandising, and Fashion Design at Seoul National University, Seoul, South Korea, and completed in 2018. Miss Dzidzornu is currently pursuing her PhD education at the Kwame Nkrumah University of Science and Technology, Kumasi in Textiles Design and Technology, which started in the 2023/2024 academic year. Miss Dzidzornu tested fabrics at the Fashion Textiles Center in South Korea Usong the Kawabata System for two (2) years and taught Textiles at Sovie Vocational/ Technical Institute, Sovie in Ghana for two years. In Asadame A.M.E Zion Schools, Asadame in the Volta Region of Ghana, Miss Dzidzornu taught Vocational Skills at the Junior Secondary School level. Miss Dzidzornu published five scholarly works in credible journals.