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Controlling Fungus Attack on Indigenous Ghanaian Vegetable Tanned Leathers

John Osei Bobie Boahin[1*] Asubonteng Kwabena[2] Lord Adu-Gyamfi[3]
[1,2,3] Department of Integrated Rural Art and Industry, College of Art and Social Sciences
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
*E-mail of the corresponding author: jboahin@gmail.com

Abstract
The attack of fungus on indigenous Ghanaian tanned leather and leather products lessen their surface qualities and socio-economic values. The paper describes technology that can be adopted to control the development of mould that affect the value of leather and leather products as a result of fungus attack.. Experiments were carried out using material/technical means to determine the possibility of restraining the negative impact of fungus attack associated with indigenous tanned leathers. The material/technical means refer to the use of sanding tool, to sand off excess flesh on the flesh side of leather; then also washing over leather with lime juice, boarding bee wax into leather and again rubbing over leather with thin layer of spray lacquer to protect it from moisture. The experiments proved that the presence of excess flesh and fatty substances left after tanning are the primary causes for development of mould on leather and finished leather products. The technology so devised has led to the production of leathers that can resist the effect of fungus attack.
Key Words: Fungus, Moisture, Sanding, Mould, Leather.

1. Introduction

Fungus attack on leather has over the years been a major setback on the development of the indigenous leather industries in Ghana, in the case of processed leathers and finished leather products. Leather has been defined severally, Newman, (1973), Taylor, Lee, Bumanlag, Cook, Brown (2009), (Leather, 2007), as animal skin that has been chemically modified to produce a strong, flexible material that resists decay. *Thomson* (2006), have also avowed that, leather is a sheet material with the area of each piece ranging from tens of square centimeters to six, seven or more square metres depending on the animal from which it was obtained. In making leather a raw, putrescible animal skin is converted into a dry, non-putrescible material with the handle and degree of flexibility required for its specific end use. The skin of any vertebrate animal can be made into leather, and the one common characteristic of these skins is that they are primarily composed of the protein collagen, (*Haines,*2006).Leather has been used to produce variety of products to meet human needs beginning from the prehistoric period to date and this is attested to by *Thomson* (2006), that, The hides and skins of animals killed for food appear to have been used for clothing, shelter and other purposes long before the evolution of modern man.

As a result of the negative effect of moulds on leather, many connoisseurs of indigenous leather products have had diminishing taste, and future development of the industry is highly threatened, as local customers of leather and leather products have turned to appreciate imported chrome tanned leathers. There are reported instances where leather items meant for export had to be returned to producers because of the white substances (evidence of fungus attack) found all over the finished products. The biggest problem with moulds in leather as explained in Emigratenz.org. (2011), is caused by a change in colour - staining. Often they stain the leather in bright colours, and leave spots and grain marks that will make finished leather look inferior. This causes downgrading of the finished product, and can cost a lot of money. Canadian Conservation Institute Notes (1993) also states that Leather objects are particularly susceptible to mould growth, which can disfigure, stain, and weaken them.Once moulds are inside the leather, simply cleaning the surface will not solve the problem, since the moulds will grow right out again. Besides, it can sometimes consume some important additives used in leather making, such as fat liquors, tannins and so on.

2. Principal grounds for growth of moulds on leather

The presence of excess flesh and fatty substances left after tanning are the principal grounds for growth of mould associated with the indigenous tanned leather products. The presence of moisture or high percentage of humidity make leather susceptible to fungus attack, this is corroborated by (Kristara), as cited in (info barrel 2011) that,

leather is not impervious to mould or mildew growth. Any surface located in a humid and dark place can be prone to mould or mildew growth, this is corroborated by Canadian Conservation Institute Notes (1993), that "The food source in this case is the leather. High relative humidity (RH) between 65% and 100% (i.e., complete saturation with water) provides environmental conditions that encourage mould growth. Warm temperatures and poor air circulation, although less important factors also speed up mould growth". Boahin et al. (2013) have stated that "After critically examining some indigenous tanned leather products under a microscope, it was detected that there were thin films of flesh left on the grained side of the leather,,,,,,,,,, These begin to decay when they come into contact with moisture or when the percentage of humidity is high". This then required the development of appropriate technology and discovery of substances that are effective in solving the problem of mould or mildew on indigenous tanned leather.

3. The subsidiary ground for growth of moulds on leather

The excess tannins left after tanning and the use of organic substances, such as food residue and vegetable based adhesives used by indigenous leatherworkers in the production of leather goods also contribute to fungus attack on finished items. A careful understanding of the character of mould is essential for the craftsman to develop the mechanism for its control. Scientists have severally defined moulds; (Wikipedia 2009) define it to include all species of microscopic fungi that grow in the form of multicellular filaments, called hyphae. (Mold (fungi) 2007), described Mould or mildew to refers to fuzzy, cobweb-like growth produced on organic matter by several types of fungi. Mould and mildew are commonly used interchangeably, although mould is often applied to black, blue, green, and red fungal growths, and mildew to whitish growths. In the case of leather, the common evidence of fungus attack has been the appearance of the whitish growth (mildew). Scientifically mildew ("Mildew" 2007), is described as conspicuous mass of threadlike hyphae (mycelium) and fruiting structures produced by various fungi. It is an acceptable fact that mildew grows on cloth, fibres, leather goods, and plants, using these substances as food for growth and reproduction. When moulds are allowed to develop on leather for a long period of time they cause unpleasant stains and these are revealed after the moulds have been wiped off. It has further been explained that moulds thrive on a great many organic substances and, provided with sufficient moisture, they rapidly disintegrate wood, paper, and fruits. The enzymes penetrate well behind the area of the visible growths to damage the products; in the case of leather, the penetration is minimal, once the leather had been properly tanned.

In extreme cases leathers that have been kept tight in moist conditions might be affected by Black bread mould, *Aspergillus niger*, according to "Mold (fungi)" (2007) it is one of the most familiar molds, it begins as a microscopic, airborne spore that germinates on contact with the moist surface of nonliving organic matter. It spreads rapidly, forming the mycelium (fungal body), which is made up of a fine network of filaments (hyphae). The mycelium produces other clusters of root-like hyphae, called rhizoids, which penetrate the organic material, secreting enzymes and absorbing water and the digested sugars and starches. The reproductive nature of the fungi which create the moulds is another source of concern for leatherworkers. These are reproductive cells known as spores; they are capable of developing into a new individual without fusing with another reproductive cell. It is known that spores are agents of nonsexual reproduction; spores are produced by bacteria or fungi. "Fungus" (2007), fungal spores serve a function similar to that of seeds in plants; they germinate and grow into new individuals under suitable conditions of moisture, temperature, and food availability. Leather as an organic matter is generally susceptible to the attack of moulds, however, the rate at which this occurs on indigenous tanned leathers as compared to chrome tanned leathers when exposed to moisture is very high. This situation does not augur well for the promotion of indigenous tanned leathers and leather goods in the prevailing competitive market era. The following illustrations (Plates 1, 2 and 3) are samples of leather articles that have developed moulds**.**

Plate 1&2. Mouldy leather articles. Table Mart (Plate 1) and Masks (Plate 2)

Plate 3. Mouldy leather article, 'Traditional Slipper'

Moulds feed on indigenous tanned leather, and the effect is seen after it has been cleaned off with rage. This assertion is observed in the illustrations below (plate 3 and 4). Areas occupied by moulds are eaten up leaving patchy spots in their places. These occurrences are further confirmed by Wanda and Betty, (2006)**,** that as the molds grow, they cause considerable damage. They discolour fabrics; and sometimes they eat into them until the fabrics rot and fall to pieces. They also discolor leather and paper.

Plate 4 and 5. After Effect of moulds on the Table Mart (Plate 4) and on Mask (Plate 5)

Plate 4. Effect of moulds on the traditional slipper after cleaning

4. Materials and Methods

The following experiments are meant to explore means of solving these problems. Indigenous tanned leather is taken through a post tanning process after it has been delivered from the local tannery, prior to its usage in processing leather articles.

4.1 Experiment one

The fleshy side of three indigenous (vegetable) tanned leather was sanded by using coarse sanding paper wrapped around a piece of wooden block. The indigenous tanned leathers were then soaked in water and later washed to get rid of the excess flesh and tannins.

The washed tanned leathers were dried on stretcher boards, making sure that the wet leather was tautly stretched out with the aid of three inches nails and allowed to dry in a shady area avoiding the effect of direct sunshine.

A smooth rounded bottle was used to burnish the grain side of the dried leather after which an abrasive paper was used to create fluffiness on the flesh side. Finally the leather was hanged in a cool humid room for thirty days to observe the effect of such condition on it.

4.2 Experiment two

Three sheets of leathers delivered from the indigenous tannery were sanded to remove the excess flesh and fatty substances left after tanning. They were soaked in clean water for thirty minutes, after which they were tautly stretched over stretcher boards until they dried. Drying was done under room temperature.
When they completely dried, bee wax was boarded on the flesh side of the leathers. In order to achieve a soft sheen on the grainy side, the waxed leathers were burnished with a smooth rounded surface bottle. This also helped to make them the suppler.

4.3 Experiment three

Following after the process in experiment one, a thin layer of Spray Lacquer was sprayed over the grainy surfaces of three sheets of vegetable tanned leathers to make them impervious to water. The secondary treated leather was kept in a damp humid room for thirty days to observe the effect such condition will have on it.

5. Results and Discussion

Keenan, (2006) has stated that one of the best strategies to deal with mildew is to prevent it in the first place. Such effort would prevent any to the aftermath negative effect which can reduce the value of the material.

5.1 Experiment one

The secondary treated indigenous tanned leathers which were kept in a damp room did not develop moulds after the thirty days period. This was as a result of the thorough activities of sanding, soaking and washing. Sanding off the fleshy sides helped remove the remaining fleshy and fatty substances left after tanning, there were no organic substances for fungi to live on and by so doing, the surface quality remained unblemished. Drying the leather under shade, coupled with the vigorous activity of burnishing with the smooth bottle softened the compressed fibers into soft, glossy grained and moisture resistant leathers.

5.2 Experiment two

The indigenous tanned leather was given a secondary treatment. Sanding removed the fatty substances and flesh left after tanning which absorbed moisture and make it easier for fungus attack. Soaking and washing made it possible for excess tannins to be washed off and soft for easy stretching. The application of bee wax sealed off the pores. Burnishing of the grain side of the leather was done with a smooth bottle. This enabled the bee-wax to penetrate the fibers and pores from beneath. Besides, it caused the natural oils of the leather to spread out producing a soft sheen, making it more compact and impervious to moisture. After observing it for thirty days it was realized that the surface quality remained in its original state as fungi attack was impaired.

5.3 Experiment 3

A thin layer of Spray lacquer was sprayed over the surface; the liquid penetrated the fibres of the leathers and this helped to seal off the surface and remnant pores, thus making the grain side of the leather water resistant and useful for the production of such articles as table mats, floor mat and coasters. The leather did not develop any moulds after it had been kept in a dampish room for thirty days. Leathers treated in this manner do not develop moulds that cause stains on leathers.

4. Conclusion

Techniques for controlling the development of moulds on leather have been discovered through this research. These techniques were each tested and found useful, thus achieving the objective for the research. elsewhere research have made available certain chemicals that help to control the growth of moulds on leather yet these are expensive and not easily available to local Ghanaian leatherworkers therefore the availability of technology for producing leathers that could resist fungus attack will promote the indigenous leather industry.

It is recommended for craftsmen to take advantage of the research findings to pay more attention to the fleshing and washing processes in tanning for production of quality leathers. Howbeit the secondary preparation of leather provides another line of production and employment avenue in the local leather industry. The pictures used to demonstrate fungus attack on leather and its effect on the surface their surface value clearly indicate the need for further research to control fungus attack on finished leather products. The pictures used in the research clearly demonstrate the importance of pursuing further research to control and restore the surface value of leather products that have come under fungus attack.

References

Ammirati, Joseph Frank, and Seidl, Michelle T. "Fungus." (2007) Microsoft Student 2008 [DVD]. Redmond, WA: Microsoft Corporation.

Ammirati, J. F. (2001). Mold. The World Book Encyclopedia Edition Volume 13 p. 689, 690.

Boahin J.O.B., Asubonteng K.., **&** Vesta E. Adu-Gyamfi (2013), “Sanative Measures against Offensive Odour that Affect Indigenous Tanned Leathers in Ghana “Journal of Science and Technology. Kwame Nkrumah University of Science and Technology, Kumasi. (JUST Volume 33. No. 1 p. 68-74).

Canadian Conservation Institute Notes ‘Removing Mould from Leather’ (1993), Minister of Public Works and Government Services, Canada, 1993 Cat. No. NM95-57/8-1-1989E ISSN 0714-6221. Canada. Retrieve on 23/3/2011 from http://www.cci.icc.gc.ca Removing Mould from Leather’

Haines, B.M. (2006), The fibre structure of leather. Kite M, Thomson, R *(Ed.) (2006)* CONSERVATION OF LEATHER and related materials, (pp.11), Butterworth-Heinemann is an imprint of Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP 30 Corporate Drive, Suite 400, Burlington, MA 01803.

Kristara, How To Remove Mold and Mildew From Leather http://www.infobarrel.com/HowTo © Copyright 2008 - 2011 by Hinzie Media Inc. retrieved 24/3/2011

“Leather.” (2007). *Microsoft Student 2008 [DVD]*. Redmond, WA: Microsoft Corporation.

"Mildew." Microsoft® Student 2008 [DVD]. Redmond, WA: Microsoft Corporation, 2007.

"Mold (fungi)."(2007) Microsoft Student 2008 [DVD]. Redmond, WA: Microsoft Corporation.

"Moulds affecting leather" http://www.tantec.co.nz/fungi.htm © emigratenz.org. Copyright © Jelsoft Enterprises Ltd. Retrieved on 23/3/2011

Newman, T. R. (1973). *Leather as art and craft.* London: Allen and Unwin.

Susan M. Keenan,(2006) *How To Remove Mold and Mildew From Leather* © http://www.doityourself.com/stry/mildewmoldtest#b Retrieved on 29/8/2013

Taylor A. M., Lee J., Bumanlag L.P., Cook P. H., Brown E. M. (2009). *Treatment of Low-quality Hides with Fillers Produced From Sustainable Resources: Effect on Properties of Leather,* The Journal of American Leather chemist Association, Vol. CIV, No. 10, 325-327.

Thomson, R. (2006). The manufacture of leather. Kite M, Thomson, R *(Ed.) (2006)* CONSERVATION OF LEATHER and related materials, (pp.1), Butterworth-Heinemann is an imprint of Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP 30 Corporate Drive, Suite 400, Burlington, MA 01803. First published 2006 Copyright © Elsevier Ltd 2006. All rights reserved

Thomson, R. (2006). The nature and properties of leather. Kite M, Thomson, R *(Ed.) (2006)* CONSERVATION OF LEATHER and related materials, (pp.66), Butterworth-Heinemann is an imprint of Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP 30 Corporate Drive, Suite 400, Burlington, MA 01803. First published 2006 Copyright © Elsevier Ltd 2006. All rights reserved

Wanda Eubank and Betty Feather (1993) *"How to Prevent and Remove Mildew — Home Methods"* Curators of the University of Missouri, Published by University of Missouri Extension, 1998 © 1993 to 2011 Retrieved on 23/3/2011.