https://chemclassjournal.com/
ChemClass Journal Vol. 9 Issue 2 (2025); 119-123
e-ISSN:3092-8214 p-ISSN:3092-8206
DOI: https://doi.org/10.33003/chemclas-2025-0901/145

Investigation into the Tanning Potential of *Azadiracta indica* (Neem)

[1*]Adeyi A.O., [1]Habila, B., [1]Adeoye D.O., [1]Ayebe B., [2]Abdullahi, S., [2]Samuel, B.I., [3]Edache J.J., Ikpe, G.D[3].,

[1]Directorate of Research and Development, NILEST, Samaru, Zaria.
[2] Directorate of Leather and Leather Product, NILEST, Samaru, Zaria.
[3]Department of Polymer Processing, Jorah Jemima Salom Nig.

(*)Corresponding Author's: *hbee4yaweh@gmail.com*

Abstract

Azadirachta indica, also known as Neem and Nim tree, is a tree of Mahogany family and it is one of the two species in the genus *Azadirachta*, and is native to *indica* which is widely planted in Nigeria. Neem bark was collected from Nigerian Institute of Leather and Science Technology (NILEST), Samaru Zaria which was dried, crushed and milled to 0.5 mm size using milling machine and was used to evaluate its tanning potential on shoe upper leather using 20 %, 25 % and 30 % of the powdered Neem bark on pelts. The shrinkage temperature of the three leather samples produced was 80 ^{0}C; the percentage elongation was 58 %, 55 % and 54 % for sample A (20 %), B (25 %) and C (30 %) respectively which is within the standard. The stitch tear strength of the resultant leather was good and the color of the sample changed slightly and became brightly colored after 4 hours which shows good fastness to light. From the results obtained, Neem bark can be used for tanning of leather for different purposes.

Keywords: *Azadirachta, Neem, Leather, Shrinkage, Tannin, Stitch*.

Introduction

Leather production is the conversion of structural protein of raw hide/skin into stable material which will not putrefy and suitable for wide variety of application [1, 2]. Leather making involves several chemical and mechanical processes and chrome tanning account for 85% of the world's leather production [3]. The term tanning was first introduced by Seguin to indicate various plant extract which have the capacity to convert hide/skin into leather. The tannins are widely distributed in nature and occur in different parts of plants such as bark, roots, fruits, leaves, pods, etc and vegetable tannin have been found to complement chrome in the production of certain leathers that requires fullness and softness [4, 5]. Thence the search for a plant with high extractable tannin. *Azadirachta indica*, also known as Neem, Nim tree, is a tree of Mahogany family: *Maliaceae*. It is one of the two species in the genus *Azadirachta*, and is native to India and is widely planted in Nigeria [6]. Neem tree may be distinguished from other trees by its dark brown bark with some crack, scaly dead tissues in old tree with wide shallow longitudinal

tissues separated in open place for shade because of its wide spread crown [7]. The objective of the work is to investigate into the use of vegetable tanning agent that is environmentally friendly suitable of replacing mineral tannage.

Materials and Methods

Three pieces of dry salted goat skins, powdered sample of *Azadirachta indica* (Neem) bark, Calcium hydroxide $Ca(OH)_2$, Ammonium sulphate $(NH_4)_2SO_4$, Analytical balance, hand gloves, pH paper, Sodium bicarbonate ($NaHCO_3$), Fatliquor, Formic acid, Oxalic acid, tannery and laboratory equipments was obtained from Nigerian Institute of Leather and Science Technology, Samaru Zaria.

Sample treatment

Azadirachta indica (Neem) tree bark was collected from Nigerian Institute of Leather and Science Technology (NILEST), Samaru Zaria. The sample (bark) was air dried, crushes and milled to 0.5mm size using a milling machine.

Leather Production

Pre-tanning operation

Dried salted skins with weight (840 g, 600 g and 580 g) were pre-soaked and rehydrated for 24hrs using water and 0.2% of Izal as bacteriocide. It was then weighed using weighing balance. The weight of the soaked skin obtained was 900 g, 700g and 680g respectively. The skins were washed and unhearing was done using 100% water and 3% sodium sulphide for 45 minutes. Liming was done for two days using 400% water and 3% lime. The pelts were hand fleshed and reweighed. The weight obtained were 960 g, 760 g and 720 g respectively. Complete de-liming was done using 80% water and 2% ammonium sulphate after agitation for 45 minutes. The pelts were washed using water and complete bating was carried out by agitation using the same de-liming liquor and 0.7% bates powder. The bated pelts were then washed using water, and drenching was done using 100% water, 8% sodium chloride and 0.6% formic acid by agitating for 2 hours.

Tanning operation

Three different percentages of the powdered Neem sample were used to tan the pelts. The percentages used for the tanning operation was: 30 %, 25 % and 20 %. The pelts were agitated for a period of two hours each and were left in the tan liquor for 72 hours with agitation of 1 hour per day. The tanned leathers were then hung to dry. The leather was conditioned, softened and flexed. Machine toggled, soaked back and stripping was done by agitation using water and 0.4 % sodium bicarbonate and clearing was achieved by agitation with water and 0.8 % oxalic acid after which re-tanning was done by agitating with different percentages of neem and 80 % water.

Post-tanning operation

The fatliquoring was done following agitation for 45 minutes with 6% sulphated fatliquor and at a temperature of 60^0C. Fixation was also done in the re-tanning liquor using 0.6% formic acid. The leathers were then hung to dry, toggled, staked and

buffed. The leather produced was subjected to physical testing to ascertain their qualities.

Results and Discussion

Table 1: Physical test of the vegetable tanned leather using *Azadirachta indica* (Neem) bark

Characteristics	Sample A	Sample B	Sample C
Shrinkage temperature (^{0}C)	82	82	82
Elongation at break (%)	58	55	54
Lastometer (ball Burst)			
Distension, mm	5.86	7.06	6.7
Force, Kg	35.88	30.69	22.86

Shrinkage temperature

From the result of the shrinkage temperature in Table 1 above the vegetable tanned leather using powdered *Azadirachta indica* (Neem) bark was 82 ^{0}C for the three samples, which is within the range of the stipulated standard for vegetable tanned leather [8]. This shows that the degree of tanning of the three samples was good.

Elongation at break

The percentage elongation at break of the shoe upper leathers gave 58 %, 55 % and 54 % for sample A, B and C respectively as shown in Table 1. The results obtained are quite within the stipulated standard which is 60 % maximum [9].

Lastometer test (Ball burst)

The shoe upper from sample A gave 5.86 for distension and 35.88 for force to crack and burst, Sample B gave 7.06 for distension and 30.69 for force to crack and burst while sample C gave 6.70 for distension and 22.86 for force to crack and burst. Sample A has more force than sample B and C, but has less distension compared to sample B and C. Sample B has more distension than sample A and C, this shows that sample C is softer than sample B and sample B is softer than sample A as shown in Table 1.

Stitch Tear

Table 2: Stitch test of the leather

Load, (g)	Time (Minutes)	Sample A	Sample B	Sample C
500	10	No tear	No tear	No tear
1,000	10	No tear	No tear	No tear
1,500	10	No tear	No tear	No tear
2,000	15	No tear	No tear	No tear
2,500	30	No tear	No tear	No tear

Table 2 shows that the stitch tears test result for the three samples were comparatively the same, that is, there was no tear after the addition of 2500 g of load for 30 minutes on the three samples. This shows good degree of stitch tear strength of the three samples [10].

2.3 Light Fastness

Table 3: Light Fastness test of the Leather

Sample	After 2 hours	After 3 hours	After 4 hours
A	No change	No change	Slight Change
B	No change	No change	Slight Change
C	No change	No change	Slight Change

Table 3 shows the result of light fastness test. The three samples had similar result after the test was carried out. The color of the samples changed slightly and became brightly colored after 4 hours which shows good fastness to light [11]. The importance of this test is to see if the leather can absorb light or not when subjected to a source of light or sunlight and how long it will take the leather to fade.

Conclusion

The results obtained from this study is quite interesting looking at some of the physical properties of the shoe upper leather, good shade retention, perspiration, fastness to light, stitch tear resistance and good shrinkage temperature. The results from this study show the possibility of using *Azadirachta indica* (Neem) bark for tanning in leather production and (Neem) bark can be used for tanning of leathers for different purposes such as shoe upper leathers, clothing leathers etc.

Acknowledgement: The authors greatly acknowledge every support from the Directorate of Polymer Technology and also Directorate of Research and Development, NILEST, Zaria.

References

[1] Sharphouse, J.H (1971). Leather technician's Handbook, London, Pg 2-10.

[2] Lawal, W.B (1979). The tanning effect of Neem extract in leather industry (Unpublished).

[3] Mahdi A.H; Khirstova, P.; Gasmelseed, G.A and Convinton A (2012). Potential of vegetable tanning materials and Basic Aluminum Sulphate in Sudanese Leather industry (part II). *J. Sci. Technol*., 19(1): 31-41

[4] Musa, A.E and Gasmelseed, G.A (2012). Characterization of Lawsonia inermis (Henna) as vegetable tanning material. *Journal of Forest Production and Industries*, 1(2):35-40

[5] Cobzac, S., Moldovan, M., Olah, N.K., Bobos, L and Surducan, E. (2005). Tannin extract efficiency from Rubus Idaeus, Cydonia Oblonga and Rumex Acetosa using different extraction techniques and Spectrophometric quantification.

[6] Mabberly, D.J (1995). Azadiratchta Factsheet Maliaceae: pg 337-343. Retrieved 19 December, 2023 from: www.key.trin.org.au/meliaceae.htm

[7] Subapriya, R and Nagini, S (2005). Medicinal properties of Neem leave: a review. *Cur Med Chem anticancer agent*, Mar. (5):159-605.

[8] Daniels, R. (2007). "The Scientific and commercial significance of variations in strength and stretch in leather". World Leather, 20-25.

[9] Caroline, B.A., Cristiana, W., Márcia, E.R.S., & Mariliz, G. (2018). Behavior of Polymer Films and its Blends for Leather Finishing. *Trends Textile Eng Fashion Technol*, 1(4), 1-10. TTEFT.000518.2018.

[10] Cheloti, M., Wangila, P., Kiprop, A., Onyuka, A., Sasia, A., Mutuku, M., Induli, M., Kundu, B., & Masenge E. Evaluation of Mechanical Properties of Goat Leather Tanned using *Acacia xanthophloea*. *Textile & Leather Review*, 6:333-342. https://doi.org/10.31881/TLR.2023.053

[11] Örk, N., Özgünay, H., Mutlu, M.M., & Öndoğan, Z. (2014). Comparative Determination of Physical and Fastness Properties of Garment Leathers Tanned with Various Tanning Materials for Leather Skirt Production. *TEKSTİL ve KONFEKSİYON*, 24(4), 413 – 418..