

The Efficiency Use of *Acacia seyal* Bark (*Talh*) as Alternative Tanning Material for *Acacia nilotica* Pods (*Garad*) in Traditional Tanning

Alsaudi Hussain Osman¹, Mohammed Alhadi Ebrahiem^{2*}, DM Makki², Mohammed Rahama Hemidan², Mohamed M Ahmed Ibrahim³ and Ekhlash Allam Bashir⁴

¹Department of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan

²Faculty of Animal Production, ElDaein University, ElDaein, Sudan

³Department of Community Development, Faculty of Developmental Studies, ElDaein University, ElDaein, Sudan

⁴Faculty of Nursing Science, ElDaein University, ElDaein, Sudan

*Corresponding Author: Mohammed Alhadi Ebrahiem, Faculty of Animal Production, ElDaein University, ElDaein, Sudan.

Received: November 07, 2020; Published: December 15, 2020

Abstract

This study aimed to use *Acacia seyal* bark (*Talh*) as alternative vegetable tanning material for *Acacia nilotica* pods (*Garad*) in traditional tanning. Twenty pieces of fresh goat skins with similar size were taken and divided into four groups (5 pieces in each group). *Talh* Bark powder was added at a rate of 10%, 20% and 30% from fresh skins weight for first, second and third group respectively. The fourth group was tanned by *Garad* in the same way that used in traditional tanning as control. The tanned leathers were examined by 10 professional workers in the field of leather products manufacturing. The data were analyzed using the Complete Randomized Design (CRD). The results indicated there were significant differences ($p \leq 0.01$) where *Garad* tanning found the highest significant evaluation for quality and efficiency of tanning in comparing with *Talh* Bark tanning. Whereas *Talh* Bark tanning revealed no significant differences in tanning efficiency between the tanned skins in the three percentages (10%, 20%, and 30%). The results of leather colour evaluation revealed that there were significant differences ($p \leq 0.01$) between *Garad* and *Talh* Bark tanning in the three tanning percentages (10%, 20% and 30%). The average evaluation of leather colour was between very good and good for *Garad* tanning with average 3.80; and good to acceptable colour for *Talh* Bark tanned leathers by average of 2.96. Also, significant differences ($p \leq 0.01$) were detected in leather strength, Flexibility and elasticity where *Garad* tanned leathers were more strong, flexible and elastic than that tanned with *Talh* bark.

Keywords: *Acacia seyal* Bark; *Acacia nilotica* Pods; Traditional Tanning; Leather Quality

Introduction

The term post tanning refer to the wet processing steps that follow the primary tanning reaction. This might refer to following tannage with chromium. In this process vegetable tanning materials were used to confer the primary stabilization to mineral tanned leathers. In all cases, post tanning can be separated into three generic processes: retanning, dyeing and fat liquoring [1,2]. Retanning may be a single chemical process or may be a combination of reactions applied together or more usually consecutively. The purpose is to modify the properties and performance of the leather. These changes include the handle, the chemical and hydrothermal stability or the appearance of the leather. The effects are dependent on both the primary tanning chemistry and the retanning reactions [1,2]. Vegetable tannins materials are widely employed for retanning side leather and they are occasionally used in calf and goatskin in leather productions. They are

also widely employed as general mordants for the production of dry crust tanned chrome leathers. They are cheap, readily, good filling agents, and make the grain hydrophilic. The condensed tannins, such as mimosa or quebracho, reduce the chrome characteristics only very slightly but give leathers of poor fastness.

The leather tanning in the modern leather industry is dominated by chromium salts, because it gives leather unmatched hydrothermal stability and excellent organoleptic properties. However, the problem of the pollution caused by chromium is being questioned. Traditional tannages are thus considered as suitable alternatives for a chrome-free tanning system [3].

Aim of the Study

Thus, this study aimed to use *Acacia seyal* bark as alternative re-tanning material instead of *Acacia nilotica* (*Garad*) which is commonly used in traditional tanning for the production of lining leathers (*Ajaco*) that used in tradition shoes making (*Markoob*).

Materials and Methods

Study area

North Kordofan State lays between latitudes 27°13' - 32°24' E and longitudes 11°20' - 16°36' N in area of 25 million hectares. Out of this area, 14.5 million hectares are rangelands. The state is considered among the leading regions of Sudan in terms of animal and range resources, where more than 60 millions heads of sheep, goat, camel and cattle are raised. Animal production in the state is mainly practiced under traditional extensive systems, depending on natural rangelands [4]. The average monthly temperature according to Nimer [5] was 34.60°C, and the coldest months were December and January with mean temperatures of 14.10°C and 13.50°C, respectively. The hottest months were April, May and June with an average mean temperature exceeding 40°C. The soil of the State lies within the sand dune area, these soils are inherently poor, but their high permeability and easy penetration of roots, compensate for their inherent poverty [4].

Experiment sampling method

Twenty pieces (20) of fresh goat skins with similar size were taken randomly. The skins were divided into four groups (5 pieces for each group). *Acacia seyal* bark (*Talh*) powder was added at a rate of 10%, 20% and 30% from skins weights for each of the first, second and third group respectively. The fourth group was tanned by *Acacia nilotica* pods (*Garad*) in the same way that used in traditional tanning as control.

Tanning procedures

Skins were tanned according to the following steps:

- 1. Soaking and unhairing:** Goat's fresh skins were weighed, washed with common water. For unhairing process Calcium hydroxide (CaOH_2) was added. Samples were stirred daily for a quarter of an hour (15 minutes), then stopping the stirring for half hour (30 minutes) in order to allow the skin to absorb the dissolved lime (CaOH_2). The process was repeat until skins hair lost or receded in the solution, due to the chemical process that occurred between the skin and the lime. Then the skins were taken from the solution and spread out on a wood platform and hair removed out with a scalding knife.
- 2. Fleshing:** For this process, the pigeons or poultry feces collected and left for a whole day for good fermentation. Samples were dipped in the fermented solution and left over night. Subcutaneous layer (adipose layer) were removed using a sharp knife. After this process, samples were washed and weighed again.

- Tanning stage:** *Acacia seyal* bark (Talh) powder was added at a rate of 10%, 20% and 30% from skins weights for each of the first, second and third group respectively. The fourth group was tanned by *Acacia nilotica* pods (Garad) and it added *ad-libitum*. Water added as 100% of samples weights and left over night for each group.

Samples evaluation method

The tanning efficiency, flexibility, strength, elasticity and colour were evaluated after tanning for each piece of the produced leather separately. Study samples were presented to 10 experienced workers in the field of leather manufacturing. Especially craftsmen whom works in traditional shoes (*Markoub*) manufacturing, for their practical knowledge about leather quality, tanning efficiency and its specifications. It was evaluated under five ratings, namely: Excellent, Very Good, Good, Acceptable and Poor. These evaluations were converted into graded numbers from the number 5 for the excellent, 4 for the very good, 3 for the good, 2 for the acceptable and 1 for the poor, in order to facilitate their analysis and statistical treatments.

Statistical analysis

Complete Randomized Design (CRD) was used for data analysis, and then the least significant difference LSD test was used for mean comparison.

Results

Tanning efficiency evaluation

The statistical analysis of the evaluation revealed that there were significant differences ($p \leq 0.01$) in tanning efficiency between *Acacia nilotica* pods and *Acacia seyal* bark tanning. Tanning with *Acacia nilotica* pods reported the highest significant evaluation of tanning efficiency over tanning with *Acacia seyal* bark. The rating was between excellent and very good with an average of 4.7. As for *Acacia seyal* bark tanning, there were no significant differences between the leathers tanned with the bark in the three percentages (10%, 20% and 30%). Their evaluations were between poor and acceptable tanning with averages of 1.2, 1.1 and 1.2, respectively (Table 1).

Samples	<i>Acacia seyal</i> Bark 30%	<i>Acacia seyal</i> Bark 20%	<i>Acacia seyal</i> Bark 10%	<i>Acacia nilotica</i> pods
1	1.3	1.3	1.2	4.8
2	1.4	1.4	1.1	4.7
3	1.3	1.3	1.2	4.5
4	1.5	1.3	1.0	4.4
5	1.2	1.1	1.2	4.7
Mean	1.34 ± 0.07 ^b	1.28 ± 0.06 ^b	1.14 ± 0.05 ^b	4.62 ± 0.07 ^a

Table 1: Leather tanning efficiency evaluation of *Acacia seyal* bark and *Acacia nilotica* pods tanning.

Means with different superscripts differ significantly at 0.01.

1, 2, 3, 4 and 5 represent Poor, good, very good and excellent respectively.

Leather colour evaluation

There were significant differences ($p \leq 0.01$) between *Acacia nilotica* Pods tanning and *Acacia seyal* bark tanning in it is three tanning rates of 10%, 20% and 30%. The average rating was between very good and good in leather colour for *Acacia nilotica* Pods tanning, with an average of 3.80. Where the evaluation of leather colour was good for *Acacia seyal* bark tanned leathers at 30% of its weight with an average of 2.96. But It was between acceptable and poor for *Acacia seyal* bark tanned leathers by 10% and 20% with averages of 1.24 and 1.96, respectively (Table 2).

Leather strength and stout evaluating

The statistical analysis results showed that, there were significant differences ($p \leq 0.01$) in leather strength and stout between *Acacia nilotica* Pods tanning and *Acacia seyal* bark tanning. Averages were between excellent and very good (4.1) for leather that tanned with

Samples	<i>Acacia seyal</i> Bark 30%	<i>Acacia seyal</i> Bark 20%	<i>Acacia seyal</i> Bark 30%	<i>Acacia nilotica</i> pods
1	3.2	2.8	1.0	4.9
2	2.9	2.4	1.3	3.6
3	2.8	1.7	1.4	4.0
4	2.8	1.3	1.1	3.0
5	3.1	1.5	1.4	3.5
Mean	2.96 ± 0.14 ^d	1.94 ± 0.14 ^c	1.24 ± 0.08 ^b	3.80 ± 0.15 ^a

Table 2: Leather colour evaluation of *Acacia seyal* bark and *Acacia nilotica* pods tanning.

Means with different superscripts differ significantly at 0.01.

1, 2, 3, 4 and 5 represent Poor, good, very good and excellent respectively.

Acacia nilotica Pods. However, there were no significant differences between *Acacia seyal* bark tanned leathers. Their evaluations were ranged between acceptable and poor in the three percentages (10%, 20% and 30%) with averages of 1.34, 1.42 and 1.82, respectively (Table 3).

Samples	<i>Acacia seyal</i> Bark 30%	<i>Acacia seyal</i> Bark 20%	<i>Acacia seyal</i> Bark 30%	<i>Acacia nilotica</i> pods
1	1.9	1.7	1.4	4.1
2	1.1	1.2	1.2	4.2
3	1.4	1.7	1.7	3.9
4	2.1	1.2	1.2	4.2
5	2.6	1.3	1.2	4.1
Mean	1.82 ± 0.16 ^b	1.42 ± 0.18 ^b	1.34 ± 0.09 ^b	4.10 ± 0.13 ^a

Table 3: Leather strength and stout evaluation of *Acacia seyal* Bark and *Acacia nilotica* pods tanning.

Means with different superscripts differ significantly at 0.01.

1, 2, 3, 4 and 5 represent Poor, good, very good and excellent respectively.

Leather flexibility evaluation

Significant differences ($p \leq 0.01$) in leather flexibility between *Acacia nilotica* Pods tanning and *Acacia seyal* bark tanning were detected among leather samples. The highest average rating was between excellent and good (4.76) for leather tanned with *Acacia nilotica* Pods. However, the evaluation averages ranged between acceptable and poor for skins tanned with *Acacia seyal* bark (10%, 20% and 30% of leather weights), and their averages were 1.02, 1.12 and 1.54, respectively (Table 4).

Samples	<i>Acacia seyal</i> Bark 30%	<i>Acacia seyal</i> Bark 20%	<i>Acacia seyal</i> Bark 30%	<i>Acacia nilotica</i> pods
1	1.6	1.0	1.0	5.0
2	1.9	1.1	1.0	4.2
3	1.4	1.1	1.0	5.0
4	1.2	1.2	1.1	4.7
5	1.6	1.2	1.0	4.9
Mean	1.54 ± 0.11 ^c	1.12 ± 0.05 ^c	1.02 ± 0.02 ^b	4.76 ± 0.08 ^a

Table 4: Leather flexibility evaluation of *Acacia seyal* bark and *Acacia nilotica* pods tanning.

Means with different superscripts differ significantly at 0.01.

1, 2, 3, 4 and 5 represent Poor, good, very good and excellent respectively.

Leather elasticity evaluation

Table 5 shows the results of the experienced craftsmen, whom works in the field of leather manufacturing; evaluation for the study leather samples. Statistically there were significant differences ($p \leq 0.01$) in leather elasticity between *Acacia nilotica* Pods and *Acacia seyal* bark tanning. The highest average rating between excellent and good was 4.66 for *Acacia nilotica* Pods tanned leathers. However, the evaluation ranged between acceptable and poor for *Acacia seyal* bark tanning with rates of 10%, 20% and 30%, and their averages were 1.24, 1.28 and 1.32, respectively, without significant differences between the different percentages of *Acacia seyal* bark tanning.

Samples	<i>Acacia seyal</i> Bark 30%	<i>Acacia seyal</i> Bark 20%	<i>Acacia seyal</i> Bark 30%	<i>Acacia nilotica</i> pods
1	1.2	1.4	1.2	4.8
2	1.4	1.1	1.1	4.6
3	1.4	1.3	1.2	4.4
4	1.5	1.5	1.5	4.8
5	1.1	1.1	1.2	4.7
Mean	1.32 ± 0.08 ^b	1.28 ± 0.08 ^b	1.24 ± 0.07 ^b	4.66 ± 0.08 ^a

Table 5: Leather elasticity evaluation of *Acacia seyal* bark and *Acacia nilotica* pods tanning.

Means with different superscripts differ significantly at 0.01.

1, 2, 3, 4 and 5 represent Poor, good, very good and excellent respectively.

Discussion

The quality and efficiency of tanning is assessed by the extent penetration of the tanning material into skins or hide fibres. Also, it gives the skin the ability to resist all natural conditions of moisture, heat, etc. Tanned leather becomes a stable material that is not subject to putrefaction and has a longer life than raw un-tanned leather. The efficient tanning enables tanned leather to resist bacteria.

The quality and efficiency of *Acacia nilotica* pods (Garad) tanning were evaluated between excellent and very good. As for tanning with *Acacia seyal* bark (Talḥ) the evaluation ranged between poor and acceptable tanning. Therefore, the use of *Acacia seyal* bark as a vegetable tanning material in traditional tanning did not give complete tanning as a basic tanning material according to the evaluator's assessment. However, it can be used as a complementary tanning material after tanning with *Acacia nilotica* pods (Garad) in traditional tanning or after mineral tanning with chrome in modern tanning as re-tanning materials as mimosa, quebracho and other materials known internationally as vegetable tanning materials. It can be replaced by those materials or used as an alternative to them, thus saving the cost of importing these materials. *Acacia seyal* bark is not suitable for full vegetable tanning in traditional tanning where only the vegetable tanning material is used. This is in agreement with [7] who found that the percentage of tanning material (Tanin) in *Acacia seyal* bark is equivalent to (20.4%) and therefore it can be considered as a tanning material and successful use as re-tanning material. Also, this result is in line with Ebrahiem [6] who mentioned that *Acacia seyal* bark can be dissolved and extracted to give a tanning powder that replaces the mimosa and quebracho. This also corresponds to what was stated by Musa., *et al.* [8] who mentioned that the suitable use of *Acacia seyal* bark is as alternative material in re-tanning operations, meaning that it can complement tanning.

Natural vegetable tanning materials extracted from some trees, they give the leather different colours after tanning. Mimosa gives the brown-red; quebracho gives the orange colour. Synthesized Syntan or ZymexR considered as one of the most expensive tanning materials due to the wide possibility of colouring in various colours, especially white and bright colours. However, *Acacia seyal* bark which used in this study as re-tanning material gives a distinctive red colour extended from bright red to dark red depending on its concentration rate used. The leather acquired bright red colour when tanned with *Acacia seyal* bark by 10% of the skin weight to dark red when tanned by 30%.

This result shows that tanning with *Acacia seyal* bark, especially at 30% of the skin weight, produced a good colour when compared to the colour obtained from *Acacia nilotica* tanning. The red colour enhances and reduces the use of colouring pigments, especially in producing the lining leather which commonly in Sudan coloured in red. The lining leather which traditionally known as (Ajco) is used in the traditional shoe's making (Sudanese Markoob). This is in agreement with Musa., *et al.* [8] who stated that re-tanning with *Acacia seyal* bark enhances the intense pigmentation and standardizes the dyeing.

As for leather strength and stout, the average evaluation for tanned leathers with *Acacia seyal* bark was between acceptable and poor. This contradicts what Musa., *et al.* [8] reported; tanning with *Acacia seyal* bark improves the fullness and smoothness of the leather.

Leather Flexibility is one of the specifications required for leather manufacturing. So, the more flexible leather can be formed into multiple and wide variety of leather products. In shoes manufacturing, leather Flexibility measured the life time of the shoe, its ability to take the shape of the foot and the possibility of bending when moving with the shoe. In the study, leather Flexibility averages were rating between acceptable and poor for *Acacia seyal* bark tanned leathers. The produced leather was tough and not flexible this result may occur as a result of incomplete tanning in addition to lime not removing in traditional tanning. But when *Acacia seyal* bark used as a re-tanning material modern tanning, leather flexibility may be good at the time for the possibility of removing lime and adding the sulphurous oils in the two stages of removal. The inflexibility assessed in this study contradicts what Musa., *et al.* [8] reported; the using of *Acacia seyal* bark improves the fullness and smoothness of the leather.

More Elastic leathers are considered one of the undesirable qualities, especially in shoes and leather belts manufacturing. When elasticity is more than necessary, the produced shoes not take a fixed or sagging form and leather belts is not tight and expands. But elastic

leather used in manufacturing of garment leather such as swedish leather. The results of the evaluation of experienced leather indicated that the average of the evaluation was between acceptable and poor for *Acacia seyal* bark tanned leather. This may be due to incomplete tanning when using *Acacia seyal* bark which resulted in inelastic, dry and thus less flexible leather.

Conclusion

The using of *Acacia seyal* Bark (Talh) as a vegetable tanning material in traditional tanning did not give a complete tanning as a basic tanning material. But it can use as a complementary tanning and dyeing material in traditional tanning after *Acacia nilotica* pods (Garad) tanning or as a re-tanning material in modern tanning after the chrome tanning which enhances in intense dyeing and coloring.

Bibliography

1. Ali SB., *et al.* "Haraz Bark Powder Extract for Manufacture of Nappa Upper Leather as Alternative Retanning Agent". *Journal of Forest Products and Industries* 2.5 (2013): 25-29.
2. Covington AD. "In Tanning chemistry: the Science of leather, published by the Royal Society of Chemistry (2009): 348.
3. Musa AE and Gasmelseed GA. "Green technology for leather manufacturing: Combined organic tanning based on garad and glutaraldehyde". 10th AICLST, Okayama, Japan (2014).
4. Abdelkarim RE and Ebrahiem MA. "Effect of Some Sudanese Traditional Hot Iron Branding on Cattle Hide Quality". *Turkish Journal of Agriculture- Food Science and Technology* 4.12 (2016): 1169-1172.
5. Nimer AM. "Effect of *Acacia Senegal* (L.) Willd., on sandy soils and Assessment of its foliage Nutrient. Case Study of Demokeya forest". Northern Kordofan. M.Sc. Thesis, University of Khartoum, Sudan (2000).
6. Ebrahiem, Mohammed Alhadi. "Defects and grading of hides and skins in Kordofan region (2015).
7. Hussin Selma Abd Elrahman. "Utilization of Tannins Extract of *Acacia Seyal* Bark (Taleh) In Tannage of Leather". PhD Thesis. Sudan University of Science and Technology- Collage of Graduate Studies- Khartoum, Sudan (2009).
8. Musa AE., *et al.* "Application of vegetable bark extract as alternative retanning agent for leather processing (2019).

Volume 6 Issue 1 January 2021

All rights reserved by Mohammed Alhadi Ebrahiem., *et al.*