International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 8 No. 2 Sep. 2014, pp. 883-890

http://www.ijias.issr-journals.org/

The Prospects of Using Basic Dyes to Extend the Colour Range of Vegetable Tanned Leathers from Bolgatanga

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ABSTRACT: Leather tanning with vegetative materials is one of the artisanal preoccupations of some craftsmen in the Upper East Region of Ghana. The leathers produced are however, limited to only three colours; brown, white and black. Their usage in multi-coloured applications by leather crafters in the region is therefore very much restricted. Some of the artisans therefore import leathers from other leather producing communities outside Ghana to supplement the local ones. This stifles the growth of the industry and robs the region and the country of the much needed foreign exchange. This experimental research therefore explored the use of basic dyes, which are cheap and readily available in the area, to extend the colour range of the vegetable tanned leathers manufactured in the region. The research showed that even though the dyed leathers were quite fugitive when exposed to extreme sunlight; and were not dyed-through thoroughly, the affinity of the dyes to the grain and flesh sides of the leathers were admirable. The leathers also exhibited excellent colour brilliance, softness and flexibility. It was found out that the dyed leathers could be suitably used in crafting utilitarian articles such as hand bags, shoulder bags, belts, mobile phones cases, neck pouches, mats, slip-ons, puffs, attaches cases and wallets.

KEYWORDS: Leather dyeing, Bolga leather, Basic dyes, vegetable tanned leather, dyeing with basic dyes

1 INTRODUCTION

Human beings since time immemorial have been influencing their environments, objects and materials with colours. Various colouring substances were used in many cultures to define varied cultural and traditional behaviours, enliven ambiances, as well as add value and panache to products. Indeed colour is known to be the crucial criterion used by many in selecting products the world over; its ability therefore to determine the success of a product cannot be belittled.

Prior to the development of synthetic dyes in the 1850s, colouring substances sourced from natural sources such as plants, animals and earth materials were the major colouring agents used to impart colour to leather, paper, textiles and many other materials by dyers and colourists [1], [2], [3]. Reference [1] details that around the middle part of the 19th century; synthetic dyes became readily available to many dyers, due to the pioneering works of Perkin in developing the relevant synthetic substances. It is known that many synthetic dye varieties such as pigmented dyes, mordant dyes, azine dyes, acid dyes, amphoteric dyes, anthraquinone dyes, azo dyes, direct dyes, sulphur dyes, just to mention a few, were used over the years to colour leather. Reference [4] however, reports that 90% of all leathers dyed currently the world over, were processed using azo dyes or dyes containing azo chromopore. It is also on record that basic or cationic classes of dyes were the initial synthetic colourants used to dye leather commercially; employing the drum, open vessel, paddle and immersion dyeing methods [5]. Reference [5] advances that basic dyes possess important qualities such as excellent colour brilliance and intensity.

Dyes generally, are staining substances which are employed in imparting colour to materials such as leather, textiles and paper in such a way that would not allow the dyeing substances to be easily removed through actions such as washing, heating, exposure to light and other atmospheric factors [2]. Dyeing therefore is basically the technique of depositing

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coloured substances "on another substance in an insoluble form from a solution containing the colorant" [6]. Leather dyes are classified into two main categories; the spirit or alcohol-based dyes and water-based varieties [7]. Reference [7] elaborates that alcohol based dyes easily penetrate deep into the moist leather promptly, giving a leveled finishing to the leather and protecting it from insect attacks. The author expatiates that whiles water based dyes retain the relevant qualities of the leather, the spirit based dyes tend to stiffen the leather, masks the natural smell of the leather, and fleeces off most of its natural qualities.

Basic dyes (cationic dyes) are dyes with positive charges in their molecule [5], [1], [8]. Reference [1] adds that the term "basic" was applied to these classes of dyes because the "dyes can be converted into water-insoluble dye bases by addition of alkali". Generally, because basic dyes are cationic or positively charged stains, they tend to have good affinity with materials which are anionic or negatively charged [9].

Cationic dyes are essentially good for dyeing vegetable tanned leathers because the tannin, which is the active agent usually used in converting pelts into vegetable tanned leathers, reacts favourably with the residual tannic acid in the leather, converting the dye into insoluble compounds, thereby doing away with mordants, which are needed to fix the dye onto the leather [8], [9].

From another dimension, basic dyes, apart from being reasonably cheap and available in wide colour ranges, also possess admirable properties such as excellent tinctorial abilities, good brightness and deep colour intensity, compensating for its generally poor light and wash fastness [8], [10].

2 RESEARCH PROBLEMS

Bolgatanga, the regional capital of the Upper East Region of Ghana has gained reputation as one of the very few communities in Ghana, noted for the production of leather, using vegetative materials and animal skins and hides found in the locality. These leathers are purchased and used by many leather crafters around the country to create various exquisite leather articles for local consumption and to feed the tourist market. The leathers which are fondly called "Bolga leather" are also used extensively to reinforce the handles of the popular grass woven "Bolga baskets" for export. This makes the Bolgatanga leather industry one of the major income earners of the region.

The leather products found in Bolgatanga and its environs are however constricted to only three colours namely; cinnamon brown, white and black [11]. Obviously, leather articles on the market could only be seen in the above mentioned colours; limiting their application in multi-coloured creative works. A baseline study conducted by the researcher on this limitation in the Upper East Region revealed that many leather crafters are therefore gradually importing leather from Burkina Faso and other leather producing regions to meet the demands of their clients. This obviously is robbing the region and for that matter the country of employment avenues and the needed revenue to develop the country.

The objectives of this research therefore are; to experiment with basic dyes, which are relatively cheap and readily available on the Ghanaian market, on some vegetable tanned leathers from Bolgatanga and its environs; and to observe the degree of levelling, colour shade and affinity of this class of dyes on the dyed leathers. The research also sorts to study the suitability of the dyed materials in crafting utilitarian objects such as hand bags, belts, mobile phones cases, neck pouches, mats, slip-ons, puffs, attaches cases and wallets, which are usually the favourite items crafted by the leather craftsmen in the Region.

3 MATERIALS AND METHODS

The experiment was conducted by the researcher himself with assistance from 22 selected students, studying leatherwork at the Industrial Art Department of Bolgatanga Polytechnic.

3.1 MATERIALS AND EQUIPMENTS

One hundred and fifty pieces of crust leathers (15 bundles) purchased from Yikene, Nawomaya and Tanzui, all in the Bolgatanga Municipality, were used for the experiment. Basic dyes (assorted colours), detergents and common salt were equally bought from the Bolgatanga central market for the study. Other materials and tools employed during the experiment were a weighing scale, rubber gloves, dust masks, stainless steel crucibles, plastic basins, plastic buckets and bowls, plastic spoons, plastic squirt bottles, gas cylinders and burners as well as plastic sheeting.

3.2 METHODS

The two main dyeing methods used to impart colour to the vegetable tanned leathers were the immersion and pouring techniques. Patterns were effected into the leathers using the scrunching (crumpling) and tie and dye techniques. The third varieties of leathers were however dyed into assorted single-solid coloured hues. Details of the various methods employed during the experiment are captured below.

Fig. 1. Crust leather

4 EXPERIMENTS

4.1 TIE & DYE (EXPERIMENT 1)

The leathers to be dyed were weighed on the weighing scale. For a pound of leather, a tablespoonful of powdered dye was used. Prior to the actual dyeing processes, the leathers were soaked in a plastic basin with detergent for 30 minutes and subsequently washed and rinsed. This was to remove any dirt or sizing that might impede the absorption of dye.

In preparing the dye liquor, the powdered dye was measured and poured into a plastic bowl, after wearing the relevant plastic gloves and a nose mask to ensure that dye particles were not inhaled nor the hands soiled unnecessarily. The dye was subsequently mixed with half-litre cup of warm water and stirred thoroughly to ensure that all lumps dissolved into the liquor. The dye-bath was constituted by mixing the dye-liquor with 10 litres (2.5 gallons) of hot water in a plastic basin. Two tablespoonful of salt (sodium chloride) was dissolved in a cup of water and mixed with the dye-bath.

The moist leathers were spread on a plastic covered table and various parts of the leathers were randomly pinched and raised into vertical tufts. The raised tufts were bound with nylon threads firmly to resist dye penetration during the dyeing process (fig. 2. right). The moist tied leathers were then carefully lifted from the table and lowered into the dye-bath for dyeing. The goods were carefully agitated in the dye-bath constantly to ensure adequate dye penetration. The materials were dyed for 45 minutes before being taken out of the dye-bath and dried in a shady area. The dyed leathers were then allowed to drain for 30 minutes after which they were rinsed thoroughly in a basin filled with water and detergent and again allowed to drain. The nylon threads were then removed and the dyed leathers washed thoroughly with detergent to ensure that all unfixed dye pigments washed away and finally rinsed in clear water. The goods were then wrung and dried.

Fig. 2. Scrunched leather (left) Tied leather (right)

4.2 SCRUNCHING /CRUMPLING (EXPERIMENT 2)

The leathers to be dyed were weighed, soaked and washed with detergent and rinsed in water before dyeing. Excess water was wrung from the goods before spreading them on a plastic sheet on the working table. The moist leathers were systematically scrunched into a flat compact mass with the fingertips and the palm (fig. 2. left). The scrunched leathers were then lifted carefully from the table into a plastic basic.

A tablespoonful of the desired dye was measured into a plastic mixing bowl and pasted with a liberal amount of warm water into smooth paste. Subsequently, a liter cupful of hot water was poured onto the pasted dye and allowed to stand for 20 minutes. The dye solution was then poured into plastic squirt bottles and cautiously squirted onto the scrunched goods. The scrunched leathers were dyed in both monochromatic and polychromatic colours. The dye solution was allowed to infuse into the leather for 45 minutes before lifting the scrunched mass out of the plastic basin onto a plastic sheet-covered board. The board was inclined to allow the residual dye solution to drain from the goods. The dyed materials were then allowed to drain for one hour before being washed with detergent adequately and rinsed in clear water. The material was afterwards dried. To get polychromatic colours, the various dyes were mixed separately and squirted one at a time, beginning with the lighter colours onto the scrunched leathers.

4.3 SINGLE-SOLID SHADE DYEING (EXPERIMENT 3)

In this final experiment, the leathers were duly weighed and prewashed as was done in the earlier experiments before dyeing. Sequentially, a tablespoonful of the desired dye was measured into a plastic container and mixed with a cup of warm water into dye-liquor. Twelve litres of hot water was poured into a plastic basin and constituted with two tablespoonful of dissolved common salt. The prepared dye-liquor was afterwards poured into the mixture to complete the preparation of the dye-bath. The moist leathers to be dyed were lowered into the dye-bath and dyed for 45 minutes. The goods were constantly agitated to ensure that they absorb the dye evenly into a solid shade without mottling. After adequately dyeing, the products were removed from the bath, wrung and dried. The dried goods were thereafter washed exhaustively with detergent and rinsed in clear water, wrung slightly and dried.

Fig. 3. Dyeing of leather (left), Washing of leather (middle) and Drying of leather (right)

4.4 FINISHING

After adequately drying the dyed leathers, they were finished off by staking, waxing and burnishing. The staking process involved rolling one end of the leather around a smooth stick and dragging the other end between two smooth pieces of wooden boards. After adequately staking the leathers, the grain sides were slightly rubbed with paraffin wax and dried in the sun for 10 minutes. A piece of cotton cloth was used to spread the wax on the grain sides of the leathers after which they were burnished with the outer parts of an empty bottle into a smooth glaze-like finishes.

5 RESULTS AND DISCUSSIONS

In all 150 pieces of leathers were dyed in various shades of yellow, red, green, orange, blue, violet, brown, black and pink in single solid colours as well as tie and dye and scrunched patterns.

Generally, it was noticed that colours such as yellow, orange, red, brown and pink leveled out readily on the leathers after single dyeing procedures. The darker colours on the other hand were dyed twice before leveling out well on the leathers. A cross sectional cut of some of the leathers revealed that the dyes did not thoroughly penetrate the entire body of the leathers. This conclusion was arrived at because thin whitish lines could be seen within the fibrils of the leather at cross section, after the cross sectional cut. The dyes however exhibited excellent affinity to the grain and flesh sides of the leathers in brilliant attractive shades of colours.

During the washing stages, it was realized that the darker shades such as navy blue, black, and green bled a lot. Leathers dyed in these colours were washed twice with detergent and rinsed tree times to ensure that crocking was brought to the barest minimum.

After staking and burnishing, all the dyed leathers exhibited appreciable flexibility and softness. It was observed that waxing the grain sides of the leathers also improves their resistance to water and soiling considerably.

Most of the dyed leathers were crafted into basic articles such as hand bags, shoulder bags, belts, mobile phones cases, neck pouches, mats, slip-ons, puffs, attaches cases and wallets. These items were exhibited to draw response from spectators. Some selected number of dyed leathers and articles produced from the experiment are captured below.

Fig. 4. Selected tied & dyed leathers

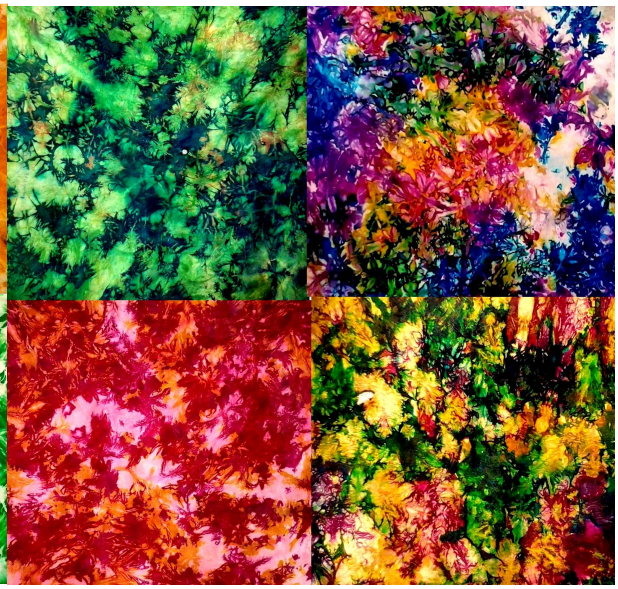

Fig. 5. Selected scrunched leathers

Fig. 6. Selected single-solid colour dyed leathers

Fig. 7. Assorted bags

Fig. 8. Slip-ons

Fig. 9. Puffs, mat & utility carrier

Fig. 10. Neck pouches & Mobile phone cases

Because basic dye is reputed for exhibiting poor light fastness; during the study, pieces of the dyed leathers were exposed to extreme sunlight for 60 days in March and April, when temperatures range between 40 – 50 degrees Celsius in Bolgatanga [12] in order to have a fair idea of the light fastness properties of the dyed leathers. After this period, it was realized that most of the leathers faded off slightly. Lighter colours such as yellow, orange and pink were particularly affected. This finding supports the assertions of [8] and [10] concerning the fugitive characteristics of basic dyes.

6 CONCLUSIONS AND RECOMMENDATIONS

The study demonstrated that basic dyes could be used in extending the colour ranges of the vegetable tanned leathers currently processed in Bolgatanga and its environs. Even though the research reveals that the dyes could not penetrate the entire body of the leathers dyed, its excellent affinity to the grain and flesh sides of the leathers makes it worthy of consideration for use by the tanners of the Upper East Region of Ghana. It has been demonstrated during the research that leathers dyed with basic dye could be used in crafting various articles for the market. It is anticipated that by processing these multi-coloured leathers commercially to feed the local industry, the leather crafters would be able to produce innovative products to feed the local and international markets. This would create employment avenues for the youth,

generate substantial income to boost the living conditions of the artisans and bring in the much needed foreign exchange for the region and the nation as a whole.

There is the need to subject the dyed leathers to mechanical light and rub fastness tests to determine exactly the degree at which the colour shades could be lost over time to light exposure and rubbing. This would enable appropriate finishes to be applied on the dyed leathers to improve the above qualities.

REFERENCES

[1] Kanetkar, V., "Colour: history and advancements," *Resonance,* vol.15, Issue 9, pp 794 – 803, 2010.

[2] Stothers, J. B., *Dye*, In: Encyclopedia Britannica, 2014
[Online] Available: http://www.britannica.com/EBchecked/topic/174980/dye

[3] McCloy, H., *A brief history of dyestuffs & dyeing,* 2000
[Online] Available: http://kws.atlantia.sca.org/dyeing.html (Accessed 20 May 2014)

[4] Page, C. & Fennen, J., *What are leather dyes today? The relationship between the dye structure and its performance properties,* (n. d.) [Online] Available: www.tfl.com/web/files/whatareleatherdyestoday.pdf (Accessed 10 June 2014)

[5] Hunger, K. (Ed.), *Industrial dyes*: *chemistry, properties and applications*. Wiley-VCH Verlag GmbH & Co., Weinheim, Germany, 2003

[6] NicDhuinnshleibhe, S., *A brief history of dyestuffs & dyeing*, 2000
[Online] Available: http://kws.atlantia.sca.org/dyeing.html (Accessed 7 May 2014)

[7] Mukherjee, B., *Types of leather dyes*, 2011 [Online] Available: http://www.buzzle.com/articles/leather-dyeing-how-to-dye-leather.html (Accessed 12 June 2014)

[8] Kiron, M. I., *Properties of basic dye,* 2014 [Online] Available: http://textilelearner.blogspot.com/2012/01/basic-dyes-properties-of-basic-dyes.html (Accessed 29 May, 2014)

[9] Kolorjet Chemicals Pvt Ltd, *Basic dyes,* 2014 [Online] Available: http://www.dyes-pigments.com/basic-dyes.html (Accessed 19 May 2014)

[10] Burch, P., *About basic dyes*, 2013 [Online] Available: http://www.pburch.net/dyeing/basic_dyes.shtml (Accessed 2 June 2014)

[11] R.Wemegah, "Vegetable tanning in Bolgatanga: challenges and the way forward," *Arts and Design Studies*, Vol. 16: 27-37, 2014.

[12] Ghana Meteorological Agency, *Regional weather – Upper East Region*, 2014 [Online] Available: http://www.meteo.gov.gh/website/index.php?option=com_content&view=article&id=79:regional-weather-upper-east-region&catid=42:regional-weather&Itemid=62 (Accessed 13 March 2014)