

Elemental Comparison of African Balsam and Shea Butter Woods Ashes for Cloth Dyeing

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ABSTRACT: *Elemental comparison of wood ashes fixating materials in cloth dyeing has not been of scholarly attention, especially in Nigeria where studies have also excluded wood ashes for fixating agent for cloth dyeing. This study therefore elementally examined and compared ashes of African Balsam Woods (ABW) (Daniella Oliver) and Shea Butter Wood (SBW) (vitellaria paradoxa) and produced fixating agent with the selected woods with a view to providing scientific fixating agent for alternate synthetic fixating. Woods of each samples were harvested and processed into ashes stage as well as analysed with particle induce Energy Dispersive X-ray Meter (EDXM). Eleven elements: strontium, (Sr), Rubidium (Rb), Zinc (Zn), Copper (Cu), Nickel (Ni), Iron (Fe), Manganese (Mn), Chromium (Cr), Titanium (Ti), Calcium (Ca) and Potassium (K) were determined. Based on the ashes of each sample drenched in water fixating compositions were formulated and used with synthetic dyes. African Balsam wood ashes fixating agent work effectively with synthetic dyes in this study. The findings call for further studies on comparative of other woods ashes for the formulating of fixating agent to have more organic and unharmed fixating and jettison synthetic fixating agents.*

KEYWORDS: comparison, dyes, fixating, agent, wood.

INTRODUCTION

Dyeing arts are practice in almost six geo political zone in Nigeria, and it is referred to as “Adire” in Yoruba Language in South West geo political zone of Nigeria. Adire is derived from the two procedural method of producing dyeing cloth arts; *adi* to die and *re* to dye (Wolf 2011). Carr (2011) maintained that the name given to the arts relates to a specific ethnic group who are the producers of the cloth dyeing arts and that is also serves as a style designator of the group of origin. The art illustrate the meanings in Yoruba and the practice itself.

The origin of dyeing arts practices is mooted and Mohammed (2024) reiterated that the art was first practiced around 555-794 AD in Japan, Asia and Indonesia, while corroborating this, Guasa (2015), maintained that dyeing arts practices was discovered in China between 615 and 906AD. Pollakoff (1982) traceable the arts to unconscious practices with cloth and organic concoctions which later resulted to dyeing arts.

Kalilu and Areo(2013) delineate dyeing arts to *Orunmila* – The Yoruba deity of wisdom encounter with six fowls, namely: (*Aluko*) Metrops Nibicus, (*Agbe*) Lamprotonis, (*Odidere*) *Psitacus erithacus*, (*Akuko*) Cocks, (*Lekeeleke*) Adeola – Ibis and (*Agbufon*) *Halearica Pavomna* and the arts later resulted to dyeing arts. The art of dyeing is now a profession within the academia and non academia with various innovations in techniques and materials like fixating (non-organic), dyes, among others.

In the past, majority of materials in dyeing art were sourced from organic materials such as: leaves, plants barks, flowers, fruits among others. Standfield (1972) pointed out that dyes and its fixating components were derived from organic materials either by burning or drenching the selected items to get the dyeing materials for the arts. There are selected vegetables for specific colour the most commonly dyes in Yoruba land among the traditional dyes is indigo dyes. Dyes are substances that have the affinity characteristics to transform surface it come in contact with aid of fixating agents. Organic indigo and organic fixating are by far the most popular and widely practiced among the Southwest Nigeria, and the favourite dyes for indigenous dyers in Africa. Polakoff (1982), and Adekunle (2017) stressed that, the introduction of synthetic dyes and its fixating diverted the attention of the Yoruba dyers from the practice of dyeing arts with organic materials. Patterns and Motif were usually formed on the cloth which Adekunle (2017) also referred to as *adire* and non pattern *amure*.

Traditionally, dyeing art is practiced by women in Yorubaland and pattern, sequencing and motifs of the arts are usually handed over from mother to daughters within a family. There is therefore an accepted repertoire of motifs from which each artists learns. The artistry of each artists however, depends on her skills and capabilities. Modern items and contemporary techniques have entered into these repertoires in line with the sociocultural changes and fluxes being encountered by the people. Wolf (2001) and Kalilu (2013) observed that an inventory of motifs in the individual repertoire would run into hundreds. These patterns are in form of designed plants, figures, animals, living and non-living objects among others.

Pattern dyeing arts (*adire*) in one or more patterns is found in most parts of Africa with the formation of patterns with small and large circles found among the Yoruba and generally throughout West Africa with the use of organic dyes and fixating Adekunle (2017). Fixating agent is germane in dyeing art because it fixes dyes to the cloth, Yolocan (2009) reiterated that organic fixating agent is free of toxicology and other hazards that dyers encountered during dyeing practices.

In a related document Siroky *et.al* (2011) and Kumbasar *et.al* (2009) reiterated that organic fixating agent made dyes solidified and last on cloth dyed and free from hazards that dyers experienced from synthetic fixating agents. Debasree *et.al* (2017) and Aguley (2017) stressed that organic fixating agent are good enough for dyeing arts especially guinea cotton with patterns and motifs and it allow dyes to stay long on the cloth dyed. Organic fixating agents are produced from plants and vegetables parts in which this study attempted to produced fixating from two woods ashes.

Fixating agents were derived from wood ashes processed among the Yoruba of Southwest Nigeria and use along the organic dyes (Alexander 1997). The adoption of organic fixating agent for dyeing arts is no longer in vogue among dyers especially among the present generation of dyers. The plausible argument for this scenario in Nigeria is the desire for foreign synthetic dyes and synthetic fixating readily available in the local markets. This has consequently led to the neglect of the production of organic fixating agent from wood ashes and as well as made indigenous dyers lose thoughts with indigenous techniques and technology of producing fixating agent against the synthetic fixating.

Synthetic fixating agents are liable with various health hazards according to (ILO, 2008) and Ogunduyile (2001) posited that skin diseases such as: allergic contact, dermatitis, irritant of body, headaches, running nose and inflammation of mucous membrane have been associated with dyeing art practitioners. These have been associated with effects of synthetic fixating agents adopted in the art of dyeing. In a corroborative documents from Grosick (2004) and Haldiya *et.al* (2005) reported that there are 270 millions occupational/craft misfortunes and 160 millions were traced to the contact of fixating synthetic agents. Thousands of people engaged in the used of synthetic fixating agents without or with little knowledge of the side effects of it.

The harmful effects of synthetic fixating on human health has been reported severally. For instance, in the documents of Lipseit (2001), Kishore *et.al* (2008) craft workers authorities around the world have established safety regulations and guides to limit workers exposures to hydrosulphite and caustic soda at the studios by controlling the air concentration of it in the work environment and sensitising workers (textile dyers inclusive) to avoid unnecessary exposures to these fixating agent. This is partly justification for this study. The study provide fixating compositions for dyers to be used along with synthetic dyes from organic materials and are not harmful to health of the dyers and other users of synthetic fixating.

Dyeing art today encloses the use of fixatings such as caustic soda (NaOH) sodium hydro sulphite (CaCoH) and synthetic dyes among other dyeing materials. Examining these materials show that their use poses a great health challenges because they consist of diazonium salt and naphthol compound which, if inhaled, could lead to serious sneezing, suffocation and discomforts among other challenges. Morse, and Stanley (2009) posited that prolonged and excessive exposure to synthetic fixating substances can result in disabling diseases. This is not only relevant to Nigeria dyers who pay little attention to the fixating agent challenges but also to the textile dyers who find no fault into covering their nose and even use ordinary hand in their practices and other synthetic fixating.

Wood ashes process (alkali) has been used to serves as fixating composition for organic dyes alone for decades but no attentions are given to alternate the fixating derived from woods ashes processed with synthetic dyes. Also, the age long wood ashes fixating has not been elementally documented and compared with each others decades ago to ascertain the elemental componets of each which this study attempted. Against this foregoings, this study aim to determine the elements in the selected woods African Balsam(*Daniella Olliveri*) and Shea Butter(*Vittalaria paradoxa*) ashes. Specifically, the study sought to describe the types of wood ashes suitable for

fixating composition to replace for synthetic dyes fixatings. The study also estimated numbers of elements and compare its with each others for better comprehenssion.

MATERIALS AND METHODS

The study adopted two specific pruned woods illustrated in table 1:

Materials and Scope

Woods Names	Botanical Names	Local Names	Collection Centres	Status	Kg
African Balsam	<i>Daniella Olliveri</i>	<i>Iya</i>	Lautech Poultry Centre	Dried	13kg
Shea Butter	<i>Vitallaria Paradoxa</i>	<i>Molla</i>	Lautech Ceramics Laboratory	Dried	10kg 23kg

Source: Authors compilation from field works (2022)

Emulsification and Combustion

The selected woods were emulsified with detergent and water to get unwanted particles out of the selected woods. The woods were sliced into 2 by 2 inches then arranged in aluminium pot for combustion. The woods were combustion seperately with the use of LPG cooking gas as illustrated in table 2.

Table 2: Comparison of Woods combustion

Name of Wood	Weights	Hours for Combustion	Gas Adopted	Ashes Outpur
African Balsam	13kg	2hrs	2 ½ hrs	5kg
Shea Butter	10kg	2hrs	2kg	5 ½ kg

Source: Authors compilation from field work (2022)

Wood Ashes Analysis.

The two selected woods ashes elements were determined at Centre for Energy and Research Development (CERD) Obafemi Awolowo University Ile Ife, Nigeria with the use of Energy Dispersive X-ray Meter (EDXM). The samples were analysed and examined with the adoption of Ion Beam Analysis (IBA) with X-ray tube; Cu, Cr, Mo, 2.4kw and focus dimension of 1×10mm.

Woods Ashes Elemental Results.

For this study African Balsam Wood (ABW) and Shea Butter Wood (SBW) ashes were analysed and eleven (11) elements were both determined in the analysis as follows: Potassium (K), Calcium (Ca), Titanium (Ti) and Chromium (Cr). Other elements from the two studied

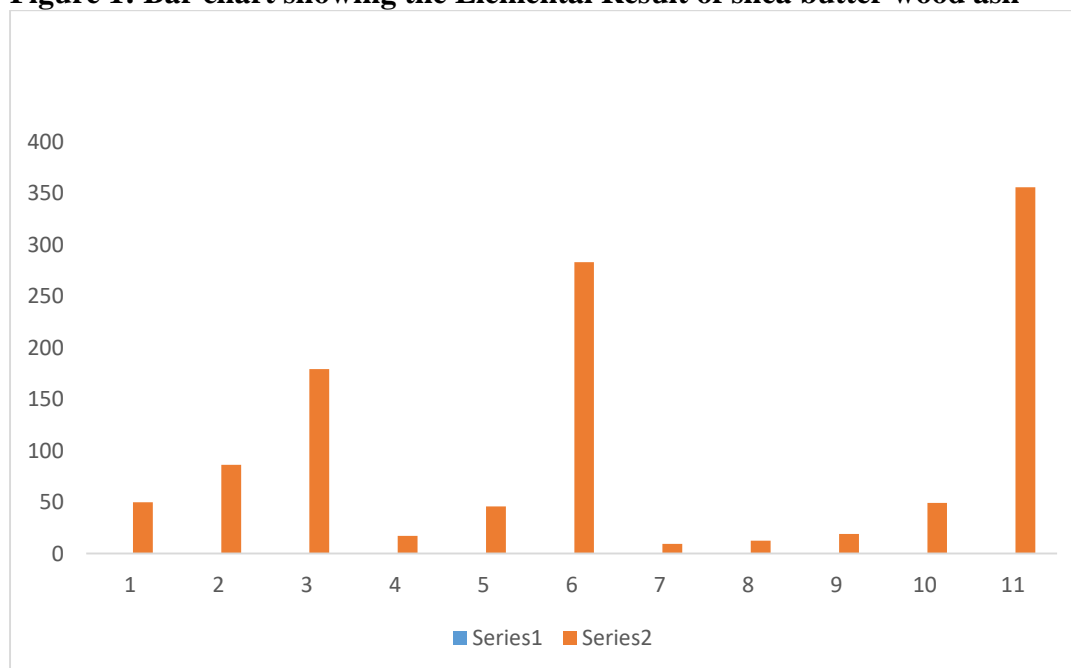
woods ashes are: Manganese (Mn), Iron (Fe), Nickel (Ni), Zinc (Zn) Rubidium (Rb) and Strontium (Sr) tables 3, 4 and figures 1 and 2.

Table 3: Shea Butter Wood Ash Elemental Analysis

S/N	Elements	Part per Million (ppm)	% Abundance
1	Potassium (K)	49.904	3.053%
2	Calcium (Ca)	86.314	6.835%
3	Titanium (Ti)	179.154	13.262%
4	Chromium (Cr)	17.024	13.024%
5	Manganese (Mn)	45.620	3.141%
6	Iron (Fe)	282.935	20.683%
7	Nickel (Ni)	9.394	0.853%
8	Copper (Cu)	12.480	1.123%
9	Zinc (Zn)	19.150	1.638%
10	Rubidium (Rb)	49.042	4.252%
11	Strontium (Sr)	355.882	31.205%
Sum of ppm		1106.899	
Sum of % Abundance			99.069%

Source: Author's classification compiled from field works (2022).

Figure 1: Bar chart showing the Elemental Result of shea butter wood ash

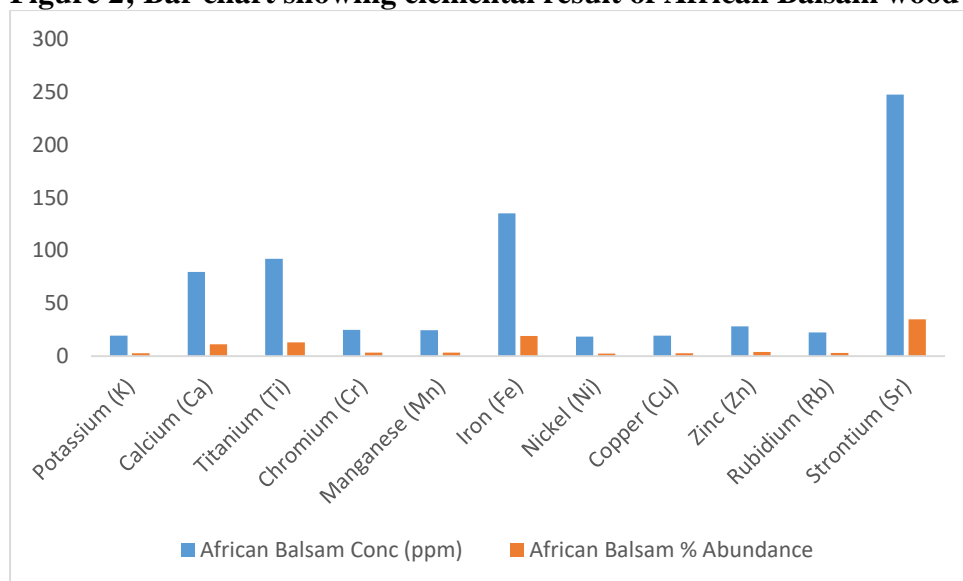


Source: Author's classification compiled from field works (2022).

Table 4: African Balsam wood ash Elemental Analysis

S/N	Elements	Conc (ppm)	% Abundance
1	Potassium (K)	19.321	2.713%
2	Calcium (Ca)	79.842	11.211%
3	Titanium (Ti)	92.265	12.955%
4	Chromium (Cr)	24.815	3.484%
5	Manganese (Mn)	24.668	3.464%
6	Iron (Fe)	135.112	18.972%
7	Nickel (Ni)	18.469	2.593%
8	Copper (Cu)	19.347	2.717%
9	Zinc (Zn)	28.11	3.947%
10	Rubidium (Rb)	22.525	3.163%
11	Strontium (Sr)	247.704	34.781%
Sum of ppm		712.178	
Sum of % Abundance			100.00%

Source: Author's classification compiled from field works (2022).

Figure 2; Bar chart showing elemental result of African Balsam wood Ash

Source: Author's classification compiled from field works (2022).

Table 5: Matrix for fixating production

Name of Wood Ashes	Kilogram	Drenched Hours
African Balsam Wood Ashes	2kg	48hrs
Shea Butter Wood Ashes	2kg	48hrs

Sources: Compilation from field work (2022)

Comparison of African Balsam and Shea Butter Wood Ashes Elements.

In the comparison of the eleven elemental results, potassium (K) of Shea Butter is (3.053%) while African Balsam Potassium element is (2.713%) African Balsam Wood Ash Calcium (Ca) is more pronounced than shea butter wood ash. Calcium (6.835%) to (11.21%). Titanium (Ti) elements of shea butter wood ashes and african balsam wood ashes are closely in appearance (13.262%) to (12.955%). Chromium of shea butter wood ashes are more pronounced (13.024%) than African Balsam Wood Ash Chromium (3.484%) is appeared faintly, In the comparison of manganese elemental components in both African Balsam Wood Ashes and Shea Butter Wood Ashes Manganese (Mn) appeared lightly (3.141%) and (3.464%). Iron (Fe) in African Balsam Wood Ash element is (18.972%) closely in appearance to Shea Butter Wood Ash Iron (Fe) element (20.638%). In the Shea Butter Ashes Nickel (Ni) element appear dotly and appear lightly in African Balsam (0.853%) to (2.593%). For copper (Cu) is appear lightly in both wood ashes studied (1.123%) to (2.717%). African Balsam Wood Ashes Zinc (Zn) element rated (3.947%) while Shea Butter Wood Ashes Zinc was analysed to (1.638%). Rubidium (Rb) of Shea Butter Wood Ashes is (4.252%) to (3.163%) of African Balsam Wood Ashes Rubidium results. The two woods ashes has Strontium (Sr) elements more pronounced, African Balsam Woods has (34.781%) and Shea Butter Wood Ashes has (31.205%)

Table 6: Studio Practice and Synthetic Dyes.

Name of Fixating	Quantity of Fixating	Quantity of Synthetic Dyes	Cloth Size
African Balsam	1 litre	20grm,(Navy Blue).	¼ 100% cotton
Shea Butter	1 litre	20grm,(Navy Blue).	¼ 100% cotton

Source: Authors compilation from field work (2022)

Dyes and Fixating Reactions

The selected wood ashes were sieved plate 3 and drenched in a plastic kegs to get fixating agent to alternate with synthetic dyes fixating for studio practices as illustrated in table 5. Two synthetic dyes were adopted to test the organic fixating of Shea Butter and African Balsam as illustrated in table 6. African Balsam Wood Ash fixating agent of one litre was mixed with the navy blue synthetic dyes of (2grms) and ($\frac{1}{4}$) one quarters of full cotton guinea was used to a alternate synthetic fixating dyes and synthetic dyes. The synthetic dyes adopted was vat dyes without concentration of synthetic fixating agent.

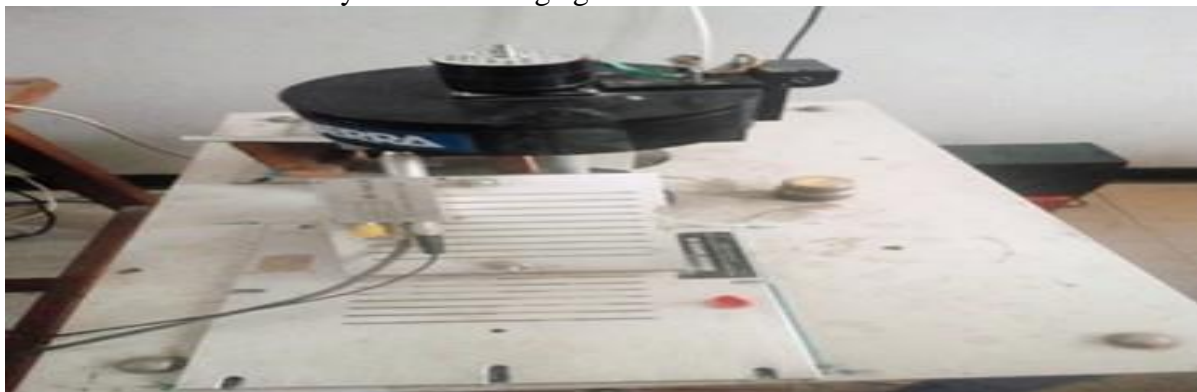


Plate 1; Energy Dispersive Micro Analysis Meter used for elemental analysis at CERD, OAU,Ile Ife. Photography by: Isiaka A,M.(2022)



Plate 2

Samples of unit of woods assembled in a pot for combustion.

Photograph by: Isiaka A. M (2022)



Plate 3

Filtering the Combusted woods

Photograph by: Isiaka A. M (2022)



Plate 4
Folding of samples cloth with rubber. Photograph by: Isiaka A. M (2022)



Plate 5
Mixture of alkali navy blue synthetic dye for cloth dyeing. Photograph by: Isiaka A. M (2022)

Shea butter wood ashes fixating products of one litre was mixed with the navy blue synthetic dyes of (2 grms) and ($\frac{1}{4}$) one quarter of full cotton guinea was used to alternate synthetic fixating with synthetic dyes plates 5.

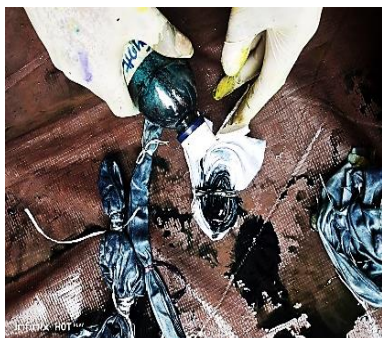


Plate 6
Applications of synthetic dyes for cloth dyeing. Photograph by: Isiaka A. M



Plate 7
Dyed cloth with African balsam alkali/ navy blue synthetic dyes Photograph by: Isiaka A. M

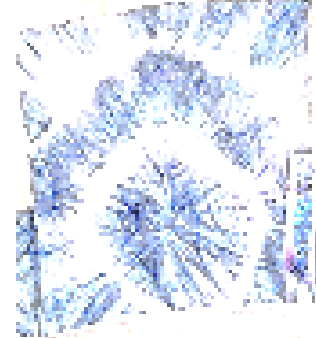


Plate 8
Dyed cloth with Shea Butter alkali/ navy blue synthetic dyes Photograph by: Isiaka A. M

The cloth and synthetic dyes.

The cloth adopted for this study was full cotton guinea and the guinea was soft basin and manufactured in Nigeria. Rubber bond was adopted to form motif on to the cloth before the application of dyes plate 4 and dyes kit was the instrument to smear the mixtures of dyes and fixating to the cloth plate 6. The weight is 1.5kg with FYCD001 and patterned.

The colour is white solid of HEX triplet number FFFFFFFF. The dyes adopted is navy blue synthetic dyes made by rung with package No. GST-27AAOPM2352B22W. The bleach rates of the two produced fixating was tested with detergent and the grades was illustrated in table 7. The visual foamy and bulbs observed during mixtures of the two studied ashes for the production of fixating were differs. Foamy and bulbs reactions of African Balsam Wood Ashes (ABWA) are more pronounced than Shea Butter Wood Ashes foamy and bulbs of this

study and the cloth dyed with african Balsam fixating fixed dyes perfectly more than Shea Butter fixating plates 7 and 8.

Table 7: Consequence of synthetic Green dyes on cloths with Alkalis

S/N	SYNTHETIC DYES	ALKALIS	BLEACHED RATES
1.	Synthetic Green	African Balsam	20%
2.	Synthetic Green	Shea Butter	20%

Source: Author's classification compiled from field works 2023.

CONCLUSIONS

African Balsam Wood Ashes(ABWA) fixating efficiently behaved in fixing syntheti dyes to the cloth than Shea Butter Wood Ashes(SBWA) fixating, and African Balsam Wood Ashes has all the eleven elements determined pronounced than Shea Butter Wood Ashes elements. The common results from the behaviour of two studied organic fixating was that no shrinkage of cloth occurred either in the width and length as well as patterned of the fabric adopted. However, it is hereby proposed that further studies on various wood ashes fixating agent to alternate synthetic fixating agent in dyeing art be carried out.

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