Volume : 2 | Issue : 9 | Sept 2013 • ISSN No 2277 - 8160

Research Paper | Home Science

Effects of Extraction Methods and Dye Fixatives on Colourfastness of Cotton Fabric Treated with Dyes Extracted From Cuberoot (Lonchocarpus Cyanescens), Plant

Ozougwu, S. U. DEPARTMENT OF HOME SCIENCE, NUTRITION AND DIETETICS, FACULTY OF AGRICULTURE, UNIVERSITY OF NIGERIA, NSUKKA

ANYAKOHA, E. U. DEPARTMENT OF VOCATIONAL TEACHER EDUCATION FACULTY OF EDUCATION, UNIVERSITY OF NIGERIA, NSUKKA

ABSTRACT

Effects of extraction methods and dye fixatives on colourfastness of cotton (100%) fabric treated with dyes extracted from cuberoot (Lonchocarpus cyanescens) indigenous plant was studied. Three types of dyes were extracted from cuberoot leaves using boiling, steeping and solvent methods and applied on cotton fabrics mordanted with aluminum potassium sulphate (alum), citric acid, tannic acid and non mordanted samples (control). Factorial experimental design was adopted by the study. Gray and Fastness Test Rating Scales (FTRS) were used to rate the extent of colour stain or fade. Data were analyzed using general linear model for factorial experiments and descriptive statistics. Analysis of Variance (ANOVA) was used to test a null hypothesis. Where significant difference(s) existed, Scheffe's post hoc test compared the treatment means at 0.05 probability level. Findings include; 43 prototype samples were colourfast. There were no significant differences in the mean rating effects of dye extraction methods (p>.05) but significant differences existed in the mean rating effects of dye fixing agents (p<.05) on colourfastness of prototypes at 0.05 level of significance. Tannic acid and alum mordant had exceptional improvements on fastness of the dyes.

KEYWORDS: Cube root plant, Dye Extraction, Mordant, Colourfastness, Cotton fabric

Introduction

The exploitation and utilization of dye from natural sources in recent time is a welcome development globally. The interest in natural dye is increasing probably due to their health and environmental benefits over some toxic, carcinogenic and non- biodegradable synthetic dyes (Jansen & Cardon,2005). Moreover, the ever increasing demand for dyes in sustainable supply to meet the ever increasing volume required in various sectors including textiles and clothing industries, leather and leather product, wood, food, paper and photography industries, pharmacology, medicine, educational institutions and homes (Grollier,1999; Chenghaiah, Rao, Kumar, Alagusundaram & Chetty, 2011) require that more research and development efforts be utilized to source dyes from natural sources. The greatest source of natural dyes has been from plant kingdom mainly from roots, stems, bark, leaves, flowers, calyces, seeds and resins. In many countries of the world, many studies have been done and are still going on dye extraction from plant sources for fabric colouration

In China, the 'Colour evaluation of wool fabric dyed with *Rhizoma coptidis* extract" was studied by Ke, Yu and Xu (2006). In Ethiopia, Jothii (2008), carried out a study on extraction of natural dyes from African marigold flower (Tagetes erectal) for textile coloration. In India, Saha and Datta (2010) experimented on the'Production of floral dye from different flowers available for textiles and dye industry in West Bengal. In India also, Kulkarni, Bodake and Pathade (2011) embarked on Extraction of Natural Dye from Chili (*Capsicum annum*) for Textile Coloration. These studies and many more were done in other countries using various materials and methods to extract and test the quality of dyes produced. A quality dye must be soluble in water or dispersible in solvent and transferable to the substrate by the process of absorption or exhaustion (Grollier, 1999). A good dye must be colourfast and organoleptically acceptable. Colourfastness is the ability of a dye to resist fading or staining due to sunlight, washing, acid rain or gases in the air, perspiration, abrasion and crocking or rubbing (Marshal, Jackson, Stanley, Kefgen & Tonchie-Speeht, 2000). Colourfastness is a measure of how well a dye is attached to fibre and a characteristic that makes a textile product serviceable over a long period of time. A single dye may not be colourfast in all circumstances. What matters is that the dye remains viable and gracefully ages with the product (Weber,1990). The colorfastness of natural dyes are enhanced by mordants. A mordant is a chemical element that quickens the rate of chemical reaction taking place between a dye and a fibre. Mordant is also a metal with valency of at least two or a polyvalent metal ion which forms coordination complexes with certain dyes (Llewllyn, 2000). Mordants help to open up the fibre to enable dye get absorbed. They deepen the shade of dye and can completely change the final colour significantly giving rise to new colour. Aluminum potassium sulphate (alum), citric acid, ferrous sulphate, stannous chloride, chromic acid, tannic acid among others are some mordants used in natural dyeing. Tannic and citric acids are regarded as acidifying and dye fixing agents that act as intermediary between fibre and basic dye rather than mordant since mordant is a metal and must have a valency of at least two to form a lake (htt://www.pysanky.info/chemistry/Alum.html). The colourfastness of a dye depends on the dye, fibre and the method of applying the dye to fabric (Johnson & Foster, 1990). Cotton, linen, silk and wool are the major natural fibre while synthetic fibre fabrics are polyester, nylon, acrylics among others. Natural dyes work well in natural fibres whereas synthetic dyes perform better in synthetic fibres. Dye extraction method could also affect the colorfastness of a dye on fabric. Plant dyes are usually extracted by mechanical processes such as grinding, crushing, steeping, boiling or simmering, chopping, pounding or squeezing (Weber, 1990; www:htt/hubpages.com/hub/naturalsources-of-the-different-colours-of-dyes). More recent development in liquid extraction from plant flowers, gum, calyces, resins, leaves and other parts that cannot be extracted by other means is the use of organic solvents (Douglas, 2010)

In Nigeria, abundant species of dye yielding plants are locally available wasting in the wild including cuberoot (*Lonchocarpus cyanescens*). Cube root plant is a legume and belongs to the family pipilonaceae. The common names are:'Anunuu', in Igbo, 'Farinloko' in Hausa, 'Apapo or Ipapo' in Yoruba and 'Agwa' in Ibibio and 'cubrroot' in English Other names synonym with Lonchocarpus syanescens include 'indigo vine' in English, (Association for Identification, Conservation and Utilization of Medicinal Plants of Nigeria, ASCUMPON, 2006), Cube root plants have been noted for their food and medicinal values and as laxative. They are used in production of dyes, stains, inks, tattoos and mordant (Burkill, 1985).Much of research studies have not been done to explore dye locally from cueroot for fabric colouration.

Clothing and textile industry has been the major employer of labour in many countries of the world including Nigeria. Unfortunately, within the past 15 years, two third of the textile and clothing industries in Nigeria were forced to close down production. For instance, up to 180 functional textile mills in the country employing about 800,000 people had reduced to just 24,000 with employees working in only 25 mills that are characterized by low capacity utilization (Osagie, 2013).The 776,000 job losses obviously impacted negatively on the nation resulting in trade deficit, poverty, crime and social nuisance. Onwualu, (2006), reported that high cost of imported raw materials and processing chemicals including dyes were some contributing factors to fold-

ing of these industries. Similarly, in educational institutions, paucity of non-toxic dyes as raw consumables hinder effective teaching and learning of skills in arts, craft and science practical classes involving dye utilization. The Federal Government of Nigeria is continually making a clarion call through the Raw Materials Research and Development Council (RMRDC), to source locally available raw materials to substitute or supplement the imported and expensive ones. Sourcing dyes from local plants will increase the volume of dyes available and contribute to ensuring sustainable supply of safe dye for industrial, educational and family utilization.This study sought to extract dye from cuberoot (*Lonchocarpus cyanescens*) indigenous plant for dye extraction.

Purpose of the Study

The main purpose of the study was to investigate the effects of extraction methods and dye fixatives on the colourfastness of cotton fabric treated with dyes extracted from cuberoot (*Lonchocarpus cyanescens*) indigenous plant. Specifically, the study sought to: extract dye from cuberoot plant using boiling, steeping and solvent techniques. apply the extracted dyes to samples of cotton (100%) fabric mordanted with alum, citric acid, tannic acid and no-mordant sample (control) test the colourfastness of the dyes to sunlight, washing, perspiration (acid and alkali) and crocking or rubbing.

Hypothesis: One null hypothesis was tested by the study at 0.05 level of significance.

H_o1: There are no significant differences in the mean rating effects of boiling, steeping and solvent extraction methods and alum, citric acid, tannic acid and no-mordant (control) on the colourfastness of cotton (100%) fabric treated with dye extracted from cuberoot plant.

Methodology

Design of the Study: The study adopted factorial experimental design.

Area of the Study; The study was conducted at the University of Nigeria, Nsukka, Enugu State and at the International Textiles Industries (ITI), Limited, Lagos State, Nigeria.

Instrument for Data Collection Two types of instruments were used for data collection. They include:

Gray Scale

Fastness Test Rating Scale (FTRS): This scale was developed and used to record the average mean ratings of the triplicate results of the fastness tests with the Gray Scale. The points in the scale range from 5 to 1 where 5 indicates no fade or stain, 4 indicates very slight fade or stain, 3-slight fade or stain, 2-much fade or stain and 1 excessive fade or stain in colour. In this scale, 3 was the minimum acceptable range or cut off.

Method of Data Collection: Data were collected in phases. *Phase 1,* was the sourcing and extraction of dyes from cube root plant. Cube root leaves were collected from the wild at Ibeagwa town, Nsukka and authenticated at the Department of Botany, University of Nigeria, Nsukka.

Procedure: Fresh cube root (1kg) leaves were dried under room temperature in the Green House for 72hours at 40°C.The dried leaves were milled into fine powder using Thomas Willey milling machine.. Two portions, each (80g) were dissolved in 160ml distilled water in the ratio 1:2 (W/V). One portion was heated at 80°C – 90°C for 20mins and allowed to cool. The second portion was steeped in distilled water and allowed to ferment overnight while the third portion (100g) was dissolved in 98% ethanol (absolute) in the ratio of 1:4.5(w/v). It was shaken to mix properly to allow extraction in an air tight container and allowed to stand for 24hours. The heated and steeped portions were filtered with 0.5 Mesh (Particle size) to collect the dye liquor while the ethanol extracted portion was filtered with cheese cloth and ethanol was evaporated on a rotary evaporator under vacuum at a temperature of 45oC to dryness . The three dyes extracted were labeled as follows: CDB – Cuberoot dye extracted by boiling, CDST- Cuberoot dye extracted by steeping and CDSV- Cuberoot dye extracted by solvent.

Phase II was the mordanting and application of the CDB, CDST and CDSV on mordanted samples of cotton fabric. Samples of cotton fabric (8" x 8") were scoured in warm water with detergent to remove all finishes. Four samples of the cotton fabric were heated separately in a solution containing 500ml distilled water, 0.1g sodium carbonate (washing soda) and each of alum, citric and tannic acid for 1hour at a temperature 80°C . The last four samples were scoured without mordanting (control). Each of the alum, citric and tannic acid mordanted samples plus control sample was treated with each of the three dyes (liquors by boiling and steeping and 2g of ethanol extracted dye) using contemporary plain dyeing method. The colour of dyed samples were modified with 0.5g ferrous sulphate each. Samples were taken out after completion of dyeing, washed off the dyes and dried under a shade for fastness tests. The following dyes and dyed fabric samples (prototypes) were produced; Cuberoot dye extracted by;

boiling on alum mordanted cotton (CDB-AC)

boiling on citric acid mordanted cotton fabric. (CDB-CC)

boiling on non-mordanted cotton fabric (CDB-NC)

boiling on tannic acid mordanted cotton. (CDB-TC)

steeping on alum mordanted cotton. (CDST-AC)

steeping on citric acid mordanted cotton. (CDST-CC)

steeping on non-mordanted cotton. (CDST-NC)

steeping on tannic acid mordanted cotton. (CDST-TC)

solvent on alum cotton. (CDSV-AC)

solvent on citric acid mordanted cotton. (CDSV-CC)

solvent on non-mordanted cotton. (CDSV-NC)

solvent tannic acid mordanted cotton (CDSV-TC)

The 12 prototype samples were replicated in triplicates making a total of 36 samples for colourfastness tests.

In *Phase 111,* the following colourfastness tests of the prototypes were conducted at the ITI, Limited, Lagos according to the International Standard Organization (ISO/AO3: 1993), specification.

Fastness to Sunlight; Each of the strips of 36 prototype samples (2" x 5") was subjected to fastness to sunlight using the ITI controlled manual method. The samples were prepared and exposed to normal day light for 72hours. Gray scale was used to rate the extent of fade and the triplicate tests recorded with FTRS instrument for data analysis.

Fastness to Washing; Each of the prototype samples (2" x 5") was covered with plain white fabric, tightly tied and fed into the 4-rack testing pots inside the Shirely Development Limited (SDL) Auto Wash Electronic Washing Machine bit by bit. The temperature of the machine was set at 32± 2°C for 45minutes. The samples were brought out, allowed to cool and untied. Using the Gray scale, the extent of staining was checked off and the triplicate samples recorded with FTRS.

Acid Perspiration Test ; For this test,5.5g sodium chloride was dissolved into a solution of 1litre distilled water and 5g disodium hydrogen orthophosphate dodecahydrate ($Na_2HPO_{12}.0_20$) with 5g histidine. O.IN acetic acid was dissolved into the solution to bring the acidic P^H to 5.5. The different prototype samples (2" x 5" each) were dipped into the solution, allowed to dry and covered with plain white fabric and tied strongly as in wash fastness tests. They were fed into the oven and allowed to stay for 4hours at the temperature 32 ± 2°C. The prototypes were allowed to cool; untied and the extent of staining were checked off with Gray scale and recorded.

Alkali Perspiration Test; The materials and procedures were same with acidic perspiration test except that alkaline medium was obtained by dissolving O.IN Sodium hydroxide in 1litre of distilled water to bring the solution to $P^H = 8.0$. The prototype samples were treated as in acidic perspiration test, rated and recorded with FTRS.

Fastness to Crocking/Dry Rubbing; The prototype samples (2" x 5") each were covered with plain white test cloth, tightly tied and fed

into the nozzles of the electronic crock meter machine which scrubbed each sample 15 times for 5 minutues. The samples were brought out, untied and the extent of staining were checked off and recorded.

Data Analysis: The data generated from the colorfastness tests were analyzed using descriptive statistics and general linear model for factorial experiment of the SPSS version 16.0. Any sample with mean score 3 or above was regarded as a colourfast sample where as any sample with score below mean 3 was regarded as a non-fast sample. Analysis of variance (ANOVA) was used to test a null hypothesis while Scheffe's post hoc test compared the treatment mean at 0.05 probability level.

Summary of Findings Three types of dyes and 36 prototype samples were produced.

Eleven prototype samples were fast to sunlight, eight to washing, seven to acid perspiration, five to alkali perspiration, and 12 to dry rubbing fastness (Table 1).

There were no significant differences in the mean rating effects of dye extraction method but significant differences existed in the mean effects of dye fixatives at 0.05 level of significance. Null hypothesis was accepted in five instances for dye extraction methods but rejected in five instances for dye fixatives effects on the colourfastness of the prototypes. (Table 2).

Tannic acid and alum mordant were the source of differences. They had comparable positive effects on the colorfastness of the prototypes more than citric acid and non-mordanted samples (Table, 3).

Table 1: Mean Ratings of the Colourfastness of Alum, Citric Acid, Non-mordanted and Tannic Acid Mordanted Samples of Cotton Fabric Treated with Cuberoot Dyes Extracted by Boiling, Steeping and Solvent Techniques

Colorfastness	Dye	Mordant	N	$\overline{X}$	SD	Remark
Sunlight	CDB	Alum	3	3.667	.577	F
		Citric	3	3.333	.577	F
		Control	3	3.000	.000	F
		Tannic	3	3.667	.577	F
	CDST	Alum	3	4.000	.000	F
		Citric	3	3.000	.000	F
		Control	3	3.000	.000	F
		Tannic	3	4.000	.000	F
	CDSV	Alum	3	4.000	.000	F
		Citric	3	3.000	.000	F
		Control	3	2.667	.577	NF
		Tannic	3	4.000	.000	F
		Total	36			
Wash fastness	CDB	Alum	3	3.333	.577	F
		Citric	3	2.667	.577	NF
		Control	3	2.667	.577	NF
		Tannic	3	3.000	.000	F
	CDST	Alum	3	3.000	.000	F
		Citric	3	2.333	.577	NF
		Control	3	3.000	.000	F
		Tannic	3	3.667	.000	F
	CDSV	Alum	3	3.667	.577	F
		Citric	3	2.667	.577	NF
		Control	3	3.000	.000	F
		Tannic	3	3.333	.577	F
		Total	36			
Acid Perspiration	CDB	Alum	3	3.000	.000	F
		Citric	3	2.666	.577	NF
		Control	3	2.000	.000	NF
		Tannic	3	2.000	.000	F
	CDST	Alum	3	3.000	.000	F
		Citric	3	2.333	.577	NF
		Control	3	2.000	.000	NF
		Tannic	3	3.000	.000	F
	CDSV	Alum	3	3.000	.000	F
		Citric	3	3.000	.000	F
		Control	3	2.000	.000	NF
		Tannic	3	3.000	.000	F
		Total	36			
Alkali Perspiration	CDB	Alum	3	3.000	.000	F
		Citric	3	2.333	.577	NF
		Control	3	2.000	.000	NF
		Tannic	3	3.667	.000	F
	CDST	Alum	3	3.000	.000	F
		Citric	3	2.667	.557	NF
		Control	3	1.000	.000	NF
		Tannic	3	2.000	.557	NF
	CDSV	Alum	3	3.000	.000	F
		Citric	3	2.667	.577	NF
		Control	3	2.000	.000	NF
		Tannic	3	3.000	.000	F
		Total	36			
Dry Rubbing or Crocking	CDB	Alum	3	4.000	.000	F
		Citric	3	4.000	1.000	F
		Control	3	3.333	.577	F
		Tannic	3	4.000	.000	F
	CDST	Alum	3	3.333	.577	F
		Citric	3	4.000	1.000	F
		Control	3	3.000	.000	F
		Tannic	3	3.667	.000	F
	CDSV	Alum	3	3.667	.577	F
		Citric	3	4.333	.577	F
		Control	3	3.000	.000	F
		Tannic	3	4.000	.000	F
		Total	36			

Key: $\overline{X}$ *– Mean, F – Fast, SD – Standard deviation, NF – Non-fast, N – Number ofprototype samples.*

Data in table 1 showed that all prototypes were fast to sunlight in all media for extraction except on cuberoot dye extracted by solvent on non mordanted prototypes (CDSV-NC). They rated highly (3.00 ±.00 to 4.00 ±.00), indicating slight and very slight change in colour. For wash fastness, eight out of 12 prototypes were fast and seven were fast to acid perspiration. For alkali perspiration, five prototypes were fast and all the prototypes were fast to dry rubbing. **Hypothesis I:** There are no significant differences in the mean rating effects of boiling, steeping and solvent extraction methods and alum, citric acid, tannic acid and no-mordant (control) on the colourfastness of cotton (100%) fabric treated with dye extracted from cuberoot plant.

Table 2: Univariate Analysis of Variance (ANOVA) Results of the Effects of Extraction Methods and Dye fixing agents on the Colourfastness of Cotton Fabric Treated with CubeRoot Dye.

Fastness	Source	Type III Sum	Df	Mean Square	P-Value	F-Value	Sig.
Sunlight	Fixatives	7.333	3	2.444	22.000	.000	S
Washing	Dye	.056	2	.028	.250	.781	NS
	Fixatives	2.972	3	.991	5.095	.007	S
Acid Perspiration	Dye	.722	2	.361	1.857	.178	NS
	Fixatives	6.000	3	2.000	36.000	.000	S
Alkali Perspiration	Dye	.167	2	.083	1.500	.243	NS
	Fixatives	7.861	3	2.620	23.583	.000	S
Rubbing/ Crocking	Dye	.389	2	.194	1.750	.195	NS
	Fixatives	4.972	3	1.657	5.424	.005	S
	Dye	.722	2	.361	1.182	.324	NS

Table 2 above showed that there were significant differences (P<0.05) in the mean rating effects of dye fixatives on the colorfastness to sunlight (F=0.00), washing (F=0.00) alkali perspiration (F=0.00) and rubbing/crocking (F=0.00) of the prototypes.. The null hypothesis stating that there are no significant differences is therefore rejected in these instances. The Scheffe's post hoc tests revealed the source of differences as presented in table 3.

However, there were no significant differences (P >0.05) in the mean effects of extraction methods used on the lightfastness (F=.78), washfastness (F=.18), alkali perspiration (F=.20) and rubbing (F=.32) of the prototypes The null hypothesis stating no significant differences (P>0.05) in the mean effects of extraction methods on the fastness of the prototypes is accepted in these instances.

Table 3: Scheffe's Post Hoc Test Homogenous Subsets
Fixatives Interaction Main Effects

Fastness	Mordant	No	Subsets		
			1	2	3
Washing	Control Citric Alum Tannic Sig.	9 9 9 9	2.00c 1.000	2.89b 3.22ab .331	3.22ab 3.67a .122
Sunlight	Control Citric Alum Tannic Sig	9 9 9 9	2.11b 2.33b .768	3.22[a] 3.22[a] 1.000	
Alkali Perspiration	Control Citric Alum Tannic Sig.	9 9 9 9	1.89[c] 1.000	2.89[b] 3.00[b] .880	 4.11[a] 1.000
Rubbing/ Crocking	Control Citric Alum Tannic Sig.	9 9 9 9	3.00[b] 3.44[ab] .234	3.44[ab] 3.78[a] 3.78[a] .477	

Key: Means for groups in homogenous subsets are displayed. Values are means of triplicate determination. Means in the same column with same superscript letter grades are not significantly different from each other at P ≤ = 0.05 probability level using Scheffe's test.

The Scheffe's post hoc fixatives interaction main effect in table 3 above revealed that tannic acid had exceptional positive effects which was not significantly different from those of alum on light and wash fastness of the prototypes. Tannic acid and alum are the source of difference for sunlight and wash fastness. Tannic acid was significantly different from those of alum and citric acid in their mean effect on alkali perspiration fastness of the prototypes. Tannic acid was the source of difference for alkali perspiration. Tannic acid was comparable to alum and citric acid in their effects on the colourfastness to crocking. For acid perspiration fastness, subsets could not be computed with alpha = .050. This implies complete homogeneity of subsets.

Discussion

Findings from the study revealed that eleven out of twelve prototypes were fast to sunlight, eight prototypes were fast to washing, seven to acid perspiration, five to alkali perspiration, and 12 to dry rubbing fastness (Table1). This finding shows that cuberoot plant has dye potentials and supports those of Bassey et al, (2012) and Spenser, (2011) who stated that *Lonchocarpus cyanescens* could be a useful substitute to the toxic and eco unfriendly synthetic dyes for textile dyeing, biological stains and as raw consumable for teaching and learning in educational institutions.

The high fastness ratings of the prototypes to sunlight may be attributed to the substitution pattern of dyes which according to Jothi (2008), plays vital role in determining their light fastness and the formation of a complex with transition metal thereby protecting the chromophore of the dye from photolytic degradation. This is the case with those prototypes that showed good light fastness properties Though tannic and citric acids do not possess the chemical complexity of forming a lake with the basic dye as reported by Pysanky (htt://www.pysanky.info/chemistry/Alum.html), the ferrous sulphate added to dye bath for colour modification is a metal with valency more than two and might have enhanced the formation of lake or complexing components that contributed to increasing the lightfastness of the prototypes.

The F-values in table 2 revealed that there were no significant differences in the mean effects of extraction methods (boiling, steeping and solvent) on the light, wash, perspiration (acid and alkali) and rubbing or crocking fastness of all the prototypes. The null hypothesis stating that there were no significant differences was accepted in these instances. This implies that any of the extraction methods used following standard procedures would produce quality dyes from cuberoot plant leaves. However, significant differences existed in the mean rating effects of dye fixing agents on the colorfastness of the prototypes to sunlight, washing, alkali perspiration and rubbing. Scheffe's post hoc multiple comparison fixatives interaction main effect results showed that the source of the difference was tannic acid which had the greatest positive effects but was comparable to alum in their effects on all the fastness tests but alkali perspiration. In those tests, tannic acid and alum prototypes had very good and good fastness ratings indicating no or very slight fade or stain in colour. Ali, Ali, Salem and Hussain (2010), had similar finding on effect of tannic acid and metallic mordant on the dying properties of natural dye extracted from acacia nilotica bark. Tannic acid has been described as a very important dyeing component which help in fixing colour to plant or cellulosic fibres. (Win & Swe, 2010). Alum mordant also improved considerably the fastness of the dye on prototypes. This result is not surprising as alum is the most commonly used mordant for both animal and many vegetable fibres.

Citric acid was not as strong as alum mordanted samples but more effective than non-mordanted samples which were the most poorly rated colourfast prototypes. It was described as acidifying agent more appropriate for animal fibres The non mordanted prototypes were the poorest in all the fastness tests. Their mean ratings (1.00±.000 to 2.67±.577), indicating excessive to much fade or stain in colour except for CDB-NC agrees with Naomi (2010) and Kulkarni (2011), that dye fixatives play very essential role in natural dyeing ,without them most natural dyes will either change or loose colour instantly to chemicals or photochemical attack or bleed away in washing water.

Conclusion

The reported study shows that cuberoot plant dyes possessed the colourfastness attribute of a dye. The extraction methods used did not have significant differences in their effects on the colorfastness of the dyes on 100 per cent cotton fabric. Tannic acid and alum mordant had comparative positive effects in improving the light, wash, acid and alkali perspiration and rubbing/crocking fastness of cotton fabric treated with cuberoot dye.

Recommendation;

- Textiles and clothing industries should find ways of sourcing, improving the quality and utilizing cuberoot dyes through their textile chemists.
- Lecturers and teachers at all levels of education should encourage their students to explore and utilize beetroot in their environment through classroom experiments and research development efforts. This should form part of their continuous assessment scores for semester or termly examinations.
- 3Home makers or individuals who practice dyeing should be educated through seminars, workshops, conferences on the need to explore plant dyes including cuberoot.
- 4Study on the phytochemical constituents, organoleptic attributes and acceptability of cuberoot dye is necessary.

The researchers express their profound appreciations to the Management of the International Textiles Industries (ITI), Limited, Lagos, for granting the request of

REFERENCES

Association for Identification, Conservation and Utilization of Medicinal Plants of Nigeria. ASCUMPON (2005), Checklist of Medicinal Plants of Nigeria and their Uses Enugu, Jameo Publishers: 77 | | Bassey, R. B; Bakare, A.A; Osinubi, A.A.A.; Oremosu, A.A. (2012). Staining Properties of Lonchocarpus Cyanescens on the Testes of Sprague Dawley Rats. Retrieved from www. Researgate.net/publication/230567664_staining_characteristics_of_lonchocarpus_cyanescens_leaf_extra_on_the_testes_of_sprague_Dawley-Rats. | | Douglas, M. (2010). Methods of extracting liquids. Retrieved on March 25th 2011 from www.worldwidehealth.com/health.arts | | Burkill, H. M. (1985). The Useful Plant of West Tropical Africa Vol. 3. Retrieved on 14th Nov, 2007 from www.goggle.com | | Chenghaiah, B.; Rao, K. M.; Kumar, K.; Alagusundaram, M., & Chetty, C. M. (2010). Medicinal Importance of Natural Dyes- A Review. International Journal of Pharm Tech Research ODEN (USA); IJRIF Vol2 No 1; 144-154. | | Grollier (2000). Dyes: A coloring matter, Encyclopedia, Americana, USA, Grolier Incorporated. | | | Jansen, P. C. M & Cardon, D (2005), Plant Resources of Tropical Africa 3-Dyes and Tannins. Wageningen, PROTA Foundations: 11. | | Jansen, P. C. M. & Cardon, D. (2005). Plant resources of tropical Africa 3–dyes and tannis, Wageningen, PROTA Foundations: //Western Publishing Co: 145. | | Johnson, J. G. & Foster, A. G. (1990). Clothing, image and impact. Cincinnati, Ohio, South | | Jothi, D. (2008). Extraction of natural dyes from African mangold flower (Tagetes erectal) for textile coloration. Autex Journal. Vol. 8, No. 2. Retrieved on 18th March, 2012 from http://www.autexrj. org/No2-2008/49. | | Ke, G., Yu, W. & Xu, W (2006), Colour Evaluation of Wool Fabric Dyed with Rhizoma Coptidis Extarct. Wiley Penodicals Inc. T Appl Polym Sc. 101. | | Kulkarni, S.S., Bodake, U.M., & Pathade, G.R. (2011), Extraction of Natural Dye from Chili (Capsicium annum) for Textile Coloration. UniversalJournal of Environmental Research and Technology. Retrieved 10th April 2012 from www.enviromentaljournal.org | | Llewellyn, B. (2000). Mordants, Retrieved on 5th June, 2011 from http//stainfileinfo/theory/mordant/ htm. | | Marshal, S. G., Jackson, J. O., Stanley, M. S., Kefgen, M. & Touchie-Specht, P. (2000). Individuality in clothing selection and personal appearance. New Jersey Prentice Hall Inc 18, 220. | | Naomi (2010). Natural dyeing; mordanting. Retrieved on 20th September,2010 from htt://inkyarnandbeer.wordpress.com | | Osagie,C2013),Nigeria's Textile Industry on a Rebound (This Day) Live. Retrieved from http://www.this daylive.com/articles/Nigeria-S-textile-industry-on-a-rebound-/1486961 | | Spenser, S. (2011). Developing an Understanding of Science from the Sierra Leonean Traditional Gara Dyeing Process. Department of Education, Foura Bay College University of Sierra Leone. Retrieved on 20th February 2011 from Commonwealth of Learning Achera-www. Col.org. | | | Weber, J. (1990). Clothing, fashion, fabrics, construction, Lake Forest Illunois. Columbus Ohio McGraw Hill, 169, 197, 133. | | Win, Z.M., & Swe, M.M. (2008). Purification of Natural Dyestuff Extracted from Mango Bark for Application on Protein Fibres. World Academy of Science and Engineering and Technology, 46 2008. Retrieved on 14th January 2012 from www.gogle.search | |