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A COMPARATIVE STUDY OF THE FASTNESS PROPERTIES OF DECORATIVE AFRICAN TEXTILES-'KAMPALAS' AND 'ANKARAS' - TO VARIOUS SERVICING AGENTS

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ABSTRACT

Fastness properties of two decorative African textiles - Kampalas and Ankaras, produced locally (handcrafted) and industrially (factory printed) respectively, were examined by subjecting them to various servicing agents-as washing in soap solutions, spotting with various chemicals and high-energy radiations (light). Both showed good fastness properties to these agencies. However, the Kampala was statistically ($P \leq 0.05$) better than the Ankara. This was probably due to the high resistance of the in situ regenerated dye within the fibers in Kampala during production compared to the surface adhesion of dye on fibers (printing) in Ankara. The latter are easily prone to attack by these agencies examined.

The Ankara and the Kampalas similarly maintained their hues (not fading rapidly) when washed occasionally with mild toilet soap compared to the use of detergent, but the scotching sun of the mid-day should be avoided in both. Both textiles showed good fastness rating values of above 4.5 on a scale of 5.0 (Grey scale) to the mild toilet bar soap washings.

KEYWORDS: *African textiles, 'Ankaras', Fastness properties, 'Kampalas', Servicing agents*

INTRODUCTION

Textile is defined as any manufactured fabric (woven) from natural or synthetic fibre, filament or yarns obtained by interlacing through weaving, knitting, felting, bonding, tufting and braiding (Gale, 1978; Hollen,et al, 1979). It is one of the basic needs of every human being all over the world. It provides clothing, and shelters are more comfortable and attractive by the use of coloured or patterned textiles. African textiles are unique and decorative, having a significant relation to the identity and image of the Africans. Their cultural legend are preserved and perpetuated through these decorative textiles.

The decorative fabrics could be achieved through either or combination of the following processes: by direct application of colourant to produce image on fabric surface or integrating coloured yarns structurally during weaving or by resist dyeing. Notably among these decorative cloths are the Ankaras (populally called printed fabrics), and Kampalas called "Adire" among the Yorubas in Nigeria, 'Adinkra' in Ghana, and 'Bokolanifini' mud cloth in Mali (Picton and Mack, 1989; Eicher,1976).

Kampala is produced locally through the techniques of tying and dyeing or 'batik' of cellulosic material. Tie and dye or batik is a resist method of patterning fabric, by withholding dye from certain areas of the fabric using threads or paraffin wax, leaving the original undyed area as a background for the design in the dyed area or vice-versa (Hollen,et al, 1979; Picton and Mack, 1989). There are lots of information in the literature on how these are done (Eicher, 1976). Ankara, in its own case was developed from techniques of Kampala's production. It involves printing a predesigned pattern called motif, with the right choice of printing ink on the woven fabric. These printed fabrics (Ankaras) could be super print, or veritable wax. Modern technology had aided the production of the Ankaras with printing machines in textile mills in Africa. The Ankaras are manufactured to supplement the traditionally made Kampalas. Both types of textiles are beautiful, reflecting the originality of their producer's culture and used almost for the same purpose.

The literature reveals that fast dyes were employed in the dyeing of the African fabrics during production (Trotman, 1984:Chatwal, 1988). This present study however, focused on testing and comparing the fastness properties of the two decorative African textiles-Ankaras and Kampalas- commonly worn among all sexes in Nigeria to various agents as washing with both toilet soap and detergent, light, spotting to various chemicals both acidic and basic in nature, to which the materials are exposed to during usage. It is also aimed at examining the best conditions or care and usage of the textiles.

MATERIALS AND METHODS

Sample collections and treatments

Several and various shades of the two African textile materials-Kampalas and Ankaras were collected prior to sowing and usage from various Tailors' Shops at Akure metropolis, Ondo State, Nigeria, for this study. The cloth samples (Ten specimen each) were paired on the basis of similarity in colours. Various colours were selected. The textiles were then identified as cotton materials using microscopic and burning methods [Lyle, 1982).

COLOUR FASTNESS TEST ON THE AFRICAN TEXTILES

Each textile material was prepared for the following assessment tests of fastness properties namely: washing in detergent, and toilet soap, spotting to various chemicals both acidic and basic in nature, and exposure to light, both to Xenon arc light and sunlight. The assessments were carried out according to the International Standards Organisation (ISO) procedures as described by the Society of Dyers and Colourists (SDC), 1990).

WASHING WITH DETERGENT AND SOAP

Ten (10) specimens of each type of the African textile, each measuring 4cm x 10cm had a pure, undyed bleached white cotton fabric sown to it along its four sides to make it one adjacent fabric. Each set of specimen was mechanical agitated separately at 40^0C for 30mins in dyetubes of 150ml detergent and soap solutions (liquor-ratio 50:1) containing $3gl^{-1}$ of detergent (blue omo) and $5gl^{-1}$ of toilet soap (Lux) respectively. The dyetubes were mounted on a single - bath dyeing machine (MBMKII). The specimens were removed, rinsed thoroughly in distilled water and squeezed. The articles were opened out and dried in air at a temperature

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not exceeding 60°C. The change in colour of each specimen was assessed with the grey scale and the mean value of each result obtained taken as the fastness rating for the test. The washing was done twice a week for 3 weeks

SPOTTING WITH CHEMICALS AND ORGANIC SOLVENTS

Another ten (10) specimens of each of the African textiles were separately treated with the following prepared solutions: Sulphuric acid solution (1M), Acetic acid (30g/100), Sodium carbonate (10g/100ml), Salt water ($3gl^{-1}$ NaCl) and Distilled water at room temperature. The specimens were also treated with organic solvents as carbon tetrachloride and petroleum ether. The solutions were worked into the specimens with a glass rod one after the other to form a spot at the center of the fabrics. The changes in colour of the specimens when wet and after drying by hanging at room temperature were assessed with the grey scale.

DEGUMMING

Ten (10) composite specimens (10cm x 4cm) of each African textile-ankaras and kampalas, were separately treated in a round bottom flask for 10min under reflux in a lightly boiled soap (lux) solution (0.7g/200ml). Thereafter, 0.15g of anhydrous sodium carbonate was added to the boiling soap solution and kept boiling for another 110min (2h over-all). After 2h, the specimens were removed and rinsed in water.Prior to the assessment of change in colour with grey scale after drying, all stitches except one on the composite specimens were removed.

Exposure to Artificial Light (Xenon arc) and Daylight (Sun)

Ten (10) specimens of each textile under study of the dimension 50mm x 10mm and the eight (8) blue wool light fastness testing standards of the same dimensions and creases free, were mounted length- wise on specimen holders of light fastness tester model 225 (available in Chemistry Department, Federal University of Technology, Akure). Both were exposed simultaneously for 6h, 3 days per week for 3 weeks to the artificial light generated within the instrument. A 65% relative humidity was generated within the instrument by saturated solution of $NaNO_3$ (73g per 100ml).

Another ten (10) specimen of each textile material with the blue wool standards were also prepared and mounted on white card boards and exposed to daylight (sunlight) by hanging on a line in an open place for 3 days per week for 3 consecutive weeks at the following time intervals: 9.00a.m-1.00p.m (First week); 1.00p.m-3.00p.m (Second week) and 2.00p.m-5.00p.m (Third week). The average temperature of the daylight during exposures of the fabrics ranges between $30.0 - 45.0 \pm 2.0$ °C. These selected time frames correspond to the periods that the textile materials are usually worn and therefore exposed to sun in Africa.

The textiles were then assessed for colourfastness by comparing the change in colour of the specimens with that of the references (Blue wool standards) after 3 the weeks.

RESULTS AND DISCUSSION

Fastness properties

The results of the fastness properties of the African textile - Ankaras and kampalas- to those various agencies tested are summarized in Tables 1-4.Tables 1 and 2 are the results of fastness properties of the textiles to washing both in detergent and bar soap solutions each for over 3 weeks duration. The result of the washing over a scale of 5 shows that the ankaras had poor wash fastness properties compared to the kampalas, especially with detergent solutions (Table 1). This was generally found to be statistically different (student t-test) at $P \leq 0.05$ (95% confidence level). When the textiles were compared after 3 weeks of final washing, the kampalas showed a better wash fastness with a rating of above 4.5 both in detergent and bar soap solutions over the Ankaras which

Table1: Mean Fastness Ratings of Washing of the African textiles with detergent over 3 weeks Duration.

		Ankara		Kampala	
Weeks	**wash**	**wet**	**dry**	**wet**	**Dry**
1	+	5.0	4.5	5.0	5.0
	++	4.5	4.0	5.0	4.5
2	+	4.0	3.5	4.5	4.5
	++	3.5	3.5	4.5	4.5
3	+	3.5	3.5	4.5	4.5
	++	3.0	3.0	4.5	4.0
Overall Means		$3.9^{a+} \pm 0.74$	$3.7^{a} \pm 0.52$	$4.7^{b+} \pm 0.26$	$4.5^{b} \pm 0.32$

Key: +- first wash

++-Second wash

Values with different superscripts ($^{a+\ b+;a\ b}$) are Significantly different ($P < 0.05$)

Table 2: Mean fastness ratings of washing of the African textiles with Toilet bar soap over 3 weeks Duration.

		Ankara		Kampala	
Weeks	**wash**	**wet**	**dry**	**wet**	**Dry**
1	+	5.0	5.0	5.0	5.0
	++	5.0	4.5	5.0	4.5
2	+	4.5	4.0	5.0	4.5
	++	4.5	4.0	5.0	4.5
3	+	4.0	4.0	5.0	4.5
	++	4.0	4.0	5.0	4.5
Overall Means		$4.5^{a} \pm 0.45$	4.3*±0.42	$5.0^{b} \pm 0.00$	4.6*±0.07

Key: +- first wash

++-Second wash

Values with different superscripts are Significant different (P< 0.05)

Table 3: Mean Spotting ratings of the African textiles to various chemicals.

	Ankara		Kampala	
Test (Spotting with chemicals)	**Wet**	**Dry**	**Wet**	**Dry**
Strong acid H_2SO_4	2.5	2.0	4.8	3.0
Weak acid CH_3COOH	4.5	4.5	4.3	4.3
Distilled H_2O	4.8	4.5	4.3	4.3
Alkali (Na_2CO_3)	4.0	4.8	5.0	4.3
Degumming	1.5	1.5	1.5	1.5
Sea water (NaCl)	3.5	4.0	4.0	4.5
Carbon tetrachloride	4.5	4.0	4.5	4.5
Petroleum ether	5.0	4.5	5.0	4.5

Table 4: The fastness ratings of the African textiles to artificial light (xenon arc light) and sunlight

	Ankara		Kampala	
Specimen	**Mf**	**Sf**	**Mf**	**Sf**
1	5	4	6	6
2	5	5	6	5
3	5	4	7	6
4	4	5	5	5
5	6	5	6	5
6	5	5	6	5
7	5	4	5	4
8	6	5	7	4
9	4	4	6	5
10	5	4	6	5
Mean Fastness ratings	5.0	4.5	6.0	5.0

Key: - MF- Machine fastness (Xenon Arc Light)
SF- Sunlight.

were less in both soap solutions. The statistic analysis of the intra fabric showed significant differences at $P \leq 0.05$ only in "wet" kampalas washed in both detergent and toilet bar soap and also in the 'dry' and 'wet' of the latter. No significant difference observed in the ankaras. At the first washing in the first week, some of the ankaras bleeded inside water, and by the time the second washing was carried out, there was crocking and migration as the adjacent fabrics were seen stained during testing. Crocking is the loss from rubbing or abrasion while migration means the shifting of colours to the surrounding area or to an adjacent surface (Hollen,et al, 1979).Since the production of Ankara is a surface phenomenon, the test agents had much effect on the fastness properties of the ankaras,resulting into the observed low rating value and fading of the colours in the material than the kampalas .Also, the solubility and rate of movement of the dye outward from the fiber in the presence of soap (or synthetic detergents) solutions of various degrees of alkanity are the factors determing fastness to washing. Dyes that chemically bind to the fibre, (reactive dye) have lower resistance to removal by soap through bleeding.Most of the surfantants used in Nigeria/Africa for domestic fabric-washing are the heavy-duty powders of alkyl benzene sulphonate products(anionic surfactants), in which the saturated hydrocarbon chains are attached directly or indirectly to the sulphonate/sulphate groups (Tedder and Nechvatal,1975).These acidic groups possibly reacted with the dyes on the fabric surface of the ankaras and hence affected its appearance resulting into change of hues.

Table 3 shows the results of the fastness ratings of the textiles to various spotting agents. Both types of the African textiles compared favourably well, both in their wet, and dry states when spotted with these chemicals. They were strongly affected in strong acid (H_2SO_4), the beauty of their colours, particularly the Ankaras, was bleached out, resulting in low rating value. These also corroborated the low rating values (poor fastness) reported above in Table 1 for ankaras when washed with the alkyl benzene sulphonated detergents. Both textiles also gave a high rating value of above 4.0 on a scale of 5 when spotted with organic solvents. This indicated that the solvents had no effect on the colour of the fabrics, as the material did not shrink, loose shape of finish as is frequently observed in 'wet-cleaning'. The solvents therefore, which are grease- loving, can be used to remove the dirt or 'soiling-matter' which are held by grease on African textiles. The poor fastness to degumming of the two textiles indicated that the materials were not silk-blended cotton and free from gum or sericin found in silk fibers (Dantyagi, 1983).

The results of the fastness properties of the decorative African textiles to artificial light (Xenon Arc Light) and daylight (Sunlight) are shown in Table 4. The mean fastness rating of 5(4) and 6(5) obtained on a scale of 8 for both Ankaras and Kampalas to artificial and sunlight respectively, can be considered as being good. This shows that the dye structure commonly employed in dyeing/printing of these decorative African textiles are fairly stable to high-energy radiation such as ultraviolet. However, the low mean rating values of Ankaras compared to kampalas in this study, indicated that it is prone to fading with time. This is due to its surface dye-pattern imprint being continually in contact with high-energy radiations that initiate fading-reactions of the dye on the material more than the Kampalas. Fading on exposure to light is undoubtedly the most complex of the reactions, which dyes undergo on a fibre and much research has been devoted and reported to discovering the causes (Giles, 1978;Nkeonye, 1987).

CONCLUSION

The Kampalas prepared and produced by tie and dye or other conventional methods of resisting, where dye/colour developed in situ within the fiber matrix shows better colour fastness properties to both liquid and non-liquid treatment agents than the Ankaras, that were produced by surface dye-printing methods. However, ankaras can be appreciated and made to last longer if washed occasionally in toilet (mild) bar soap solutions, avoid the use of detergents, and expose to less intense light energy, preferably, using the fabrics in cool weathers and avoiding the scotching sun at mid-days.

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