



## THE EFFECT OF LOCALLY PREPARED SOAPS WITH DIFFERENT OILS ON THE COLOUR AND DIMENSIONAL STABILITY OF AN AFRICAN PRINT FABRIC

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### **Abstract**

Ghanaians that patronize the locally produced soap “Azumah blow” have raised concerns about the quality and its effect on fabrics. Meanwhile, palm oil is the oil used in its production. The aim of this study was to vary the oils for the production of the soap to determine if a change in oil used can reduce or eliminate the soap’s effect on a textile fabric. The objective of this study, therefore, was to investigate the effects of locally prepared soaps from three different types of oils on the colour fastness and shrinkage of an African print fabric from TexStyles Ghana Limited (GTP). Palm oil, Palm kernel oil and Coconut oil were used in the preparation of the soaps. Test specimens were subjected to washing with the 3 different types of soaps at 60<sup>0</sup>C for 30 minutes using the standard Launder-Ometer (Gyrowash 315). Each washed specimen was dried at room temperature. Dimensional stability was measured with the aid of a tape measure. Colour fastness and staining were measured by means of grey scales. The results indicated that soap samples employed for the study generally showed less change to the dimensional stability of the fabric used for the study. They were gentle on the colour staining properties; however, the coconut oil soap had the best performance compared to the soaps with palm oil and palm kernel oil. It is recommended that other performance attributes of cotton fabrics are explored with these types of soaps to give an overall picture of their total performance.

**Keywords:** Azumah blow soap; Shrinkage; Colourfastness; African print

### **INTRODUCTION**

Ghanaians patronize African prints extensively. They are used almost on all occasions. In some cultures, traditional African Wax print is even demanded as part of the bride price. These prints, no matter how they are used to adorn the body, are washed with water and soap to keep them neat and maintain their beauty for further use. Soap is a substance used with water for washing and cleaning. It is made by the reaction of animal or vegetable oils and sodium hydroxide or potassium (Hopkins, 2010). Consumers mainly use soaps as surfactants for washing, bathing, and cleaning (Donkoh, 1986). The production of soaps has increased and many industries in Ghana are engaged in such production (Amenumey, 2008). The major companies that produce soaps in Ghana include PZ Cussons Limited and Unilever Ghana Limited. Through the soap production by such companies Ghanaians have access to soaps



such as “Key”, “Sunlight”, “Brilliant”, and “Guardian”. There are, however, locally manufactured soaps used for washing and bathing, especially by rural dwellers. Examples of such soaps are “Alata” soap and “Azumah blow”. The locally manufactured soap, “Azumah blow” is a very popular soap in Ghana. Seemingly, the soap is named after the much beloved Ghanaian three-time featherweight boxing champion, Azumah Nelson (Baker, 2010). According to Baker (2010), the reason for the soap being named after him varies. Some people say it is because the soap looks like the blow of Azumah Nelson. Others say it is because the soap is very hard and heavy like Azumah Nelson’s fist blows or the soap is very strong that it combats any stain like the way Azumah Nelson combated his opponents. This soap was introduced by the colonial masters. Due to the complex nature of preparing traditional potash soap it was no surprise when indigenous soap makers swiftly switched over from the production of the traditional soap to “Azumah blow” which involved the use of ready-made imported caustic soda (Donkor, 1986).

The raw materials for the making of soap cover a wide range of substances. However, fats and oils constitute approximately 90% of the soap maker’s raw materials (Donkor, 1986). The cost of production and properties of any particular soap are largely dependent on the nature and properties of the various oils and fats used in its manufacture (Donkor, 1986). As indicated, soap making involves a definite chemical decomposition of fats and oils into their constituent parts, namely fatty acids and glycerol. The fatty acids combine with caustic soda, potash or other base to form soap, and the glycerol remains free (Donkor, 1986). Various oils and fats have become established in Ghana for soapmaking. These are all edible oils. These oils which are extracted locally using both commercial and traditional technologies include palm oil, coconut oil, palm kernel oil, Shea butter and cotton seed oil.

The main ingredient for making the “Azumah blow” soap in Ghana, however, is palm oil and sodium hydroxide. Although the prices of the locally manufactured soaps are cheaper as compared to that from the industries, many concerns have been raised according to Quame (2013) about their quality. She noted that some people complain about their effects on the texture, colour and strength of fabrics. Atta (2013) also indicated that some people have complained of the soap being of low quality and causes textiles to fade (Atta, 2013). For example, Quame (2013) found out in her study on the effects of locally manufactured soaps on colour, strength and elongation of selected cotton fabrics that Azumah blow soap had effect on the colour fastness and strength of the selected cotton fabrics. Ghana has lively industries that produce the beautiful African cotton prints which are a popular sight in Ghana and throughout West Africa. Almost all individuals who patronize these fabrics always want them to last. One can imagine how disheartening it will be if after using a soap to wash such an adorable fabric, the colour changes or the fabric becomes weak.

Since no two oils have identical soap making properties, the art of soap making lies not only in the boiling operation but in the judicious selection of the oils and fats to produce the qualities needed (Donkor, 1986). As indicated, Ghanaians that patronize the soap “Azumah blow” have complained about the quality and its effect on textile fabrics. Meanwhile, the oil that has been constantly used in its production is palm oil. The purpose of this study, therefore, was to vary the oils for the production of the soap to determine if a change in oil used can reduce or eliminate the soap’s effect on a textile fabric. For this study however, palm, coconut and palm kernel oils were used to produce “Azuma blow” soaps and these soaps were tested on an African print fabric to evaluate their effect.



Looking at the exploratory nature of the study, three research questions were developed to guide the investigation.

1. Do differences exist between the colourfastness of a fabric washed with Azumah blow soap made with different oils?
2. Do differences exist between the colour staining properties of a fabric washed with Azumah blow soap made with different oils?
3. Do differences exist between the sizes of a fabric washed with Azumah blow soap made with different oils?

The significance of the study is that, since Ghanaians, especially those at the rural areas patronise the Azumah blow soap it may help determine the type of oil which will give the best results when used in its production. This will help producers of the said soap to improve the quality of the soap and increase profit. The results may help determine a type of Azumah blow soap that will perform better with African prints which are extensively used in the Ghanaian community. The study may also provide additional information on the effect of Azumah blow soap on the performance of cotton prints. In addition, the study's outcome may serve as literature for teaching and research.

## **RESEARCH METHODS**

### **Materials**

Two yards of Real Wax printed cotton fabric from TexStyles Ghana Limited (GTP) was bought from the market. In addition, there were palm oil, coconut oil, palm kernel oil and alkali solution (Dilute sodium hydroxide).

### **Preparation of the Soaps with the three different oils**

In preparing the soaps, each of the three types of oils were first boiled on fire till they turned pale. Zero point five (0.5) litres of each oil which are palm oil, coconut oil and palm kernel oil were measured into separate bowls. After, 0.3 litres of diluted sodium hydroxide solution was added to the first oil (palm oil). The ratio of oil to sodium hydroxide was 5:3. After adding the caustic soda to the oil, the solution was stirred in a clockwise position with a laddle till it solidified. After the solution had solidified, it was moulded into the traditional ball shape. This was repeated for the other two oils. The balled soap was left to dry for seventy-two hours. The hardened soap was then grounded into powdered form in order to make measuring easy and then labelled. The code "R" was used for palm oil, "C" for coconut oil, and "P" for palm kernel oil. The labelled powdered soaps were taken to the Ghana Standard Authority textile testing laboratory to carry out the test on the selected fabric.

### **Preparation of test specimens**

#### **Dimensional Stability**

Dimensional stability used 2 specimens for each type of soap prepared in order to arrive at a satisfactory average performance. Ghana Standard GS ISO 5077:2005-Textiles determination of dimensional change in washing and drying was employed in testing the effect of each type of soap on the dimensional stability (shrinkage) of the fabric used for the study. Each specimen had a dimension of 150cm by 150cm and was cut such that the yarns in both directions (warp and weft) were parallel to the edges. Distance of 100mm×100mm were marked parallel to both the warp and the weft directions of the fabric and stitched with a contrasting thread.



### **Colourfastness and Staining**

Colour fastness to washing and staining used 2 specimens for each type of soap. Specimen measurement for colour fastness and staining test was 100mm×40mm. A multi-fibre fabric of same size was attached to each specimen as indicated by GS 126:2005- Textiles- Tests for colour fastness to washing. The specimens were then washed using Standard Launder-Ometer (Gyrowash 315) and dried after which colour assessment was done using the ISO Grey Scale (Fianu & Adams, 1998; BS 1006:A02, 1990, Textiles-Test for colour fastness-Part A02: Grey scale for assessing change in colour). Five readings were taken in the visual inspection of the specimens for colour change for each fabric in a well lighted chamber (colour assessment chamber). A total of 12 specimens were used for the study.

All specimens for the investigations were conditioned in moisture equilibrium with air having a temperature of 27°C±2°C and relative humidity of 65%±2% for 24 hours in a relaxed state as indicated by GS ISO 139 (2005) for tropical and subtropical countries. All the procedures stated in this test for the selection preparation and testing were done according to the standard test methods employed by the Ghana Standards Authority in carrying out the stated tests.

### **Instruments**

Standard Launder-Ometer (Gyrowash 315) was used in the washing of specimens and the washing was done with the three types of soaps prepared. The ISO Gray Scale was used to determine colour fastness and staining. Tape measure was used for determining change in size.

### **Washing and Drying of Specimens**

To test for both dimensional stability (shrinkage) and colour fastness to washing and staining, specimens were subjected to one cycle of washing with each of the soaps prepared using the Standard Launder-Ometer (Gyrowash 315). The amount of soap solution used in the washing of the specimens was 2.4L and the washing was done at 60°C temperature for 30 minutes. The 2.4L of soap solution was enough to wash 12 specimens in one round of washing. The amount of soap solution used was obtained based on the weight of the specimens that were washed. In one round of washing 6 cylinders were used with each taking 2 specimens. It is noted that 1 gram of sample weight takes 50ml of soap solution and 1L of water takes 5g of soap. Each cylinder contained 400ml of soap solution from each type of soap which was used to wash two specimens. In all 800ml of soap solution was made from each type of soap. Ten steel balls were placed in each cylinder for agitation. Specimens were rinsed after washing with every two specimen from each of the 6 cylinders making use of 1.5L of water. The washed specimens were dried at room temperature.

### **Determination of dimensional stability (shrinkage), colour fastness on washing and staining**

After drying the specimens, they were tested for colour change and staining by the use of the Gray Scale (Fianu & Adams, 1998; BS 1006:A02, 1990, Textiles-Test for colour fastness-Part A02: Gray scale for assessing change in colour). Five people were involved in the visual inspection of the specimens for colour change and staining in a well lighted chamber (colour assessment chamber). After that an average change in colour and staining was determined. For dimensional stability (shrinkage) on washing, the distances between the marked lines of 100mm×100mm were measured again after washing with the aid of tape measure. The stitched areas were measured again to determine if there had been a change in dimension



(shrinkage) or not. Six readings were taken for dimensional change after washing the specimens in both the warp and weft directions and calculated in percentage with the formula:  $\text{dimensional change} = \frac{\text{original measurement} - \text{final measurement}}{\text{Original measurement}} \times 100$

At the end an average change in size was established.

## RESULTS AND DISCUSSION

### Differences in colourfastness of fabric washed with Azumah blow soap with different oils

Table 1 shows the mean grey scale values of the test for color fastness with the different soaps. The specimen washed with the R soap scored 3.5, the specimen washed with the P soap scored 4.5, and that washed with the C soap scored 5.0 on the grey scale for colour assesment.

*Table 1: Means of gray scale values of the different soaps for colour change to washing*

Soap type	N	M
R	5	3.5
P	5	4.5
C	5	5.0

The results in Table 1 indicates that when the specimens were washed with the different types of soaps, the C soap (coconut oil) had the best gray scale value (5.0) compared to R (3.5) and P (4.5). GS 124 (2012) indicates the minimum standard of 4 with regard to colour fastness to washing for Real Wax printed cotton fabrics, the specimens washed with the C soap went above the minimum standard. According to British Standards (BS) 1006:A02 (1990), a rating of 5 is given only when there is no perceived difference between the tested specimen and the original material. This indicates that there was actually a change in the colour of the specimens washed with both soap P and R with R performing even below the standard set by GSA. With the soap R taking the rate below standard for colourfastness, it is likely to cause fabrics to fade when used in washing. In the case of the P soap scoring 4.5 which is a little above the minimum standard set by GSA, its effect on colour of fabrics would not be intense. But the C soap produced the best results looking at the outcome.

### Change in size of African print fabric after washing with Azumah blow soap made with different oils

The results for dimensional stability on washing with the three different types of soaps are presented in Table 2.

*Table 2: Means of dimensional stability (shrinkage) of the different soaps after washing*

Soap type/ Fabric direction	N	M
<b>R</b>		
Warp	6	0.2%
Weft	6	0.3%
<b>P</b>		
Warp	6	0.5%



Weft	6	1%
<b>C</b>		
Warp	6	0.5%
Weft	6	1%

The purpose of this investigation was to determine how the soaps will affect the dimensional stability of fabrics. Table 2 indicates that the average percentage shrinkage in the warp direction of the fabric for the R soap was 0.2% and that of P and C was 0.5% (Table 2). For the weft direction of the fabric, the R soap had average percentage shrinkage of 0.3% and soaps P and C had 1% (Table 2). In accordance with the GS 124 (2012) the maximum a fabric should score for the test for dimensional change is 5%. However, after washing the African print with the three types of soaps, the specimens with the R soap had the lowest change in dimensions in both directions of the fabric employed for the study and the figures fall within the standard specifications used by GSA for African prints. On the other hand, the specimens washed with the P and C soaps on the average had dimensional change values that also fell within the standard and the values indicate that the two types of soap had greater effect on the dimensions of the fabric used for the study compared to the R soap.

**Differences in colour staining properties of Azumah blow soap made with different oils**

Table 3 presents the outcome of the colour staining properties of Azumah blow soap made with different oils.

*Table 3: Mean grey scale values for colour stainig after washing*

Soap types	R	P	C
<b>Fibers</b>			
Wool	4-5	4-5	5
Acrylic	5	5	5
Polyester	5	5	5
Nylon	3	4	4
Cotton	4-5	5	5
Acetate	3-4	4	4-5

Assessing with the grey scale for colour staining, the minimum value with each fibre type is 4 (GS 124, 2012) with 5 being excellent. A value of 4 is very good, 3 is good, 2 is moderate and 1 is poor. Table 3 shows that for colour staining the R and P soaps performed very good on wool but soap C performed excellently with the average value of 5 (Table 3). On polyester and acrylic, all three types of soaps performed excellently. With regard to cotton, the P and C soaps performed excellently with R soap doing very good with the value of 4-5 (Table 3). However, on the whole, the C soap had the best performance compared to the other two soaps which means it will not cause colour staining when used in washing.

The outcome of this investigation has proven the point made by Donkor (1986) that no two oils have identical soap making properties, and the art of soap making lies not only in the boiling operation but in the judicious selection of the oils and fats to produce the qualities needed.



## CONCLUSION

From the findings of the study, it can be concluded that the Azumah blow soap with the different oils had effects on the colour and size of the real wax print used for the study. However, it can be noted that the C soap (coconut oil soap) performed best in terms of colour fastness to washing and staining. Even with the change in dimensions its outcome is acceptable looking at the standard set by GSA. The soap made with Palm oil was also of good performance with the R soap having least performance on the fabric used for the study.

The investigation has brought to light that a change in the oil used in the making of the Azumah blow soap is likely to cause a difference in the quality of the soap and reduce its effects on the fabrics when they are used in washing.

## Recommendation

It is recommended that other performance attributes of cotton fabrics are explored with these types of soaps to give an overall picture of their total performance. This same study could also be repeated using at least three washing cycles to further confirm shrinkage and colour change performance attributes of fabrics washed with “Azumah blow” soap. These will help to establish their total performance and help establish the type of oil that can produce best results with the Ghanaian locally made Azumah blow soap.

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