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# Hand Block Printing: Experimenting with Assorted Surfaces and Inks

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**ABSTRACT**

Block printing has gained attention in academic discourse over the years due to its primacy in the art of printing. This oldest method of printing which is believed to have originated from Asia is currently practiced globally. In Ghana, the art is locally known as Adinkra printing, which essentially rely on a natural dye called Adinkra Aduro and calabash as the chief block surface for printing. Despite the popularity gained by this traditional art, little has been explored with respect to block surfaces, fabrics and printing inks. The Adinkra Aduro which lacks a colour fastness property is printed only on woven cotton fabrics. With the art studio-based research method, this study sought to explore varied block surfaces on assorted fabrics with both water-soluble and water-insoluble printing inks to open the horizon of block printing in the Ghanaian context. The study revealed marvelous effects which could be achieved with other block surfaces apart from the calabash surface used by Ghanaian textiles artists for block printing. It is recommended that, the block printing sector of the Ghanaian textiles industry would extend their resources to varied block surfaces and printing inks if not the fabric, to broaden the scope of the art.

Keywords: Block printing, assorted fabrics, varied block surfaces, Printing inks, Print impression.


## 1. Introduction

Textiles printing could be executed through several techniques including hand block printing; a process that requires steady movement and careful hand-eye coordination as noted by Gujral (2017). In this technique, a design to be printed is carved to project above the surface of a medium (normally a wooden block). The raised design picks the ink when the block is dipped in the ink bath, and

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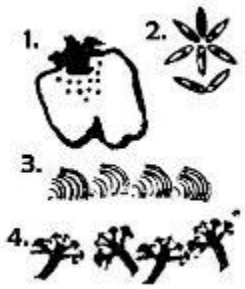
subsequently creates an impression when stamped on a substrate. Since block printing is done manually, imperfections are unavoidable. This, however, is considered as the beauty of the craft according to Needleman (2018). The author further expresses the fact that screen prints have been designed to have these mistakes incorporated in them, showing how block printing is cherished by textiles artists in their profession.

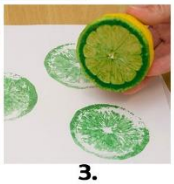
Block printing has gained popularity around the world and is believed to have been practiced in India, China and Japan as early as the 15th Century BC (Anand, 2020). According to Kime (2020), printing textiles with wooden blocks is thought to have started in China several millennia ago, but its full potential wasn't fully realised until it was adopted by Indian textile manufacturers in the Middle Ages. Literary records has it that, wood block printing had been widely used in China as a technique by the Tsin dynasty in 303-379 AD, and about the seventh or eighth century, the Chinese already used the technique (Chau, 1978). Ganguly and Amrita (2013) confirmed Chau (1978) and Kime (2020) assertion that, the art was first developed in China towards the early 3rd century. Its origin has therefore remained debatable. Nevertheless, it is regarded as the oldest method of printing and one of the most eco-friendly printing techniques in existence as far as natural dyes application is concerned (Ross, 2016). The drawbacks of natural dyes such as smell impartation on the cloth and the lack of colour fastness has necessitated the adoption of synthetic dyes by most countries for traditional dyeing and printing (Frimpong, et al., 2013; Oduro and Addo-Yobo, 2015; Seidu, 2019). This arguably has landed the art in a state not so considerd as an eco-friendly technique. Records of block printing was found in Egypt around the 4th century (Ganguly and Amrita, 2013). Today, the art of block printing is practiced as ancient art in most African countries including Ghana.

Researchers have delved into block printing using different media of natural and artificial origins as block surfaces for printing. Badoe et al. (2015) explored the area of screen printing using materials within the immediate environment. Ashitey (2013) also delved into the creation of textile design patterns from natural and artificial sources focusing on a direct transfer of the objects onto a screen. Although, the above-mentioned scholars focused on screen printing in their research, their results attest to the fact that artists are surrounded by significant items which could be adapted at the studio to foster creativity in the area of printing. In the case of block printing, TeacherPlus (2012) in a studio practice realised that, fruit and vegetables make wonderful natural blocks for printing. The exploration made use of natural stuffs such as capsicum, French beans, a quarter spring onion and a cauliflower. Ashe (2018) under studio conditions also experimented with rubber surface stamps for block printing and obtained impressive results. Again, McMahon (2013) in exploration to foster creativity in children utilized celery, orange and cabbage as blocks for printing. Reference could also be made to an experimental study carried out by Csiky (2019) with surfaces such as traditional lino, Japanese vinyl, speedy-carve, softcut and quickprint blocks. These researchers show with their studies, the extent to which surfaces could be explored in block printing. This situation is however different in the Ghanaian context where traditional block printing is practiced with only calabash surface. Table 1 shows sample results obtained by researchers in a studio experiment with various block surfaces.

Table 1:

*Block surfaces explored by researchers in block printing.*

| Author | Material used for stamp | Results (effect) |
|---|---|---|
| TeacherPlus (2012) | Capsicum<br>French beans,<br>A quarter spring onion<br>A cauliflower |  |

| | | |
|---|---|---|
| Ashes (2018) | Rubbber |  1. |
| McMahon (2013) | Celery<br>Cabbage<br>Orange |    2. 3. |
| Seidu (2019) | Styrofoam |  |
| Csiky (2019) | Lino |   |

In Ghana, the art of block printing is locally known as Adinkra printing, and it is practiced by the Asante people of Ntonso in Ashanti Region (Kissi, et al., 2019). Some scholars however believe that, the Asantes learnt the Adinkra cloth production from the Brongs after they defeated the Dormaas before 1699 (Adom, et al., 2016). Adinkra printing thus involves the designing of symbols, which are transferred onto calabash stamps for printing with a local dye known as Adinkra Aduro (Essel, 2017). This natural dye is extracted by boiling the bark and roots of Badie together with iron slag for several days (Kquofi et al., 2018; Ntiri and Kemevor, 2018; Kissi, et al., 2019). Badie is the local name of a shrub tree called Bridelia ferruginea. It is a small non-laticiferous scaly tree that grows to about four (4) meters high and often bears spines in slash crimson colour (Alowanou, et al., 2015).

Block printing in Ghana is only linked to adinkra printing. Adinkra cloth boasts as one of the major African printed fabrics and is therefore regarded as an uthentic 'African print' according to Essel (2017). Unfortunately, the dyes used for the art comes with a challenge of colour fastness, and the fact that only one colour could be printed on the cloth (Seidu, 2019). Little has therefore been explored in the area of block printing with respect to block surfaces in Ghana. These challenges have given way for the importation of cheap textiles from developed world which has landed the ghanaian textiles printing industry in general at the verge of collapsing (Howard, 2013; Tsekpo, 2020). Quartey (2006) in a study confirmed the decline of the industries due to the impossibility of the Ghanaian textile products to compete with the cheap imported ones. According to Amissah and Letcher-Teye (2018), the rich culture of Ghana is embedded in its printed fabrics. The fabrics are used as occasional wears to send messages and reflect the beliefs of the users. With reference to the value embodied in the products, the industries, especially the local block printing sector, needs to be sustained to promote the locally made products as aimed in this study. Adinkra, although has gained popularity over the years as a Ghanaian traditional cloth, its hand-woven counterpart known as Kente has become more popular in exhibitions around the globe (Willard, 2004). The need to overcome its limitations to compete with the other locally made textiles therefore arises.

In a quest to expand the scope of block printing in the Ghanaian context, Seidu (2019) researched into the use of substitute surfaces (plastic nets, wood and Styrofoam) for block printing. The author brought to bear the interesting effects which could be obtained by such surfaces and the feasibility of other materials apart from calabash in block printing. The study however utilized only water-soluble fabric print paste and three surfaces among the numerous surfaces in the environment which stand the chance of giving more interesting designs when adopted for block printing. Emma (2012) realized the need to preserve craft knowledge as a cultural heritage by investigating into hand block printed and resist-dyed textiles of rural Rajasthan. This study practically goes an extra mile to addresses alternative methodologies needed to improve upon the performance of traditionally produced artifacts for cultural preservation in the Ghanaian setting. It sought to experiment with other block surfaces such as Sand paper, foam (polyurethane), rubber tyre, straw board and wood with both water-soluble and water-insoluble (polyvinyl chloride-based) print paste under studio condition. This is to observe and document the impression created by the said print pastes on the various fabrics with the aforementioned block surfaces to sensitize the local block printers on the various alternatives available to them as far as their business is concerned. In this case, the art studio-based research method became significant in a two-phase experimentation with water soluble and water insoluble printing inks on assorted fabrics.

Findings revealed that, alternative surfaces give impressive print effects. Unavoidable imperfections given by the surfaces in the experiment is considered as the beauty of the art. The use of Sand paper, foam (polyurethane), rubber tyre, straw board and wood as block surface with printing inks which are fast to washing is a step to improving the performance of the local block printed fabrics. The paper has contributed to the improvement of the local art by addressing a means of combating against the wash fatness shortfall of the Adinkra cloth, and the adaptation of alternative surfaces in the art to increase the versatility of the products.

The rest of the manuscript is structured in three sections including; Materials and Methods, Results and Discussion, and Conclusion and Policy Implications. Materials and Methods present the preparation of materials and two phases of a studio experimentation concluding with a wash fatness test. The results and Discussion section outlines the main findings with an in-depth analysis. The last section concludes the study and presents a set of policy implications.

## 2. Materials and methods

The study employed the art studio-based research method to carry out the experiment. The availability of materials coupled with inspiration from researchers informed the choice of the following block surfaces for the experiment: Sand paper, polyurethane foam, tyre, strawboard and wood. Other materials used include; fabrics (satin, silk, khaki, mercerized cotton, polished cotton, polyester, velvet, chiffon and linen), print pastes (water-soluble and water-insoluble) washing powder, mild soap and water. The fabrics selected, as confirmed by Seidu (2019) finds application by consumers in the Ghanaian economy. The two inks used most often in textile printing are water-based and plastisol (Dina et al., 2020); hence, their preference in this experimental study. The tools and equipment used include; a wood cutting machine, a foam pad, spatula, thermometer, pH meter, knife cutter, plastic containers, a pair of scissors, staple machine and pins.

### 2.1 Preparation of the blocks

A print-out image sketched with adobe photoshop software was placed on the various surfaces and carefully cut out with a knife cutter. The blocks were then prepared by mounting the various cut surfaces onto wooden bases with handles to aid the printing. These handles were made with a light-weight wood Triplochiton Scleroxylon, locally known as Wawa to reduce the weight of the stamp block. The wooden base was however cut with a wood cutting machine to have the shape of the prepared image. This was done to allow the surfaces to project well for easy picking of the print paste and subsequently give a good print image upon stamping. Figure 1 shows the image used for the stamps whiles Plate 1 shows the stamps made from the various surfaces.

Figure 1. Image used for the stamps. Source: Studio practice.


Plate 1. Stamps made from the various surface. Source: Studio practice.

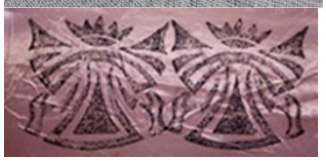
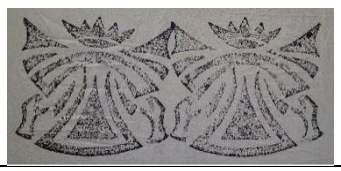
## 2.2 Phase one (1) of the experimentation

The first phase of the experiment made use of water-soluble print paste (acrylic). Twenty-eight (28) experiments were done using the block surfaces (Sandpaper, polyurethane foam, rubber tyre, strawboard and wood) with the aforementioned print paste. The fabrics used were; satin, silk, khaki, mercerised cotton, polished cotton, polyester, velvet and chiffon. These fabrics were cut into pieces in two different dimensions, thus; 7x14 inches (to make room for repetition) and 7x7 inches (without repetition). With the help of a spatula, the print paste was spread evenly on a flat foam (pad) and the various block surfaces were experimented on the fabrics by dipping into the print paste and stamping on the fabrics. The samples were made to go through an open air drying condition after the printing. The block surfaces, the fabric on which the experiment was done, the effect given and the observations made during the experiment are documented in Table 2.

Table 2.

*Phase one (1) of the studio experiment (with water-soluble print paste).*

| Surface used for the block stamp | Fabric | Effect | Remarks |
|---|---|---|---|
| Polyurethane foam | Satin |  | A clear impression with some amount of texture was obtained. |
| Polyurethane Foam | Silk |  | The impression created was averagely clear with reduced textures as compared to the sandpaper block on same fabric (silk). |
| Polyurethane Foam | Khaki |  | A bit clearer than sandpaper block on same fabric. |
| Polyurethane Foam | Mercerised cotton |  | A clearer impression observed as compared to sand paper surcface block on same fabric (Mercerised cotton). |
| Polyurethane Foam | Polished cotton |  | Similar impression observed as gave by the same surface block (Polyurethane Foam) on mercerized cotton. Mercerized cotton however gave a bit smoother impression |

| | | | |
|---|---|---|---|
| Polyurethane Foam | Polyester |  | Quick drying of the paste and easy penetration of the paste. |
| Polyurethane Foam | Velvet |  | The impression created was averagely clear. However, the print paste was not clearly seen at the wrong side of the fabric after printing. The piles on the surface of the fabric absorbed the paste which prevented its registration at the wrong side |
| Polyurethane Foam | Chiffon |  | The sandy (rough) feel of chiffon together with the soft surface of the block (polyurethane foam) yielded a textured but moderately clear impression. |
| Wood | Satin |  | Bold and clearer impression. The paste was not peeling off as happened with the polyurethane foam surface block. |
| Wood | Silk |  | The impression created was bold and clearer with reduced texture. |
| Wood | Khaki |  | The impression created was solid and clear with well-defined outlines |
| Wood | Mercerised cotton |  | Averagely clear impression observed. Reduced textures could also be observed. |
| Wood | Polyester |  | Quick-drying of the paste and easy penetration of the paste as seen in the use of polyurethane foam surface block on the same fabric |
| Sandpaper | Satin |  | The print paste was peeling off from some areas when the stamp was been lifted from the fabric after stamping. The impression created was more textured reflecting the true nature of sandpaper. |
| Sandpaper | Silk |  | The impression created was not bold and clearer as observed with the use of wooden block on same fabric. Textures were observed in the print. |

| | | | |
|---|---|---|---|
| Sandpaper | Khaki |  | Faded impressions created with fine textures. |
| Sandpaper | Mercerised cotton |  | Faded and textured impression created. The textures are more as compared to what was observed with use of wood on same fabric (mercerised cotton) |
| Sandpaper | Polished cotton |  | Faded impressions as compared to the result given by polyurethane foam block on same fabric |
| Sandpaper | Velvet |  | The piles absorbed the paste which resulted in a quick drying after the printing. Also, the textured surface of the sandpaper was not clearly visible because it was absorbed by the piles on the surface of the fabric after printing. |
| Sandpaper | Chiffon |  | Bold and clearer impression created as compared to foam block on same fabric. The soft feel of the surface block (sandpaper) coupled with the sandy (rough) feel of chiffon yielded such an impression, with textures. |
| Straw board | Velvet |  | Sharp edges with a bit clearer impression. The paste was however absorbed by the piles on the surface of the fabric. |
| Straw board | Polyester |  | Similar impression observed as seen in the use of rubber tyre surface block on the same fabric (polyester). Thus, the print paste penetrated through the fabric and could be seen at the back. The impression was also textured. |
| Straw board | Satin |  | A clearer print with reduced textures as compared to the print observed with the use of tyre surface block on the same fabric (satin) |
| Straw board | Khaki |  | Bolder impression as compared to the print given by a tyre surface block on same fabric (khaki) |

| | | | |
|---|---|---|---|
| Rubber Tyre | Polyester |  | A textured impression observed. The print paste penetrated through the fabric and could be seen at the back. It also dried faster after printing. |
| Rubber Tyre | Velvet |  | Similar impression observed as seen in use of strawboard on same fabric (velvet). However, this print had some faded portions. |
| Rubber Tyre | Satin |  | Textured print observed. Some portions were however not clear |
| Rubber Tyre | Khaki |  | Textured print observed. Not bold enough with some imperfections. |

## 2.3 Phase two (2) of the experimentation

The second phase of the experiment was conducted with water-insoluble print paste (plastisol ink) with the same surface block stamps used in the first phase. The fabrics were cut into pieces of 7x7 inches and carefully arranged on a printing table to carry out the experiment. Table 3 shows the second phase of the studio experiment.

Table 3.

*Phase two of the studio experiment (with water-insoluble print paste).*

| Surface used for the block stamp | Fabric | Effect | Remarks |
|---|---|---|---|
| Polyurethane foam | Silk |  | Uneven print with textures observed. The edges are not sharper as compared to print given by wood surface block. |
| Polyurethane foam | Khaki |  | The polyurethane surface block gave a similar print as given by the wooden surface block on the same fabric (khaki). |
| Polyurethane foam | Mercerised cotton |  | The fabric absorbed more print paste at certain portions than other portions. The sticky nature of the print paste gave unleveled impression with the polyurethane foam block. The effect was however good. |

| | | | |
|---|---|---|---|
| Polyurethane foam | Polyester |  | The polyurethane foam surface block gave a similar print as given by the wooden surface block on same fabric. |
| Polyurethane foam | Linen |  | A similar print observed as seen when experimented with the wooden surface block on same fabric (linen). |
| Wood | Silk |  | A bold impression is observed with minimized texture. The edges are moderately shaper. |
| Wood | Mercerised cotton |  | A fairly clear print observed. The edges are a bit defined with minimised texture. |
| Wood | Polyester |  | A bold print achieved with visible edges. The fabric absorbed the print paste with the wooden surface block |
| Wood | Linen |  | The linen fabric gave a fair print with the wooden surface block. The print was visible with minimised texture. The print paste penetrated through the fabric and could be seen clearly at the back. |
| Wood | Khaki |  | Bold and clear impression created. The print paste was able to penetrate through the fabric to give an effective print. |
| Sandpaper | Silk |  | A textured and patchy impression observed. The print gave a true reflection of the surface block stamp used (sandpaper) |
| Sandpaper | Mercerised cotton |  | A texture and faded impression observed. The fabric absorbed minimized print paste with the sandpaper surface block |
| Sandpaper | Polyester |  | Uneven impression observed with textures. Most of the paste remained on the stamp after removal from the fabric |

| | | | |
|---|---|---|---|
| Sandpaper | Linen |  | Uneven print observed. The sandpaper surface block could not deposit much print paste on the fabric. Most of the print paste remained on the block after printing. |
| Straw board | Velvet |  | A fully registered image observed. The edges are visible |
| Straw board | Polyester |  | Same print observed when compared to the result given by rubber tyre surface block with same printing ink (plastisol) on same fabric (polyester). |
| Rubber Tyre | Velvet |  | The full image was quite registerd. The piles on the fabric absorbed the print paste. |
| Rubber tyre | Polyester |  | The print had less imperfections but not bold and clear as given by polyurethane foam surface block on same fabric (polyester) with same printing ink (plastisol). |

## 2.4 Wash fastness test

The block printed fabric samples were subjected to a wash fastness test to ascertain their feasibility in the local art in the quest to combat against the colour fastness shortfall of the locally printed cloth. Four samples were used for the test. Two samples printed with water soluble print paste and another two with water-insoluble print paste. The fabrics were of the same dimension, structure and content; thus, 7x7 inches plain-woven 100% cotton fabrics with thread count of 120T. These printed fabric samples were conditioned in a room temperature of 29.0°C for 24 hours and subjected to a hand washing experiment with both strong detergent and mild soap.

Test 1: The first test was conducted with a detergent (Kleesoft washing powder). 15g of the powdered detergent was diluted with 3.5 litres of water with a pH 8.0 at 29.9°C. The specimen were washed separately with equal volume of the aforementioned solution. After 1 minute 15 seconds of a vigorous hand washing, the samples were rinsed and line-dried in an open air for an hour. With visual assessment, conclusions were drawn on the tested specimen as summarized in Table 7.

Test 2: The second test was carried out with a mild soap (Geisha) with the same volume of water, pH and temperature used for the first test. Two samples, each printed with separate inks (water soluble and water insoluble) were subjected to the hand washing technique as happened in the first test. Conclusions were drawn again with visual assessment after the washing. Table 4 presents the wash fastness test conducted.

Table 4.
*Wash fastness.*

| Soap/Detergent | Print ink/fabric | Original specimen | Tested Specimen |
|---|---|---|---|
| Washing powder | Water soluble/ 100% cotton |  |  |
| Washing powder | Water insoluble/ 100% cotton |  |  |
| Mild soap | Water soluble/ 100% cotton |  |  |
| Mild soap | Water insoluble/ 100% cotton |  |  |

## 3. Results and discussion

The studio experiment was conducted in two phases. The first phase featured twenty-eight (28) experiments with 3 variables (print paste, substrate and block surface), whiles the second phase covered eighteen (18) experiments with the same variables. This added up to forty-six (46) series of experiments. Acrylic print paste (water-based) was used to conduct the experiments in the first phase whereas Platisol of Polyvinyl Chloride (PVC) origin was used for the second segment of the experiment. Both natural and synthetic fibre fabrics were used since they all find application in the Ghanaian Fashion and Textiles industry (Quartey, 2006). The block surfaces were of the same dimention (5x5 inches) with a common supportive material (wood) to aid in the handling and stamping of the image to create the impression on the fabric.

### 3.1 First phase

Wooden surface block stamps gave good prints with water-based print paste, and this lends credence to its usage as a main type of block for printing as noticed by (Ganguly and Amrita, 2013). Researchers (Gujral, 2017; Seidu, 2019) are of the view that, wooden blocks give a bold and clear print in addition to crack resistance when it is dipped in an oil bath for a period of time prior to printing. The wooden block used for this experiment was not dipped in an oil bathe. However, it was realized that, among all the surface block stamps used, wood was yielding bold and clear impressions with the print paste (water-based), although the results varied per the fabric used. No cracks were also detected on the wooden block during and after printing. This suggests that, the type of wood, either hard or soft may also influence the performance of the block. This experiment made use of a soft wood Triplochiton Scleroxylon, locally known as Wawa.

Sandpaper surface block was giving a recurring textured impression with the water-based print paste on the various fabrics. Nonetheless, velvet and chiffon yielded to odd results with the sandpaper block and the water-based print paste. The sandpaper block surface was used successful to execute the printing without any distortion or tearing. This became possible by regulating the viscosity of the print

paste at the laboratory before the commencement of the printing. In this process, a reduced amount of water was added to the print paste and stirred to ensure a lump-free ink. This resulted in a print paste with an average viscosity which could not deteriorate the sandpaper surface block during the printing process.

Polyurethane foam surface showed distinct but close results as seen previously in wooden and sandpaper surfaces on the various fabrics using the water-based print paste. It was observed in the experiment that, although polyurethane foam has a low moisture permeability and low water absorption property as ascertained by Thirumal et al. (2008), the polyurethane foam surface block allowed much intake of the print paste when the stamp was dipped into it. This subsequently resulted in bold and clear prints next to wooden surface upon careful observation and comparison. The excellent dimensional stability property of polyurethane foam became a contributing factor to this outcome.

Straw board is known for its usage as a building material due to its numerous advantages. It is more low-carbon and environmentally friendly in terms of production and use; good physical properties, including high strength, good seismic performance, excellent thermal insulation, good fire resistance and less costly (Zhang, et al., 2020). In this study, however, it became a significant surface for block printing. The outcome of the experiment with the straw board surface block using water-based print paste is seen in Table 2.

Recently, the worldwide growth of the automobile industry and the increasing use of cars as the main means of transport have tremendously boosted tyre production (Bekhiti et al., 2014). An estimated 1000 million tyres reach the end of their useful lives every year (Banerjee et al., 2016). The environmental waste generated by rubber tyres has therefore become a challenging issue in the 21st century. To find a significant application for this ecological-threat material, it became necessary to utilize it as a surface for block printing in the studio with water-based print paste. The results, as documented in Tables 2 and 3 show the admirable print effect given by this surface.

### 3.1.1 Significance of results in relation to the local art

As evident in the results, the various block surfaces explored in the study have the tendency of giving effective results as far as block printing is concerned. In the Ghanaian context where calabash is the chief block surface used for printing, artists were presented with varied materials as block surfaces in this study to diversify the art. Ghanaian local artists are holding onto the use of calabash as a surface for block printing with cultural preservation as a motivation. The use of alternative block surfaces are suggested in this study to complement the local calabash stamps if not a complete eradication from the system for cultural preservation purposes, in order to broaden the scope of block printing in the country. Kissi, et al.,(2019) has it that, Ghanaian symbols known as Adinkra are visual symbols that represent concepts and are used in fabrics, on walls, logos and can be found everywhere. Adinkra symbols have therefore become national symbols which easily identify Ghana (Aboagyewaa-Ntiri, et al., 2018). These symbols form an integral part of the adinkra printing which will equally identify and keep the culture of Ghana when other block surfaces are employed to print the symbols on any base fabric.

As an alternative to natural dyes, Ghanaian textile artists employ water-based printing paste for their studio practices, although efforts are being made to get rid of synthetic dyes due to environmental pollutions (Oduro and Addo-Yobo, 2015; Dzramedo and Ahiabor, 2020). This is mainly seen in the screen printing technique (Gbadegbe, et al., 2017). The application of synthetic dyes in Ghana due to their good wash fastness property is therefore not a new practice. From the experiments carried out in this study, it is evident that water-based print paste which is fast to wash give good prints with the block printing method. To cater for the colour fastness deficiency of the adinkra printed cloth made from the local dye, artist are presented with print samples in this study to serve as evidences to the possibility of adopting the water-based printing ink in block printing. Aboagyewaa-Ntiri and Mintah (2016) in a study noted that, the decline of the adinkra textile subsector of the Ghanaian textile industry is partly due to the adinkra dyes made by the local artist. The authors further established the fact that, the self-made dyes are generally poor in quality as compared to the factory dyes. The merger of these dyes by the local artists would help sustain the dwindling art.

The adinkra printed fabrics are used only as traditional funeral cloth for mourning and bidding farewell to the dead (Ventura, 2012; Adom, et al., 2016; Adom, et al., 2018). This is due to the fact that

the cloth comes mainly in black colour which is connected to mourning in Ghana (Aboagyewaa-Ntiri and Mintah, 2016). The application of only the local dyes therefore limit artists to only one colour (Seidu, 2019), which undoubtedly limit the application of the prints. With the water-based printing ink explored in this study, artists have the chance to play with numerous colours on the plain fabrics to achieve diverse coloured adinkra prints. This will increase the patronage of the prints, as they become useful in other occasions other than funeral events.

As an eye-opener, this study utilizes other fabrics rather than the cotton fabrics used by the local artist for their crafts. Howard (2016) observes that, there are numerous foreign textiles on the Ghanaian market such as silk, nylon, polyester, etc. which find application in clothing, curtain, bedspread, carpeting and upholstery. Those fabrics are gaining attention based on the interesting designs found on them. These fabrics could be employed for adinkra printing in order to widen the application of the local block printed cloth. This situation is addressed in this study by carrying out experiment on such imported fabrics to draw the attention of local artist to the adaptation of those fabrics in their practices. As seen in Table 2, satin and silk gave prominent print effects with a wooden surface block and water-based printing ink. Unfortunately, these variables are abandoned by local artist in their profession. This necessitates the sensitization of artist on the adaptation of alternative base fabrics for printing to ensure a significant improvement in the industry.

## 3.2 Second phase

The second phase of the studio experiment delved into water-insoluble print paste (plastisol ink) using the block surfaces employed in the first segment; thus, wood, polyurethane foam, straw board, rubber tyre and sandpaper. Plastisol ink is a PVC-based ink composed of a clear, thick plasticizer fluid and PVC resin (Dina et al., 2020). It is commonly used in textiles printing for T-shirts. The side effect of this ink is that, the prints do eventually break down after a handful of washes; it tends to crack, peel, and flake off (Harris, 2018). Eighteen (18) series of experiments were therefore conducted with this ink at the studio to observe and document the effect. The fabrics used were khaki, velvet, linen, polyester, mercerized cotton and silk.

### 3.2.1 Significance of results in relation to the local art

As established previously, Ghanaian artists are adopting water-soluble printing ink as an alternative for the natural dyes mainly in screen printing. Frimpong, et al., (2013) in a study concluded that, although the traditional methods of adinkra cloth production are very much in use, the cloth is more widely available today because of the introduction of mill-woven fabric and the use of synthetic dyes. It is therefore of much interest to explore with plastisol ink which is rarely used for block printing in Ghana to increase productivity and combat against the wash fastness shortfall of the local block printed cloth. As evident in Table 3, the plastisol ink responded amazingly to polyurethane foam and wooden block surfaces. These variables could be adopted significantly to widen the scope of the local block printing industry.

Adinkra cloth printers use cotton as the chief fabric for their art. Polyurethane, wooden and sandpaper surfaces were experimented on this fabric with the water-insoluble printing ink in the second phase of the experiment to examine the print effect. Attention was paid to the reaction and effect of cotton fabric in the process due to its wide usage as a raw material in the Ghanaian textile printing industry (Taylor, 1999; Quartey, 2006). With reference to the results presented in Table 3, the variables, with exception of the sandpaper block surface which gave a bit faded impression, are worth adopting for the local art.

## 3.3 Wash Fastness

With a careful observation, it could be seen from Table 4 that, the colour intensity of the tested samples are not so different from the original samples. With exception of a specimen (water soluble ink printed) which gave a slightly different result with the washing powder, the remaining specimen gave a very good wash fastness result with both the washing powder and the mild soap. This validates the feasibility of the methodologies applied in this study in the local block printing art, in an attempt to address the poor fastness deficiency of the adinkra printed cloth.

With reference to the results obtained from the wash fastness test as shown in Table 4, mild soap could be recommended as the best cleaning agent for the washing of block printed fabrics as far as this experimental study is concerned.

## 3.4 Summary of results

The summary of results obtained in the first phase of the studio experiment with the water-soluble printing ink is presented in Table 5, whereas that of the second phase with the water-insoluble printing ink is presented in Table 6. Table 7 presents a summary of the wash fastness tests conducted after printing the samples.

Table 5.
*Summary of first phase results.*

| Block surface | Fabric | Effect/Impression |
|---|---|---|
| Wood | Satin, silk and khaki | Bold and clear |
| | Mercerized cotton and polyester | Clear with little imperfections |
| Polyurethane Foam | Velvet, chiffon and silk | Clear |
| | Polished cotton, mercerized cotton, satin and polyester | Clear with minimal imperfections |
| | Khaki | Less loud |
| Sandpaper | Satin, silk, khaki, mercerised cotton and polished cotton | Faded and textured |
| | Velvet and Chiffon | Bold and clear |
| Rubber Tyre | Polyester, velvet and satin | Clear with little imperfections |
| | Khaki | Less loud |
| Straw board | Velvet and satin | Clear |
| | Polyester, khaki. | Clear with minimal flaws |

Table 6.
*Summary of second phase results.*

| Block surface | Fabric | Effect/Impression |
|---|---|---|
| Wood | Silk and polyester | Bold and clear with well-defined edges |
| | Mercerized cotton, linen and khaki | Clear |
| Polyurethane Foam | Polyester | Bold and clear with well-defined edges |
| | Khaki | Bold and clear |
| | Silk, mercerized cotton and linen | Clear with minimal flaws |
| Sandpaper | Silk, mercerized cotton, polyester and linen | Patchy prints |
| Rubber Tyre | Polyester and velvet | Clear |
| Straw board | Polyester and velvet | Clear |

Table 7.
*Summary of wash fastness test.*

| Detergent/ Wash method | Volume of $H_2O$/ Temperature | Print ink used | Degree of fastness |
|---|---|---|---|
| Washing powder (Kleesoft)/Hand-wash | 3.5L/29.9°C | Water Soluble | Good |
| Washing powder (Kleesoft)/Hand-wash | 3.5L/29.9°C | Water insoluble | Very good |

| | | | |
|---|---|---|---|
| Mild soap (Geisha)/ Hand-wash | 3.5L/29.9°C | Water Soluble | Very good |
| Mild soap (Geisha)/ Hand-wash | 3.5L/29.9°C | Water insoluble | Very good |

## 4. Conclusion and policy implications

The studio experiment was conducted in two phases using three (3) variables (block surface, fabric and printing ink). These variables were alternated in both phases of the experiment to achieve the aim of the study. Wood, polyurethane foam, sandpaper, rubber tyre and straw board were used as block surfaces. The fabrics employed for the study were satin, silk, khaki, mercerized cotton, polished cotton, polyester, velvet, chiffon and linen. Water-soluble and water-insolub textiles printing inks were used.

In the first phase, wooden surface block, on average bases gave outstanding effect. Fabrics such as satin and silk gave bold impressions with well-defined edges. Considering the intensity of the impression obtained with the water-based print paste (acrylic), the block surfaces could be appreciated sequentially as follows; Wooden surface, polyurethane foam surface, straw board surface, rubber tyre and sandpaper surfaces.

In the second phase, wood and polyurethane foam surface blocks gave similar and impressive results among the block surfaces used for the experiment. Polyester fabric became an icon using the wooden and polyurethane foam surface blocks with the water-insoluble printing ink. The sequential order of preference of the block surfaces in terms of good print effect in the second phase is given as; Wood, polyurethane foam, rubber tyre, straw board and sandpaper.

Local artists employ synthetic dyes mainly in screen printing due to their good wash fastness property. The water-soluble and water-insoluble synthetic print pastes were explored in the study to sensitize artists on their exploitability in block printing. A wash fatness test was conducted to prove the good wash fastness ability of the inks used and their feasibility in the local art. This is aimed at increasing productivity, and combating against the poor wash fastness of the local block printed cloth. Adinkra cloth is used as a mourning cloth because the natural dye (Adinkra aduro) comes only in black. Synthetic dyes were introduced in this study to allow more colours in the art to make the cloth a multifunctional one. Alternative block surfaces were used in this study to draw the attention of the artists to the adaptation of other surfaces to complement the calabash stamps to achieve diverse print effects. Print samples are presented in the study to confirm the feasibility of the variable.

It could be said that, the diverse responses given by the various block surfaces in the experiment collectively express the beauty of hand block printing. It is therefore recommended that, Ghanaian textile artists would adapt the use of alternative block surfaces, fabrics and printing inks in their practice of hand block printing. This would render the adinkra cloth a multifunctional one and also curb its lack of wash fastness shortfall.

The study also recommends the adaptation of methodologies established in this study by art teachers in training their students. This would sharpen their creative abilities in the area of printing.

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