

Extraction and Harnessing Natural Dye for Fabric Dyeing Techniques in Industries in South-East And West Nigeria

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Abstract- Dyeing is the process of application or coloring of desired fibers, yarns, or fabrics to obtain fastness. This involves special solution containing dyes and particular chemical material. The study is to develop extract and harness natural dye for fashion dyeing techniques in industries in south-east and west Nigeria. The extraction will x-rays the three types of dyes from Roselle, Beetroot and Cube root plants, therefore, the application of extracted dyes to fabrics using different techniques, test the fastness of the dyes on fabrics and assess the desired acceptability of the dyes on the fabrics using textile industrial workers and masters-craftsmen. In this study, the Research and Development (R&D) design was adopted to extract natural colorant for textile industry. 4 research questions guided the study. Basically, the study constituted the tasks needed for attaining the objectives in fabric resist dyeing techniques (tying, folding and tying, stitching, marbling and batik). These available plants are cheap source of natural colorants and good alternative to synthetic dyes. The reliability of the instrument was done by experts within the area of the study. The population (138 N) which comprised of workers in industries and master-craftsmen within the area of the study. There was prove that these extracted natural dyes were more affordable, accessible, can be used effectively for fabric dyeing and getting nice colour strength and shades are assured.

Keywords- Dyeing techniques, Natural dyes, Fabrics, Dye extraction, Industries.

I. INTRODUCTION

Most plants has become the prominent and abundant sources of colourant which one can utilize for application of dye on textile products since ancients. One of the objectives for instituting industries in Nigeria is for skill acquisition, job creation, poverty reduction and opportunities for individuals to develop manipulative skills that will enable them function effectively in the society. Textile industry is an arm of other areas where practical works in textile should be inculcated to interested individuals. The extraction of the textile colouring agents was done by making a detailed study of natural plant leaves and its cell walls to enhance the dyeing quality, dyeing extraction and fastness coloring patterns on fabrics. A dye must be soluble in water or dispersible in a solvent and transferable to the substrate (Fabric to be dyed) by the process of absorption and exhaustion (removal of the dye from the solution). (Ochili, .2014) noted that a good dye must also be colour fast, otherwise it loses its quality and acceptability level the consumers. Different dye assistants and mordants have been identified to improve dye fastens on fabrics during washing and exposure to light. Atkin, (2006) stated that dye is one of the most crucial raw materials and processing chemicals required not only in the word, food, paper, photography, textiles, wearing apparel, leather and leather product industries, but also in all textile industries and even in educational institutions at all levels.

Fabrics is very essential in peoples' lives whether it is for attire, furnishing, designing, decoration. They are manufactured assembly of interlacing fibres, filaments and yarns having substantial surface area in relation to its' thickness, adequate mechanical strength to give a cohesive structure. Olabisi, (2004) maintained, that fabric materials made from fibre dyed with natural dyes are preferred by most individuals because of its colour fastness which retains and does not lose the dye colour easily.

Dyes are obtained from different sources such as natural sources and manmade or synthetic sources. Natural dyes are extracted from animals, plants and minerals whereas synthetic dyes are prepared from aromatic or chemical reagents in laboratory by man (Churchman, 1990). Observations has been made that dyes are scarce and synthetic dyes imported into the country are very expensive (Graw, 2011). Presently, in Nigeria, funding for textile industries is a great challenge and the inability of the industries to purchase materials and consumables such as synthetic dyes pose a threat to practical work. Natural dyes are locally and readily

available in our various environments. They are cheaper and can give an array of requisite and interesting colours for dyeing fabrics. Abundant species of potential dye yielding plants abound in Nigeria. These however, have remained largely unexplored (Dorin, 1990). Obikpo, (2004), made a comprehensive list of forty-three unexplored species with potentials of yielding dye which could be found in tropical Africa including Nigeria. Some of the plants include among others, cuberoot, roselle, beetroot, oil bean, oil palm.

Made in Nigeria fabrics are being currently popularized both within and outside Nigeria. Besides, the recent emphasis on acquisition of entrepreneurial skills to make products in our industries, schools, more effective should not be over looked. Emphases on local sourcing of materials to substitute the imported and expensive foreign goods are on the increase and our textile industries should not be left out. The study will involve the use of R & D model of Gal et al (2007) which has ten steps and which could be modified to suit this study.

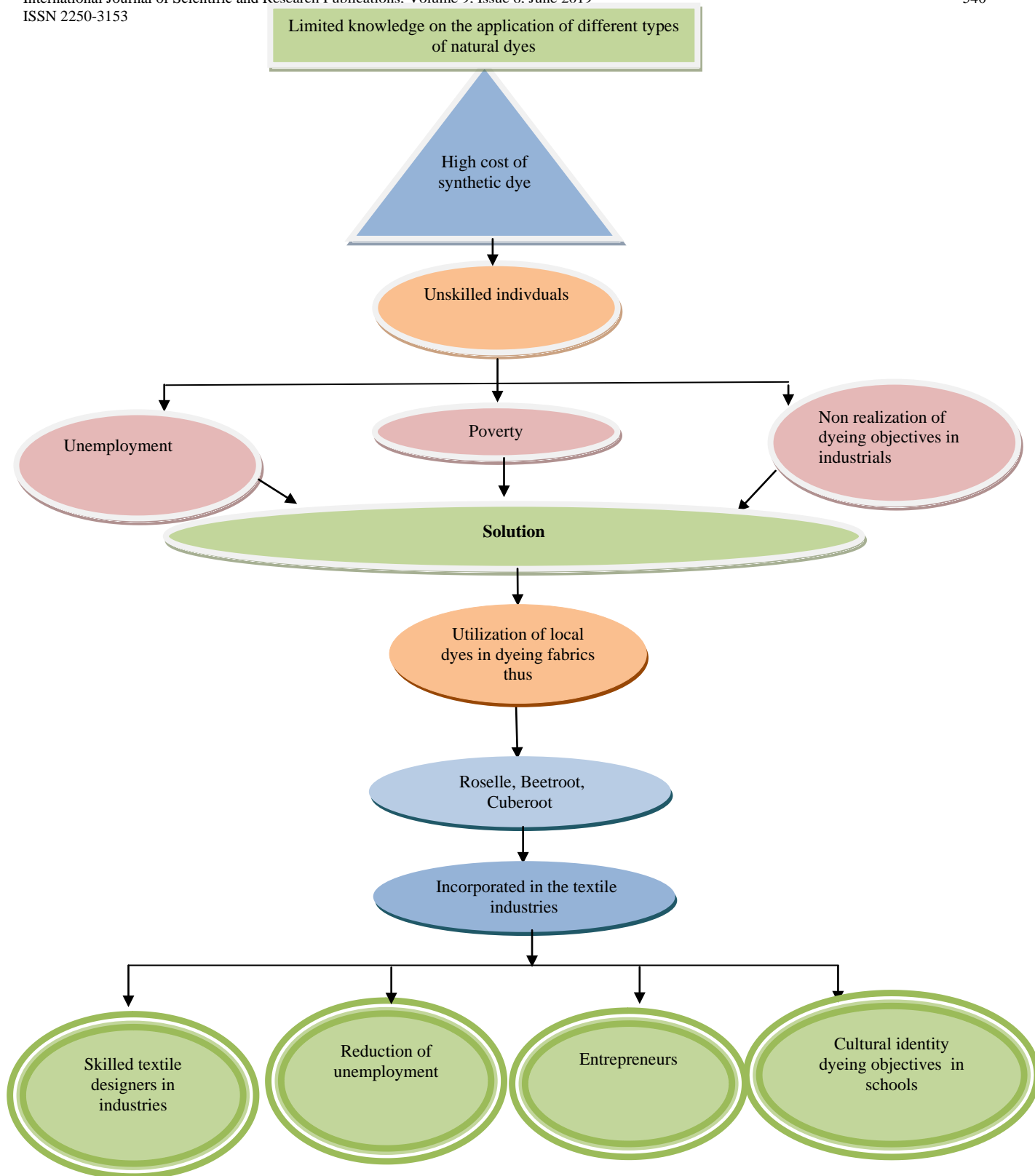
II. LITERATURE

In the word of Ezeoguine, (2018) a dye can be considered as a substance which can be fixed to a material by the selective absorption of certain wave length which will produce a sensation of colour. According to him, dyeing is craft practiced in many countries all over the world. Otubelu (2015) observed that the fabric which is mostly used in dyeing is light weight cotton fabric although silk, or any other fabric of light weight quality can be used. Before embarking on actual dyeing or resist operations, the fabric must be treated by washing to remove different fabric and any likely impurity in form of dirt or dust. This will ensure even dyeing. Okafor (2008) noted that fabric dyeing colouration could take any of the following method – tying, folding and tying, stitching, marbling, batik and printing techniques.

Dye can be obtained through man made natural agents. The natural dyes are so called because they are gotten from plants while man made dyes can as well be called synthetic dye some of the synthetic dyes are vat, basic direct and so. Natural dyes could be indigos dye from beetroot, Roselle or cuberoot. Mordant dyes do not dye fabric directly – it is an element that quickens the chemical reaction. The attachment of mordant to dyes is by means of a covalent and coordinate bond called chelation. (Dukpe 2015). Lemchi (2006) listed some of the textile industries like Arewa textile mills limited Kaduna, Sunflag Nigeria, Apapa Lagos. Bendel Textile will limited Asaba, General Cotton mill Onitsha, Kano textile Industries limited, aswani textile industry Osholi Lagos, International Textile Industries Lagos.

Latif, (2014) stated that dyed materials which were previously ignored have now been widely recognized by most Nigerians. Various fashion shows now promote new ideas and increasingly expose the public to the richness of our indigenous fabric dyeing and their potentialities for modern fashion. The economic situation in the country has helped to celebrate the total liberation of Nigeria fashion. This helped in making a complete turnway from the days of massive importation of fabric and ready made dresses, it can be said quite confidently, that fashion in Nigeria now reflects local climate, needs and materials (Anderson, 2014).

Agusiobu (2001) noted that the fastness properties of natural dyes must be ensured by going through some chemical analysis or testing directly on fabrics where the results are also ex-rayed. The dyeing techniques which could be applied in testing the fastness of the dye are – tying, folding and tying, marbling, stitching (both hand and machine) and batik techniques.



Designed Conceptualized Framework on The need of Natural dyes

Source: Researchers (2015).

III. IDENTIFICATION, RESEARCH AND COLLECTION OF IDEAS ON NATURAL DYES

The following procedures were adopted for the extraction of dyes from natural plants.

MATERIAL AND METHOD

Sample Preparation

Mature and healthy Roselle, Beetroot and Cube root plants was collected from the non-cultivated areas of the south-east and western part of Nigeria. Some of the collected materials were oven dried for 47 hours at 70°C and grinded into power. The application of Viscose fabric used for the dyeing was treated with NaOH solution (5%) for 15minutes, boiled with toilet soap (10g) for about 45minutes and dried.

Research on the three natural plants for practical extraction of dyes for fabric colouration

The researchers engaged in some methods to extract dyes. Thus – dissolving in liquid method, heating method and steeping method. The methods are uniquely suitable for extraction of dye from the plants. All these methods are closely related in application but with slight difference.

Dissolving in liquid method (Beetroot & Roselle): Any liquid that can dissolve another substance is called a solvent. This method was basically used for extraction of dye from Beetroot and Roselle using ethanol content. The researchers used one hundred (100g) of beetroot which was very fresh (not dry). Production started by washing, peeling and crushing while wet. Its paste was collected and dissolved in the 200% of ethanol as solvent to dissolve the crushed wet beetroot. The content was poured in a tight cover container and shaken properly to obtain a well mixed content which was left for a day (24 hours). On a tiny grain cloth, the content was passed through and the chaff was filtered off. This was kept for one week in an open room with enough air for evaporation to take place. Within the one week, the ethanol evaporated and the paste was the dye which was used to dye fabrics.

Heating method:

i). Cuberoot and Roselle dye extracted by heating method: The researchers scouted for and obtained reasonable quantity of cuberoot and Roselle plants leaves. Six kilograms (6kg) of both cuberoot leaves and Roselle was subjected to room temperature drying. The Roselle was dried already while the cuberoot was fresh. The fresh cuberoot is dried between 70-75 hours and the roselle (dried already) were further dried little just to keep them warm for 35 minutes. The two contents were crushed together and a fine flour content was achieved which was kept and was used for extraction of dye by the application of heating method. The two contents were heated differently, at the temperature range between 75°C and 95°C for 15 or 25 minutes. The two contents were allow to cool and they were sieved to remove the chaff while the content (dye liquor) were used for fabric dyeing.

ii). Beetroot Dye: This was the use of very hot water to heat up something by boiling. Dye from beetroot using heating method. To maintain cleanliness, 100g of beetroot plant were well washed and peeled. The researchers blended the wet beetroot. The paste was heated up with 200ml of water, approximately in the ratio of 1:2, in a temperature range of 75°C – 95°C and was allowed to heat for 25 – 35 minutes. The content realized was allowed to cool. This was then sieved with tiny mesh. The result was collected, labeled as dye liquor from beetroot which was used for fabric dyeing.

Steeping Method (Beetroot & Roselle): dyes can be extracted from beetroot plant using the above method. The researchers searched and got reasonable quantity of Beetroot and Roselle plants leaves which were well washed and kept to dry a little for easy handling. This was followed by peeling after which they were sprinkled with water, crushed/grinded. The quantity was soaked in water for twelve (12) hours in the ratio of 2:4 (of Beetroot flour/Roselle and water) upon completion of soaking in water for 12 hours. Tap water was used. The researchers sieved them with 0.3 or 0.5 size mesh just to remove the dirt/impurities. The liquid content is the dye liquor from Beetroot which the researcher used to dye fabrics. No heating was applied.

The fabrics were dyed using natural dye obtained from Beetroot, Roselle and Cuberoot. Two mordants alum and ash were used other items applied include:

- 15 – 20 grams of seasalt
- 0.15 litres of mixed caustic soda
- 50 grams of sodium hydrosulplite
- 100 grams of any of the already produced natural dyes
- 5 litres of water
- 20 yards of cotton/silk of fabrics.

Method of the Practical work

Traditionally, dyeing is done depending on the desired shades. The quantity of dye to be used therefore depends on the depth of colour required. The mordant was poured over the dye until it is enough. Both are then mixed together and other materials added too. The content was left to stand for two days before it is considered ready for use. It is stired at interval during this period. The fabrics were then pre-treated by washing and followed by immersion in the dye solution. Fabrics are held in the dye bath for three – five minutes, and were lifted into the draining board for 3 minutes before they were dipped again into the dye solution for three minutes. Fabrics were brought out washed in a cassava starch to ensure fastness of the dye to the fabrics and spread on a hang line to dry.

Researchers observed that the dye solution was good for five days after which it begins to produce unpleasant smell. As soon as the dyed fabric dries, collect them and fold them carefully and get them ready for beating process. This is achieved by the use of

log of wood (3 feet) and use the mallet (like pestle) to beat the fabrics. Fold the fabrics further as the beating goes on while the researchers pulls the beaten side towards them. The fabrics were finally packaged and kept for end user.

TEST FOR EFFECTIVENESS OF THE EXTRACTED DYE FROM THE NATURAL PLANT LEAVES ON THE FABRICS USING FOUR DYEING TECHNIQUES

The industrial workers and textile craftsmen were subjected to some tasks to test the effectiveness of the extracted natural dyes. Four techniques were adopted thus:

Technique One: By Folding and Tying: This is based on fabric dyeing using folding and dyeing technique. Out of the 15 tasks listed, 14 were chosen as needed tasks to achieve the desired dyeing result. This is with mean scores ranging from 3.19 to 3.94 and standard deviation ranging between 0.31 and 0.40. This indicates that all the 14 tying tasks were needed for attaining the objectives in fabrics tying and folding dyeing technique. It then adds validity to the mean and its implications.

Technique Two: Stitching: This involves the use of running stitches to design fabrics before dyeing. 18 procedural tasks in the application of stitching dyeing technique were agreed upon as appropriate tasks which had between 0.00 and 0.28. This indicates that all the tasks were appropriate for stitching technique. This adds validity to the mean and its implications.

Technique Three: Marbling: This is another technique which involves colour application on fabrics that have rough surface as designed. Based on the 12 tasks listed, 10 were chosen as needed tasks for attaining the desired colour in marbling technique with mean score ranging from 3.29 to 3.92 and standard deviation for the tasks ranging between 0.27 and 0.35 which indicated that the 12 items in the marbling tasks were needed for attaining the objectives in fabric marbling dyeing in the industry and for local craftsmen. As a result, they add validity to the mean and its implications.

Technique Four: Batik: The process in this technique involves the application of hand stamping or wax-resist dyeing on whole cloth to create an interesting design. Finally, out of the 16 batik tasks listed 14 were needed for attaining the objectives in batik fabric resist dyeing techniques, with mean scores ranging from 3.38 to 3.95 which implied that the tasks were agreed upon as needed tasks in batik dyeing. The values of the standard deviation for the tasks ranged between 0.21 and 0.39. This indicates that all these 14 batik tasks were needed for attaining the objectives in fabric resist in industrials and among the craftsmen. Therefore, on the values of the standard deviation which are low (less than 0.5), this shows that the individual responses on each item are close to the mean calculated. Thus, they add validity to the mean and its implications.

Test for effectiveness

Samples	N	Tasks	Mean	Standard deviation	Achievements
Natural Plant Dyes	38	Practical Work	49.5000	.84984	23.40
Synthetic Dyes	38	Practical Work	23.4000	3.89444	10.10

Author's Source

The results presented in the above table shows that the craftsmen and students taught using the conventional method on synthetic dye had mean test scores of 23.40 then the achievements for synthetic dye is 10.10 while in Natural plant dye which is 49.50 through the use of conventional method, then the achievements for natural dye is 25.90.

Finally, Synthetic dyes has a very harmful effects on the environment and human beings because they are made up from chemical compounds like mercury, lead, chromium, copper, sodium chloride, toluene, and benzene therefore exposure to these toxic substances can cause cancer like skin cancer etc. water pollution can also result from manufacturing synthetic dyes when untreated dye effluent is dumped directly on bodies of water. Natural plant dye is safe and is not harmful because they are effluent with organic bacteria in order to lessen fungi disease and reduction of cancers. Beetroot helps in inflammation and it has anti-cancer properties. Roselle contained and is packed with Antioxidants which helps to prevent some un-pleasant circumstances to individuals.

IV. DISCUSSION OF FINDINGS

The study found out various fabrics resist dyeing techniques – tying, folding and tying, stitching, marbling, batik among others. It is therefore expected that the implementation of experiences from the study will adequately motivate and encourage textile industrial workers and individuals who wish to go onto entrepreneurship in fabric dyeing and other such related ventures. This invariably will help to reduce unemployment and consequently poverty among individuals.

Moreover, the finding of the study reveal that skill in fabric dyeing using natural dyeing will equip the industrial workers and entrepreneurs with good knowledge in fabric dyeing, there will be job opportunities. These will promote our local fabric dyeing adequately. This then implies that natural dye are consider adequate for fabric dyeing (Okpara, 2012).

V. CONCLUSION

This study has filled the gap of non-availability and high costing of synthetic dyes. This is because the natural dyes can also be used to achieve good result in all the dyeing techniques in textile industries within the study area in Nigeria. Dyeing covers a wide area and a good number of people are engaged in the textile dyeing in industries throughout Nigeria today. Central to human resource training and development is the role of most textile industries and entrepreneurs. These industries are expected to use not only the synthetic dyes which is not easily affordable but also natural dyes and appropriate techniques for equipping individuals especially the textile industrial workers and entrepreneurs with skills to cope with situation of serious challenges in fabric dyeing, unemployment facing individuals, families and the countries at large are grossly reduced. Industries are thereby charged with the responsibility of equipping individuals with variety of skills in dyeing and accessibility of natural dyes from the local plants – instead of relying solely on the purchase of foreign dyes.

In gatherings where dyed fabrics are worn by a lot of people, they came in a wide range of colours. Natural dyes also offers this and it is easily affordable from the bushes in our environment. Nigeria have now accepted the locally produced dyed fabrics which are in different colours. Nigerian dyes fabrics are already competing favourable with other textile in the world market. Most people and groups can now open up small cottage industries to be run within the scale they can afford. This will enhance the production of dyed fabrics in large quantities. by this approach, improvements can be made in production and the advantage taken of both in internal and external markets.

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