INTERNATIONAL JOURNAL OF PHYTOFUELS AND ALLIED SCIENCES
(A Journal of the Society for the Conservation of Phytofuels and Sciences)
(http://www.phytofuelsciences.com) (ISSN 2354 1784)

Indigenous Decorated Fabric Production using *Jatropha curcas* and *Indigofera tinctora* Dyes

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ABSTRACT

Over the years, various scientific researchers have revealed that *Jatropha curcas* and *Indigofera tinctora* are plants with variety of uses in different spheres of human endeavours but not much research has been done on its use in textile industry. This study examines the use of *Jatropha curcas* and *Indigofera tinctor*a in the production of Indigenous fabric for the benefit of the society. *Jatropha curcas* dye was obtained from the stem and leaves of the plant while the dye of *Indigofera tinctora* was obtained from the stem. The extraction method stages were procedural using different mordants to discover variations in hues and colour fastness qualities in the products. The result revealed that chemicals such as indicine, saponin and tannin are the properties that impart colour fastness in fabric in these plants and that the production is economically cost effective. It concluded that government and various entrepreneurs should be encouraged to use the new innovation in the textile industry for the socio-economic growth and development of this nation.

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Key words: *Jatropha curcas*, *Indigofera tinctoria*, production, indigenous, decorated, textile, dyes.

INTRODUCTION

Textile materials are integral part of everyday life of man and have the potential to enhance and enrich his daily activities and that of his society because they are used as daily wears, social and cultural outfits, and also for commercial and domestic purposes (Shuaib and Olarewaju 2011). In the world today, the statistics of the labour force engaged in textile industry are estimated to be well above 1. 4 million people (Oloyede, 2014). Textiles play a major role in the development and industrialization process of countries and their integration into the world economy (Brenton and Hoppe, 2007). The World Trade Report (2006) also confirmed that in 2004, developing countries as a group of low and middle income countries accounted for more than half of all world exports of textile and clothing and that in no other category of manufactured goods do developing countries enjoy such a large exporting position. This shows that textile design has become a product of material culture, innovation and technology and as a result plays significant roles in the socio-economic and religious lives of the society by providing clothing and steady source of livelihood to the people within and around the communities where they are produced (Awosika, 2002). Unfortunately, in the Nigerian society of today, apart from few functional industrial textile manufacturing industries, most of the thriving textile industries to date are the indigenous textiles industries who apply traditional knowledge and technology that largely depend on raw materials derived from plant dye and fibres readily available in their environment for the dyeing and weaving of their textile materials as in Tie and dye and Aso Oke weaving, which are widely practiced crafts in Nigeria. Osubu, (2014), showed that 85% of the industrialized industries in Nigeria are dead while their employees are pushed out of jobs (Faleye ,2013) due to the neglect of the Agricultural and Textiles sectors over the years by the Federal government after the discovery of crude oil in the Niger Delta area of the country in the 1970s. Consequentially, this attitude of the government undoubtedly, removed the protection of local textile industries in Nigeria by making imported raw materials scarce for manufacturers for their productions due to their exorbitant foreign exchange rates while at the same time promoting the importation and smuggling of foreign textiles into the country at outrageous prices. In view of this, the critical study and analysis of Nigeria indigenous textile raw materials and

production processes is essential for the drafting and planning of future design solution.

Jatropha curcas is a quintessential plant with numerous functions in different facets of human endeavours. It has been identified as a good candidate for the production of biodiesel, organic fertilizer and animal feeds (Belewu *et al*., 2010). Okeola *et al. (2012)* reported on the production of activated charcoal using *Jatropha curcas. Jatropha curcas* belongs to the species of flowering plant in the spurge family of Euphobiaceae that mostly grows in the tropics and sub-tropical regions.

Indigofera tinctora is an herbaceous branchy plant that belongs to the Leguminosae family. It is commonly known as indigo in most countries of the world. It is cultivated or grows best in dry season in subtropical or tropical countries. Apart from creating dyeing effect in fabrics, indigo has been discovered to have some medicinal values such as treatment of mercurial poisoning, antispasmodic, diuretic, stomachic, febrifuge, purgation and sedative (Sas 1990).

In this study, the strength and type of pigment dyes in some unique plants like *Jatropha curcas* and I*ndigofera tinctoria* were investigated as reliable sources of raw materials for the production of decorated textile designs in Nigeria**.**

Fig. 1: ***Jatropha Curcas Plant***

Fig. 2: ***Indigofera tinctora plant***

Materials and Methods

Procedures for Producing Decorated Textile from *Jatropha curcas* and *Indigofera tinctora* Dyes

Materials Used : The materials used for the production of decorated textile (Tie-dye) are: water, fabric, Arabic gum, Karo gum, Starch, cooking pot, rolling stick, local ash, caustic soda, hydro- sulphite, sodium hydroxide, stove, Vinegar, mortar and pestle and the dyes extracted from the two plants.

Extraction of Dye from Jatropha and Indigofera Leaves

a. Jatropha Dye Processing

Jatropha leaves were harvested from the tree and were later cut into small pieces, mixed with water and covered up for 3-4 days for enzyme fermentation to occur. After the fermentation, it was sundried for 7-8 days and later milled using mortar and pestle to attain the right consistency before moulded into ball. Water was then added to the mixture intermittently and boiled for at least one hour until it simmered. The pot was removed from the fire when the desired colourant had been extracted from the leaves. Colour fixation through soaking of the fabric in vinegar solution was done before the proper process of dyeing took place in order to absorb the fabric into the colour of the intended design.

b. **Indigofera Dye Processing**

The leaves were harvested from the trees and later milled with a mortar and pestle until a blue mass was produced. The crushed material was moistened with water and covered up for some days for enzymes fermentation. The fermented leaves were formed into a diameter or circumference ball and sun-dried on a cloth for about 10 days and pounded again. The dried balls were broken and mixed with water added gradually to prevent bubbles which may not allow proper penetration of moisture and allowed to settle for about 2 hours. The quantity required was then placed in a clean pot and the prepared mordant solution was poured over it gradually to allow for seepage.

c. Mordant Substances

Mordant substances for the extraction of the plant dyes to ensure colour fastness and brilliance in the decorated fabrics are obtained from local ash and vinegar while the bath-type for dyeing are pots. Soaked ashes from burnt wood were placed on a filtering device or sieve layer positioned on a pot while water was poured. The soaked ash was stirred while the water was scooped intermittently to work up the alkaline or

salty taste before it was sieved. Dried indigo and Jatropha balls were crushed separately, soaked in the filtered mordant water separately, stirred gently for about twenty minutes and allowed to remain for another 5 days to get the required intensity of colour before use.

d. Design Methods

Decorated design or Tie and Dye method as described in the World Book 1997 was adopted for printing design on fabric using the two natural dyes. The method was used in introducing patterns and motifs on fabrics by tying common methods used for introducing patterns and motifs on fabrics by tying portions of the fabric with strings, raffia or by applying starch paste as resisting agent. Portions of the textile materials were also picked according to planned patterns and tied, folded, pleated, marbled and squeezed so that the dye solution did not penetrate into the tied areas in order to effect the desired designs successfully.

e. The Dye-bath

Since dyes are colouring agents that cannot be directly applied on clothes but has to be mixed with some chemical, mordant and water. The dye-bath for this study was a pool containing colouring pigment, which was the dyestuff of desired colour, with some chemical mordant such as Sodium roxide /NaoH- (caustic soda) and Hydro sulphite, which were mixed together and dissolved in water. The dye-bath was voluminous enough to allow the textile to be totally immersed in it. The dye-bath was constituted with hot water to quicken the reactions between dyestuff and the chemical which assisted in colour affinity.

f. **Dyeing Procedure**

The fabrics were dyed using the two plant dyes by dipping the tied textiles into the prepared dye vat and turned at intervals up to eight hours during which they were brought out at interval to take oxygen for thirty minutes at each instance. After dyeing, the fabrics were brought out to allow for oxidation and uniformity in color. This means that the dye molecules were absorbed by fibre through the help of force of attraction while the force of repulsion occurred between the water and the dye molecule when it was separated from water and the molecules gave the fibre a desired colour which was necessary for the creation of excellent dyeing effect on fabric.

g. Finishing Procedure

After the dyeing of fabric was completed, the fabric was rinsed, and allowed to dry in a cool airy space. Thereafter, Arabic or Karo

gum was washed to remove impurities and dirts, and then soaked in hot water to melt into liquid before it was mixed with starch. The fabric was then starched to introduce stiffness. When the stiffened fabric was sundried enough, it was taken to the beater to be beaten to have a smooth and glossy finish.

Fig. 4: ***Textile design from Indigofera tinctora Dye***

Fig. 5: ***Textile design from Jatropha curcas dyes***

Fig. 6: ***Textile design from the mixture Jatropha curcas& Indigofera tinctora dyes***

RESULTS AND DISCUSSION

Table 1 Quality of the Dye Fabrics

Parameters	Jatropha Dye	Indigo Dye	Jatropha and Indigo Dye
Stiffness	Average	Average	Excellent
Glossy Look	Average	Good	Excellent
Colour fastness	Good	Excellent	Excellent

From Table 1, it was discovered that the mixture of Jatropha dye with starch on white guinea brocade fabric resulted in moderate glossy look with minimal stiffness of the fabric and good colour fastness of the design while at the same time, the mixture of the indigo dye with starch on the same fabric presented an excellent glossy look with moderate stiffness and brilliant design colour. However, the best of the designs on the fabric was achieved with the combination of both dyes on the fabric because the glossy outlook of the fabric came out clearly and at the same time, the stiffness of the starch did not distort the beauty of the fabric and the two colours of the dyes perceived in peach and indigo blue designs were clearly absorbed by the fabric, making it very beautiful and attractive to the eyes.

Table 2: **Comparative Analysis of Cost Implications of *Jatropha Curcas* and *Infigofera Tinctora* Tie & Dye Fabrics and Foreign Fabrics**

FABRIC DESCRIPTION	PRICE (₦)	MEASUREMENTS
General Tie and Dye (Adire)	Above 4,000	5yards
Lace	Above 3,000	5yards
Guinea Brocade	Above 3,000	5yards
Ankara	Above 3,000	5yards
Aso-oke	Above 3,000	5yards
Jatropha plus Indigo Tie and Dye	2,000-3,000 (depending on the fabric used)	5yards

It is obvious that the cost implication of producing tie and dye made from Jatropha and Indigo dyes (Table 2) was very moderate and affordable because the main material resources used for its production are locally sourced compared to other foreign fabrics mentioned. The implication of this is that if these locally made fabric are produced on larger quantities it will bring quality and affordable clothing to generality of the people and many people will not need to spend exorbitantly on foreign clothing anymore.

Table 3: **Chemical Composition of *Jatropha curcas* and *Idigofera tinctora***

DESCRIPTION	*JATHROPHA CURCAS*	INDIGOFERA TINTORA
Alkaloids	+	_
Indicine	_	+
Tannin	+	_
Flavonoid	+	+
Saponin	+	_
Apigenin	_	+
Phenols	+	_
Quercetin	_	+
Kaemferol	_	+
Luteolin	_	+
Phatate	+	_

Comparatively, Jatropha plant contains some chemical properties that are not found in Indigofera plant (Table 3). These include alkaloid, tannins, saponin, phenol and phatate. However, these phyto-chemicals are different from apigenin, kaemferl, luteolin, quercetin and indicine that are synonymous with the chemical composition of *Indigofera tinctora*. Although, flavonoid is a common element that was found in both plants because of its metabolic property that usually assist the colour fast attribute in the dyeing process of a fabric.

The study equally revealed that the dyeing effect of the fabrics was achieved through the dyes obtained from the leaves of both plants. Indicine is the chemical component that produced the blue dye in *Indigofera tinctora* that impart brilliant hue, value, and intensity in fabric, Whereas, tannin and saponin are the two chemical properties of Jatropha that produce dye used in the dyeing fabric, although the dye of Indigofera is stronger than Jatropha in terms of colour fast and depth. The two plant dyes has the potential of assuming industrial status when fully exploited.

CONCLUSION

This paper examined the role of *Jatropha curcas and Indigofera tinctora* in the production of decorated art in the Nigerian textile industry by establishing their dye extracts as viable raw materials for dyeing indigenous textiles designs and patterns into unique textile products at affordable rate that can be utilized in the Nigerian society or exported to other countries. At the same time it also highlights that *Jatropha curcas and indigofera tinctora* are important plants for advancing the economic growth of the Nation.

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