EXPLORING UNCONVENTIONAL RAW MATERIALS FOR TEXTILE PRODUCTION IN NIGERIA

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Abstract
The importance of textiles in human essence cannot be overemphasized. Essentiality negates fundamentality. Textile has taken a wave in contemporary style. Given the alarming increase in world population, the permutation is that conventional materials would not be sufficient any more. Hence this paper explored unconventional natural fibers such as kuka (adonsoniadigitata), kargo (piliostigmathonningii), and farin kaya (cassia sieberiana) as diversification. The study is experimental in which case Chemical method was used for extraction of the fibers using hot and cold water. Parameters such as tensile strength, fiber yield, and dyeability were tested. It was discovered that of the three plants, kuka has the highest fiber yield followed by kargo and lastly farin kaya. Seizing was done by boiling of the fibers with chemical Na0H. It was also discovered that boiling of the extracted fiber in caustic soda (Na0H) increased the tensile strength of the fiber to resist the rigours of production for table mats and rugs. The fibers in all are suitable for manufacturing of strings, ropes, and cords. The fibers were also discovered not to retain vat dyes.

Keywords: Unconventional, Extraction, Dyeability, Fiber, Textile Production

Introduction

The role of textile and clothing industries in the global growth and development strategies cannot be under estimated especially in developing countries as it connects heavily to their economic and social status through the immediate provision of jobs, income and foreign currency as well as providing the country the opportunity for sustained economic development. Textile is also known as fabric or cloth. Quizlet (2017) describes it as a flexible material made up of a network of natural and artificial fibers (thread or yarn) formed by weaving or knitting, or pressed into felt. Basically "all materials that can be or have been formed into yarns or fabricated into cloth" (Udeani, 2002) can be termed textile. These materials are so termed either in processing of their raw materials into yarn or in their method of construction such as knitting, braiding, felting, bonding or by lamination. Generally, therefore, textile can be described as any material which method of production involves one or a combination of the aforementioned processes. Further study by Whewell and Abrahart, (2017) describe textile as 'any filament, fiber, or yarn that can be made into fabric or cloth and the resulting material itself' thereby extending textile meaning to Products with any connection to textile material or process. Idoko (2011 in Udeani, 2017) also defined textile as "any material produced through the process of interlacing of fabrics" but textile has gone way beyond interlacing as it can also be processed through various other means as mentioned above to produce varying products that may not even be fabric related as seen in paper production and some synthetic fiber production. Andrew, (2014); Whewell and Abrahart (2017) opined that products obtained by the paper-making principles that have many of the properties associated with conventional fabrics are textile. Therefore, textile is mainly concerned with fabrics and the materials from which they are made.

Conventional textiles are those textiles used on daily basis to protect the body from surrounding environment. It is more of a show of affluence and does not have any special properties. This is the primary requirement of man where decorative and aesthetic properties

were the main requirement. The idea of conventional is not based on cloths which maybe area and time specific but can be applied on basic materials although these are also region and time specific. Back in history, textile structures were derived from two sources, ancient and handicrafts and modern scientific inventions. The earliest textile products - net, born from the need to gather food, were produced from one thread, employing a single repeat movement to form loops and basketry, the interlacing of flexible reeds, canes or other suitable materials. The crafts of forming loops and making baskets for gathering and storage using the natural things in the environment brought us to where we are today in textile production. This evolved into the use of cotton, silk, wool, and flax as essential textile materials in different ancient kingdoms from Egypt, India, China and the entire globe, thus making the materials highly conventional. Necessity they say is the mother of invention and the growth in population encouraged the multiplication of these materials and development of new ones scientifically to create numerous textiles increasing the conventional materials so as to satisfy choice and need as well as serve for effectiveness and function.

Through history, the production of textile was seen as craft but with time the speed and scale of production has altered it almost beyond recognition by industrialization through modern manufacturing techniques which introduced the conventional materials such as cotton, wool, silk linen, jute and numerous synthetics from which were developed smart textile and technical textiles. These changes in production was to meet up with the needs, aspirations and challenges of the explosive and overwhelming population growth and this same effort has obviously turned against humanity through environmental pollution, skin diseases and enormous waste incurred through both production and consumption of textiles. To this effect, researches are going back to the biodegradables to cushion the damaged effects of the hard high technological synthesis circulating in our environment. Recently Aloe Vera fabric was produced to fight against skin bacteria as well as combat body odour. This is possible by infusing Aloe Vera capsules into the amorphous part of the fabric fiber. These capsules are microscopic airtight and waterproof which only opens up the gel when it is touched or rubbed. Its contact with the skin releases these anti – bacteria capsule (Textile spotlight, 2012). Ayurvastra, from India is a fabric produced with organic yarns which were dyed using plants that contain medicinal properties. The process infuses the fiber with the natural colours of the plants along with their healing components.

Special clothing requirement came with man's change in the idea of clothing and the intense need for protection for and against their new discoveries (technology). In these discoveries, clothes were loaded with functional properties while aesthetics and decorations were down played. This is the birth of technical textiles commonly referred to as industrial tech or Hi-tech or functional, performance, engineering or invisible textiles. This industry produces textiles for automotive applications, medical textiles, geo-textiles (for crop protection), and protective textiles (against heat and radiation). Essentially technical textiles have requirements to satisfy specific functions while conventional textiles provide primary requirements of man. Textile fashion study (2012) reported that global growth of the technical textile sector is about 4% per year greater than the growth of home and apparel textiles (1% per year), while according to Lenzing's preliminary calculation of global fiber market from 2015-2017reports an increase of the world market fiber consumption to be 1.5% up to 99 million tons in 2016. Another study reveals that World textile fiber demand was 89.8 million tons in 2015 and is expected to grow to 93.7 million tons in 2016. Global demand for textile fibers is driven by population growth and by economic activity resulting in increasing wealth, particularly in emerging economies (Krifa and Stevens 2016). A trend that sways across all fibers but with disparity in the demand level of natural against man-made fiber. The increase in demand of cotton fiber alone has been reported by Lenzing (2016) as 24.3% against 62% of all synthetics while Textile Exchange (2016) reported 27% increase in cotton demand against 55% increase in all synthetics. It is interesting to note that once in a time and place there existed some fiber materials like, jute, flax and ramie.

Obviously, these conventional materials which have been area and time specific has been forgotten while all attention is laid on cotton and it is highly pertinent to give these fibers a place in history.

The recent discovery by Saxena and Raja (2014) of the toxic nature of synthetic dyes and their harmfulness to human skin based on their production and application has revived the search, exploration, experimentation and use of natural dyes. More researches carried out also revealed that only a small part of our clothing is not harmful to wear and these are the ones produced with natural and eco-friendly fibers and dyes (Messina, 2012; IFASH News, 2016). This is because most of these fabrics are still manufactured with hard chemicals that are highly toxic and thus increasingly affect our health negatively. Several of these dyes have been banned because they cause allergy-like symptoms or are carcinogens (Hasan et al, 2015). For this reason, the Global Organic Textiles Standard (GOTS) permits the use of safe synthetic dyes only. Ghosh (2011) stated that manufacture of synthetics right from the beginning causes pollution. The demand for textile continues to go high with the up surge of the population and with the Global Organic Textile Standard policy to keep man healthy, there must be a search for alternate renewable resources for textile and thus the search for non-conventional textile, to give effective solution to this driving need. A solution that can provide man's primary requirements as well as functional properties. This also revived and intensified the search for biodegradable fibers.

Although in and around, synthetic fiber has overtaken the use of natural fiber notwithstanding the ergonomic and the biodegradable nature of natural fibers, a search for renewable fiber has become a global search to curb the menace of synthetic in our global world. Sanjay et al (2016) testify on the rapid attention in research and development in the natural fiber composite field due to its better formability, abundant, renewable, cost-effective and eco-friendly features. Aloe Vera and Ayurvastra fabrics were developed to remedy the effects of the synthetic fabrics on human skin which limits the use of synthetics but enhances that of natural fibers. In Nigeria and other parts of the world, natural fibers have been sourced from jute, bamboo, kaneef, coire, banana, sisal are known to have very high strength and hence can be effectively utilized for many load-bearing applications. These natural fibers have special advantage on the synthetic fibers (Deshpande et al, 2000). Few investigations have been carried out with Adonsoniadigitata L ('*kuka*'), Piliostigmathonningii (*'Kargo*'), and Cassia sieberiana (*'Farin Kaya'*) plants for fiber extraction despite the high strength, biodegradability and low cost accosted to natural fibers. However, the investigation carried out shows that Adonsoniadigitata ('*kuka'*) L, Piliostigmathonningii *('Kargo*'), and Cassia sieberiana (*'Farin Kaya*') are actually sourced for fiber due to their high strength and other economic uses. Their ability to be degradable become an added advantage. Despite all, these fibers were not utilized or used as it should except for ropes and never household items and accessories to reduce the pressure on the over demanded conventional textiles.

Materials and Methods

This experiment was conducted in the lab and studios of the Department of Industrial Design Modibbo Adama University of Technology Yola, Adamawa State, Nigeria from January to July. The actual experimental set up was from 1st – 5th July 2017.The products production were done in series within four (4) weeks using crocheting method. This experiment was carried out in five step- Cutting of the xylems from the mother tree, soaking of extracted xylems in water for 24 hours to allow for crushing; submerging in solutions in an experimental situation; boiling of fiber extracts for more strength and further opening of the fibers; and finally, test for tensile strength.

Plants species used and their locations

Nigeria is situated in the Western part of Africa and its coast lies on the Gulf of Guinea and three-quarter of the land is characterized of savannah climate (fig. 1). The plants used for this experiment are both desert and savannah plants. Adamawa State is located in this mixed region and as such Modibbo Adama University of technology (MAUTECH formally Federal University of Technology) Yola, habours these plants which are scattered in the premises in and around the campus. The plants used were identified by a plant scientist in the Department of Forestry in MAUTECH who also supplied the botanical names as *Adansoniadigitata (Kuka)* (Plate. 1), *Piliostigmathonningii (Kargo),* (Plate. 2), and *Cassia sieberiana (Farin Kaya)* (Plate. 3).

The name **Adansonia** was given to this tree to commemorate the French botanist Michel Adanson (1727-1806). Adansoniadigitata is the most widespread of the adansonia species, and is native to the African continent. It is commonly known as baobab tree, *'kuka'* in Hausa. Baobabs are of enormous girth and stores water inside their swollen trunk (New world encyclopeadia, 2017)**.** The fruit pulp, seeds, leaves, flowers, roots and bark of baobab are edible and they have been studied by scientists for their useful properties including fiber extraction. According to Sidibe and Williams (2002), fiber from the inner bark is strong and widely used for making rope, basket nets, snares, fishing lines and is even used for weaving. Fibers are also available from disintegrated wood and have been used for packing. Other fibers used for rope are obtained from root bark. The vernacular name 'baobab' is derived from Arabic (buhibab), which means 'father of manyseeds'.kuka (Adansonia) is a very common shrub tree to be found in the savannah region in general and ModibboAdama University of Technology (MAUTECH) Yola in particular.

Piliostigmathonningiia deciduous or evergreen shrub or tree with a rounded crown. It can grow 3-5 m tall. Otherwise known as camel's foot. Piliostigmathonningii, *'kargo'* in Hausa, has a dark brownish-grey bark with a rough surface. A conspicuous feature of the tree is its large, simple two-lobbed leathery leaves which resemble a camel's foot and account for the common name. A multipurpose tree, gathered from the wild and providing food, medicines and a range of other things. According to Ruffo, Birnie and Tengnas (2002), von Maydell (1990) and World AgroforestyCenter, Piliostigmathonningii is a fibre plant which can be sourced from the inner bark and can be used to make string, ropes and cloth. A red-brown dye can be obtained from the macerated bark. A blue dye can be obtained from the seeds and pods. A black dye is obtained from the roasted seed. The bark contains up to 18% tannins. The roots are a source of tannins. The inner bark is said to contain a gum that swells in water and so can be used for caulking boats etc. Piliostigma is a plant of the semi-arid to moist tropics, where it can be found at elevations up to 1,850 metres. It is found in areas where the mean annual temperature can be around 20°c, and the mean annual rainfall is in the range 600 - 1,500mm. It succeeds on a variety of soils and likes a rich, alluvial soil. Heavy clayey soils or medium loamy soils are preferred (World Agroforesty Center; Grassland Species-Profiles; Williamson, 1955; von Maydell, 1990). This plant is found in almost all regions of the country but particularly at MAUTECH, Girei region of savannah vegetation zone, Adamawa State of the North Eastern Nigeria.

Cassia sieberiana (drumstick tree or paperback thorn), is a tree in the Fabaceae family native to Africa. Hyde, Wursten and Balling (2018) describe it as a small to medium-sized tree. The Bark is grey, rough on the older trunk, peeling off the branches to reveal a yellowish layer underneath. The tree has thorns paired at the nodes, straight, often very long (up to 15 cm). It ranges from 10–20 metres in height and has very bright yellow flowers with leaves compound, large with 8-20 pairs of pinnae; leaflets pale green or yellowish-green. The flowers are in axillary, globose heads, and creamy-white. Pods large, thick and woody, sometimes splitting long after they have fallen and dried. – Vachellia Seberiana's bark/root decoction is used for inflammation of the urinary passages. Leaf, bark and resin are used as an astringent for colds/chest problems, diarrhea, and hemorrhage and eye

inflammation. In Tanzania, bark is used to treat gonorrhea. The edible gum is a good adhesive. Twine from the inner bark is used for threading beads. It is used for multiple medical purposes in Africa and is found in the secondary jungle of a forest. It is also located at Mautech Yola region of savannah. After locating these plants, some samples were taken to a plant taxonomist for identification. They were collected from the parent stock and labeled 1-3 based on their plate numbers.

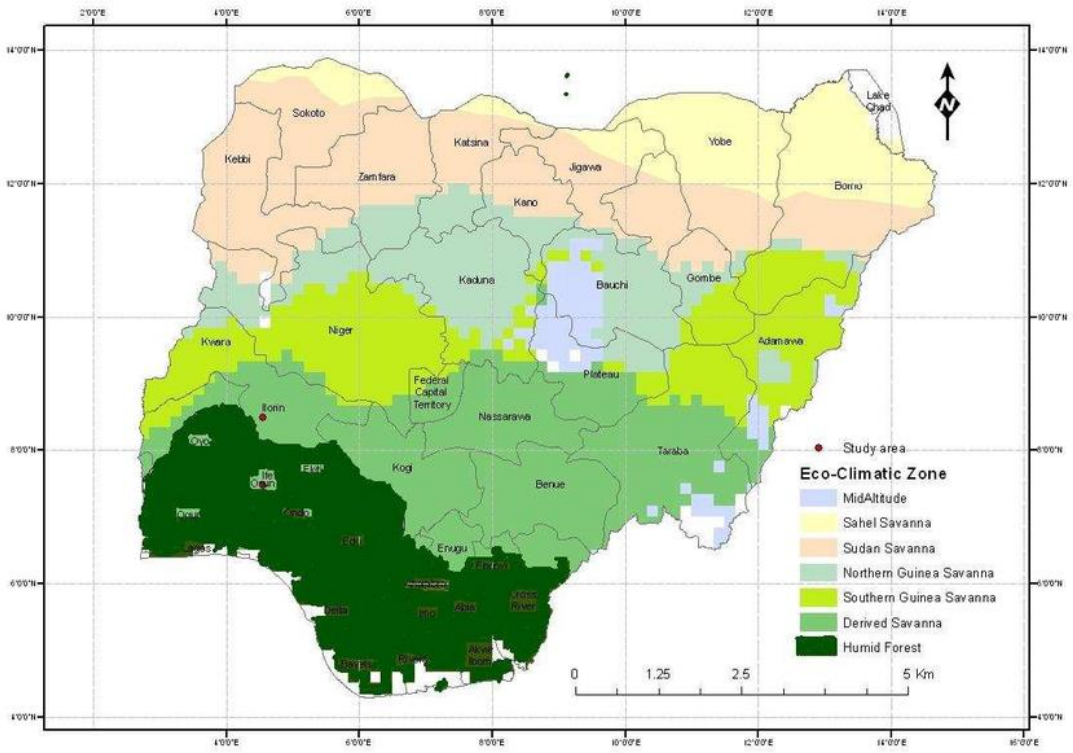


Fig.1: Map of Nigeria showing eco-climatic zones of Nigeria and study areas Source: International Institute of Tropical Agriculture (2005) (Internet sourced)



Plate. 1. **Left:** Adansoniadigitata (Kuka), **right**: zoomed part of the leaves. Source: author



Plate. 2. Piliostigmathonningii (Kargo).Source: author



Plate. 3. Cassia sieberiana (Farin Kaya). Source: author

Experimental set-up for fiber extraction

Hollen and Saddler (1969 in Udeani, 2011) approved retting by tank method and this was modified and adopted. In this study a catalyst, caustic soda was used to fasten the retting period while bleaching agent was used for brightening of the fibre and a control set-up was introduced. The process employs water and microbial action to separate fibre from the Woody core (i.e. the Xylem) and the surrounding epidermis as well. This process has major impact on the final product quality (Islam Bossunia et al 2016).

The plants used in this experiment were labeled 1-3. They were given ten different treatments with each having a control and they are labeled 1**a-l**; 2**a-l**; and 3**a-l**. There were twelve bowls containing 2 L of water. The experiment was carried out in hot and cold water solution.

Hot Water Experiment

six bowls (**a-f**) containing 2lits of hot water; **a, b**, were treated with 40gms of caustic soda, **c** & **d** with 40mls of bleaching agent; **e**&**f** control (without caustic soda or bleaching agent), each of the bowls **a – f** contains three specimens of the extracts; bowls **a, c,** and **e** contains crushed extracts while bowls **b, d**, and **f** holds un-crushed extracted samples.

Cold Water Experiment

Six bowls (**g - l**) containing 2lits of cold water; **g – h** were treated with 40gms of caustic soda; **i**&**j** with 40ml of bleaching agent while **k**&**l** is control (without caustic soda or bleach); each bowl **g – l** contains three specimens of the extracts; bowls **g,i**, and **k** contains crushed extracts while bowls **h**, **j,** and **l** holds un-crushed extracted fibers samples.

Alkali treatment of cellulosic fibers, also called mercerization, is the usual method to produce high quality fibers (Islam Bossunia et al 2016). Alkaline treatment improves the

fibre-matrix adhesion due to the removal of natural and artificial impurities. Moreover, alkaline treatment leads to fibrillation which causes the breaking down of the composite fibre bundle into smaller fibres. In other words, alkaline treatment reduces fibre diameter and thereby increases the aspect ratio. Therefore, the development of a rough surface topography and enhancement in aspect ratio offer better fibre-matrix interface adhesion and an increase in mechanical properties. Alkaline treatment increases surface roughness resulting in better mechanical interlocking and the amount of cellulose exposed on the Fibre surface. (Islam Bossunia et al 2016). The experiment lasted for twenty – four hours due to the high content of alkali introduced and the end use of the fiber. Specimens were observed for fiber yield after overnight standing, removed, washed and rinsed out.

Boiling of fiber extracts

Soft fibers were put in the pot and boiled for 1h: 45miutes in a chemical solution of sodium hydroxide (caustic soda). This is to increase the toughness quality of the fiber, strengthen the fiber tensile strength and to give the fiber the resistance needed during the final production (Sinha and Rout, 2009; Goud and Rao, 2011).

Qualitative analysis of the specimen

The observations made were recorded for the retting rate, effect of the treatments and fiber quality of the plants specimens.

Results

The results from the observations of first soaking of extracts in different containers exhibit signs of fermentation in all by the level of foamy substance with kargo (Piliostigmathonningii) depicting highest level of fermentation and reddish brown solution, followed by Farin kaya (Cassia sieberiana) with light brown solution. Kuka (Adansoniadigitata) showed slight change in the colour of water. The fermentation signs show that the extracts were ready to be crushed in readiness for use in the experimental set up.

Generally, the results obtained using caustic soda in treatments a, b, and g, h (hot and cold water respectively) reveal changes in solution colour – deep red brown, indicating the presence of a new substance. Treatments c, d, and i, j (hot and cold water respectively) with bleach showed slight change in the water solution colour to light yellow; In the control experiments e, f, and k, l (hot and cold water respectively) there was a slight change of colour in the hot water with a slight indication of fermentation while in cold, the water was clear with no change in colour.

Hot water treatment

Treatment a with caustic soda (NaOH) reveal a change in solution colour (reddish brown), all the fibers were easy to wash out from the xylem and they exhibited very high level of softness due to further opening up done by crushing coupled with the softening action of heated water and the effect of caustic soda but they were still weak and easily breakable. The fibers were all dyed to the colour of the solution (red brown). In treatment b, (un-crushed) the acid had great impart as the fiber extracts exhibited great level of softness. Piliostigmathonningii – '*Kargo'* (plate.2) extracted fiber that has been very tough and unaffected showed a level of uneven softening. This shows that longer emersion time is needed. Here Piliostigmathonningii – '*kargo'* fiber extract revealed a complete black colour. Cassia sieberiana – *'Farin kaya'* (plate.3) extracted fiber exhibited light and black colours for the inner and outer bark respectively. The fiber showed high level of softness and can be used for production after washing out from the solution though the strength needs an enhancement. The cream coloured Adansoniadigitata–*'kuka'* (plate.1) extracted fiber was

completely dyed in the solution colour of dark red brown but faded out as the fiber dries. The fiber softness was almost close to farin kaya fiber and can be used for production but was weak and tender in strength. In this hot water treatment, all fibers with the exception of un-crushed '*kargo'* can be used for further project. They were all washed out from the solution, rinsed and soaked again for the last step of processing.

In treatments c, and d, with bleach, 1c (*kuka*) showed the effect of bleach by changing from cream to white (plate 5) and the fiber is softer, enough to be used without further processing due to the softening agent in the bleach as well as the action of heated water. 2c Piliostigmathonningii (*kargo*) was not affected by the bleach or the impact of crushing and there was no solution colour change as was observed in treatment with caustic soda. 3c (*farin kaya*) showed slight effect of the bleach in the inner bark colour. In treatment d (un-crushed), the whitening effect of bleach was slightly felt on 1d (*kuka*) while 3d (*farin kaya*) was darkened as well as softened a little due to the softening agent contained in the bleach but 2d Piliostigmathonningii(*kargo*) remain very dark brown indicating no effect of bleaching agent. The controls- 1e was slightly softened than when it was soaked. 2e and 3e also exhibited the same treat while in f sample1, 2, 3 also showed the same effect as in e.

Cold water treatment

In treatments g and h with caustic soda, (NaOH) fibers were dyed in deep red colour caused by Piliostigmathonningii (*kargo*)'s discharge of the extracted fiber. The crushed fiber species in g were all very soft and ready for use. The colours exhibited in this set up show 2g black, 3g with mixture of light and dark brown while 1g was completely submerged in the solution colour (deep red) but the colours were not sustained but faded away as the fibers drip dry (plate 6). 2h, fiber revealed slight softening but needed further treatment before use. 3**h** became softer and showed readiness to use while 1h exhibits softness and ready to be used for textile construction. It is important to note that in all treatments with caustic soda, the dyed fibers did not retain the colour. In treatments i and j with bleaching agent, 1i showed more effect of bleaching agent due the extent of whitening as well as softness caused by the softening agent in the bleach; 2i still showed no change in softness and colour while 3i is soft and showed a little whitening of colour in the inner side of the fiber. 1j showed whitening effect of the bleach as observed in hot water. *Kargo* (2j) showed no change both in softening and in colour. Farin kaya (3j) exhibited a slight smoothness / softness and change of colour in the inner part of the extracted fiber. In control k and l, the fibers of 1k, 2k, and 3k were softer than the un-crushed in l. The un-crushed in l, showed 1l slightly softer than when it was soaked, the same with 2**l** and 3**l** but still need more time of processing.

Boiling of fiber extracts:

After boiling the fiber extracts with caustic soda solution, the crushed fiber extracts of Piliostigmathonningii, Cassia sieberiana and Adansoniadigitata showed maximum softness and toughness as it was easier to handle better than when it was not boiled as reported by Sinha and Rout (2009). Smoothness was not guaranteed because the extracts was not subjected under further processing such as combing and straightening so as to separate the short fibers from the longer ones.

Discussion

The boiled extracted fibers became more soft and absorbent. Their resistance was high enough to be used in crocheting technique to produce a table cover (plate 8 & 9). The experiment carried out in this research has shown that the use of catalyst, caustic soda, is a far easier and better method of retting as demonstrated in experiment a, b, and g, h of hot and cold solution respectively as proved by Islam Bossunia. (2016). It also shows that baobab woody bark is a good fiber as confirmed by Orwa et al (2009), though creamy in

colour it can be bleached (mercerization) to white as seen in the result of the bleaching experiment (plate 5)**.** The fiber yielding capacity of baobab is higher than that of piliostigma and cassia sieberiana in confirmation with Kamtoul, Vermaak and Viljoen (2011) who stated that baobab is rich in fiber (approximately 44%) and that the fiber content varied considerably between studies due to several factors such as the origin of the plant material and the extraction procedure. Although piliostigma has been attested to have been used for bark cloth, it was also found to possess tannin as reported by Gardon (2005) which may be the result of colour emission in water. Baobab fiber was also found to be soft and flexible and very compliant in the technique it was subjected to (crocheting). This was made possible after boiling the extracted fiber with caustic soda.

The investigation also revealed wet fiber suppler to handle in crocheting process than when it is dry. The morphology and structure of natural fibers can only be appreciated in textile if proper extraction method is used that will improve the quality of the natural fiber production. There is need for proper washing and rinsing of the fiber to remove the binding tissues that bind the fibers together (Cruse, 2008 in Udeani 2011), hence retting.

Boiling with Na0H (Sinha and Rout, 2009) should be followed up with seizing which is a finishing process of yarn in which substances like glue, wax, casin, or clay is added to the yarn (cloth) to give it additional strength smoothness, or weight. Although seizing was not considered in this research as the main focus was on extraction, bleaching, increase in strength of fiber and application of fiber into functional product. Nevertheless, boiling with Na0H is also a way of seizing though for additional strength. The strength of the extracted fiber was not scientifically measured in this research but the strength was measured by level of breaking during textile construction and its ability to sustain the rigors of crocheting, a textile technique. It was observed that the crocheting can only take place while the fiber is wet to maintain a maximum smoothness. This is because of lack of seizing of the yarn and wetness helps to maintain the turgidity of the fibers. It is believed that seizing of yarn can improve the weight, strength and smoothness and enable twisting of the yarns (Udeani, 2011).

Creative Applications of Extracted Fiber

The product of this experiment was gainfully utilized in various capacities. According to Desai (2018), hand – extracted fibers have been used to produce handbags, wall hangings, table mats and other fancy articles. Extracts from this experiment were used in the creation of various items of use which can be decorative as in wall hangings of assorted designs; utility in form of hand /shopping bags, table cover, table mats, purses, garment decoration, belts to mention but a few. Although coarse in hand, the outcome can be termed successful. Using unconventional fibers generally will relieve the high weight of demand on conventional fibers, reduce the use of synthetic fibers and most importantly heal our bodies, our lands and the entire globe due to their healing effects and their degradability. Textile Spotlight and numerous other researchers have alerted and enumerated the benefits of using eco-degradable fibers of high medicinal ingredients in healing of skin diseases, the use of adansoniadigitata, piliostigmathonningii, cassia sieberiana and other natural fibers will not perform less. Bamalli, Mohammed, Ghazali and Karim (2014) revealed that the baobab stembark holds anti microbes that fight against some bactiria infections.

Conclusion

Fibers extracted from Piliostigmathonningii, Cassia sieberiana and Adansoniadigitata plants were done in Na0H solution and fiber yield was better in hot water solution with Adansoniadigitata yielding more fiber followed by Cassia sieberiana. Bleaching improved the whiteness of the fibers while boiling with Na0H increased the strength and toughness needed to sustain the rigors of crocheting being a technique employed for the textile production.

This experiment has also proved that more tropical plants are fiber yielding plants as was suggested in Udeani (2011) and that the improvement of these fiber properties can enhance their usefulness as well as their potentialities. To this effect Kabore et al (2011) opined that considerable interest should be placed in exploiting the unconventional fiber for a variety of household and industrial uses on a large scale.

Further Research

From the results of this experiment, the following research is on course; -

1. Analysis of colour emitted by Piliostigmathonningii, to identify the substance.
2. the experimental set up time for further investigations

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APENDIX I



Plate 4: Crushed and un- crushed kuka soaked. Source: Author



Plate 5: Bleached crushed and un-crushed kuka in ordinary Water (control). Source: Author



Plate 6: extracts in cold water caustic soda solution (dyed). Source: Author



Plate 7: Un-crushed and crushed Extracts in hot caustic soda solution (dyed)



Plate 8: Table cover produced with the processed extracted fibers. Source: Author



Plate 9: Table cover detail. Source: Author