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Conversion Strategies of Palm Kernel Shells for Costume Jewellery

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Abstract:- Apart from the use of the palm kernel shells for fuelling furnaces in local craft industry, the exploration of palm kernel shells is silent in the arts. This paper is aimed at ascertaining the systematic procedure of conversion of the palm kernel shells for the making of costume jewellery. With existing knowledge on the characteristics of the palm kernel shells, there were two organized experiments, namely: deliberate conversion and random conversion. Moreover, the results of both categories were given a derma-friendly finish. The deliberately converted units were either based on jewellery concepts of arrangement or served as dictates to new designs. However the random category could only satisfy the latter with elements of originality. Apart from the numerous amorphous shapes regarding the random conversion, interesting shapes and forms were also realised from the deliberate adventure. The shapes are ready like any other beading material employed for the making of costume jewellery. Researchers noticed that, the results from palm kernel shells are conformed shapes and sizes on one hand and variety of shell, sizes and shapes on the other hand, all with smooth and friendly surfaces and edges. This research affirms Palm kernel shells as a viable material for jewellery making.

Keywords:- *Conversion Strategies, Deliberate Conversion, Random Conversion, Costume jewellery, "PKS".*

I. INTRODUCTION

There are a variety of costume jewellery materials on the market today ranging from organic to inorganic materials and a mixture of these. In Ghana these materials are patronised appreciably, however there are other unique materials such as the palm kernel shell that could also be employed. But this is not so because of the form and how these materials currently exist. This paper contributes in the area of the processing the palm kernel shells (PKS) into consumable jewellery material for the costume jewellery industry.

Palm kernel shells (PKS) are the shell fractions left after the kernel has been removed after processes such as crushing in the Palm Oil mill. The primary use of palm kernel shells is as a boiler fuel supplementing the fibre which is used as primary fuel. In recent years kernel shells are sold as alternative fuel around the world because it is a green fuel as compared to coal according to Zafar (2014). Common research directions of using these shells besides energy includes its use as raw material for light-weight concrete, fillers, activated carbon, and other materials. In view of this, the non-exploitation of palm kernel shells and its processes of conversion for use in jewellery making led to the inception of this paper.

II. REVIEW OF LITERATURE

In the quest for how palm kernel shells are transformed for jewellery, this review focuses on the conversional processes of PKS as well as its employability for costume jewellery. Despite the insufficient and indistinct data regarding conversion strategies of palm kernel shells for costume jewellery, researchers found the following literature relevant for analyses and further consideration for this paper: The description of palm kernel shells for identification and selection; comparison of conversion strategies of other biomass related to the palm kernel shells; and other organic materials employed in jewellery making.

- *Costume Jewellery*

Dex Media (2014) among others explain that, the use of the word "costume" is not supposed to mean pieces only meant for dressing up for costume parties; rather, is reflective of the origin of the inexpensive jewellery trend, when in the 1930s, outfits were called costumes. It is further revealed that most costume jewellery is made out of plastics, base metals, synthetic stones and gems, glass and inexpensive strings. Some styles feature leather and acrylic. The jewellery itself is often only plated with a precious metal, with the internal structure usually made of brass, vermeil, plastic, nickel or pewter,. This is such that, it is even possible for one to buy materials for costume jewelry and make it at home.

- *Palm Kernel Shells*

In an interview with Obeng (2014) Juaben Oil Mills: their Palm Oil Plant (Elais Guinensis) has three different varieties namely: *Durà, Pesipherà* and *Tenerà*. The plant produces an edible fruit which has a shell and a nut inside. During crude palm oil processing, the fruit's flesh is melted through a steaming treatment. The residual nuts are further mechanically crashed to extract the seeds or kernels. The crashed shells are called palm kernel shells botanically: an endocarp. This is illustrated in Figure 1.

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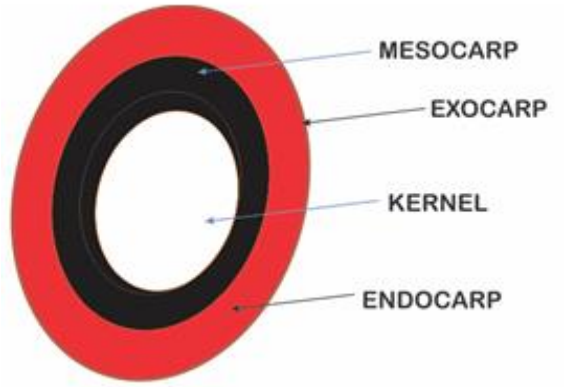

Fig 1:- Cross- section of the palm fruit showing the PKS (endocarp)

Najmi et al (1989), adds that, palm kernel shells are flaky, parabolic and angular, and possess smooth concave and convex surfaces (Plate 3). Though the sizes of palm kernel shells may vary depending upon the type of machinery used to crack the palm kernels, the sizes generally ranges from 2-15mm and varies from 1.5-3mm in thickness. Tachie-Mensah and AbenaYeboah (2013) conclude that, the Dura type of PKS (Plate 1) is efficient for costume jewellery making due to its thicker shell walls and big sizes unlike the Tenera type (Plate 2) which is small in size with slender or thinner shell walls. Also, Aragbaiye (2007), estimates that the palm kernel shells constitute about 34.5% of a single ripe, fresh fruit.

Plate 1: Dura type of PKS

Plate 2: Tenera type of PKS

Plate 3: Parabolic, concave, convex nature of the "PKS"

➢ *Conversion of palm kernel shells*

In an article titled "Palm kernel shells as biomass resource", Zafar (2014), Compares palm kernel shells to other industrial residue and concludes that, it is a good quality biomass fuel with uniform size distribution, easy handling, easy crushing, and limited biological activity due to low moisture content. According to Bioenergy global solutions, palm kernel shells can be processed into various dimensional grades to suit specific applications such as: Green fuel for Industrial boilers and Furnaces for foundries. Olutoge et al (2012), further explains that, palm kernel shells are burned together with the husk as fuel in the boiler of palm oil mills to produce steam for electricity generation. After combustion, about 5% ash by weight of the solid waste is produced. The ash produced is further used as cement substitute for concrete making. Though there is less if not no literature on converting palm kernel

shell for jewellery its credibility for such a purpose cannot be overemphasised in literature.

➢ *Conversion of natural beading materials*

Jewellery materials range from a variety of metals to non-metallic materials which include plastics, fibres, wood among others. These materials undergo series of processing before they are employed for jewellery. In the light of this, Kumekpor, Bredwa-Mensah and Landewijk (1995) assert that, various types of beads are produced all over the world including seed beads, grass beads, shell beads, teeth beads, bone beads, rock beads, ceramic beads, glass beads among others. These beads are produced using a variety of production methods. For instance rocks and minerals such as agate, carnelian, jasper and bauxite, to be used for bead production are shaped roughly with a hammer. A hole is drilled through and the rough edges smoothened with sharpening stone, water and abrasives such as fine sand and clay.

Kumekpor et al, (1995) further state that, seeds, cowry shells, snail shells, teeth, and bones most of the times do not require any shaping except the making of a hole to enable it function as a bead. Most of these beads are finished by painting or polishing to make them look brighter. However it is also concluded by Tachie-Mensah and AbenaYeboah (2013) that certain designs may not require the drilling of holes. However, apart from finishing the custume jewellery materials, they would require one or more of the processes as shaping, drilling and abrasion.

III. MATERIALS AND METHODS

In this study, researchers employed a number of materials which were further classified as direct and auxiliary materials. However, inferences from literature also provide the method in conjunction with what is developed through this study.

A. Materials

For this study the Dura variety of PKS was selected due to its size ranges and thick walls. Other materials as aids to the conversion process include: abrasive papers, petroleum jelly and Shea butter. These were employed to render the converted "PKS" smooth and presentable appearance and at the same time friendly to the skin.

B. Method

The methods include the conversion methods, then finishing and preservation methods.

➢ *Conversion Methods*

As mentioned earlier, the conversion methods are in two categories: random conversion and deliberate conversion. In each case however, sampling of the PKS is of essence to satisfy preferences.

The random conversion has both mechanical and manual approaches. These involve the cracking of the PKS by the crasher and the manual cracking with a hard object by hand. Both approaches result in variety of shapes resulting from the random impact of the tools on different part of the different shapes of the nuts. To achieve these shape varieties, the following processes were executed:

1. Shells were selected purposively
2. Soaked in water over night
3. Holes were drilled through designated points
4. Applications of abrasives to remove all harmful projections as in plate 4.
5. Rinsed in fresh water and allowed to dry gradually in a shade

Plate 4: Abrasion of sampled cracked shells

The deliberate conversion on the other hands involves conscious approaches to achieving definite shapes. Due to regard for precision, the use of holding devices as well as saws: the jewellers saw and the bench vice were employed. The hacksaw and other saws including the jewellers saw were experimented with as shown in plate 5 and 6, but the jewellers saw proved best. This process however, begins with purposive sampling of the cracked or full shell according to the intended form, or shape to be achieved.

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Plate 5: Sawing with the jewellers' saw

Plate 6: Sawing with the hack saw

The forms considered under the deliberate conversion are: geometric forms, halve shell, and full shells. These are the sawing of cracked shell into geometric forms; division of full shell into halves and the removal of nuts from the shell to obtain an empty shell. For the geometric conversion of the PKS for costume jewellery, the following processes were engaged.

1. Sampling of shells with seemingly flat surfaces
2. Abrasion to flatten the surfaces
3. Marking out of specific shapes on the PKS
4. Sawing out the shapes with aid of a holding device (vice)
5. Soak in water overnight
6. Drilling of holes through the sawn shells as desired to aid linking with other materials like the string, wire, and findings as in jewellery.
7. Smoothening of edges in fine sand or clay by tumbling
8. Rinsing in fresh water and allowing them to dry in a shade.

However the halving conversion involves three steps to precede the step five, six, seven and eight in the geometric conversion. The three processes are as follows:

1. Selection of full shells
2. Clamping the shell in the vice and sawing into two equal halves and allowing the kernel to fall off with the support of a vice and the jewellers saw
3. Application of abrasives to remove dangerous projections

The full shell conversion approach employs a method similar to the halving shell conversion. That notwithstanding, there is a difference between the two. The procedure is as follows:

1. Selection of full shells
2. With the support of a vice and the jewellers saw, the shells were clamp and sawn into two equal halves allowing the kernel to fall off.
3. The shells were soaked in water
4. Drilling of holes at appropriate points for stringing
5. Application of appropriate adhesive of the cut edges and aligning them to flash as a whole
6. Clamping according to the time required by the adhesive to cure.
7. Application of abrasives to remove unnecessary projections and fibrous particles
8. Rinse in fresh water and allow to dry gradually under a shade.

➢ *Finishing Methods*

Finishes application to the processed shells may depend on the kind of finish desired. It may be an antique finish, a natural look or a glossy glassy look. Paints and other add on media were identified as requiring different materials and procedures. However, this paper focuses attention on the natural appearance of the PKS. The following steps were considered in ensuring such look:

1. Heating of wax/ shea butter/petroleum jelly in a container to melt
2. Pouring of the dried shells in the molten substance
3. Stirring to ensure even distribution and leaving on fire for 10mins maintaining the same temperature.
4. Draining the molten substance
5. Allowing the shells to cool
6. Transferring the shells onto a cotton cloth and rubbing them together to burnish their surfaces

➢ *Preservation Methods*

Due to the natural durability of the PKS, preservation was concentrated on the finish only. With regards to the absorption ability of PKS, it retains oils and others agents to maintain surface lustre. However, it can lose its gloss or lustre over time of use. To preserved to always look its best, picking shear butter/wax/petroleum jelly with a piece of cotton and then applying it on each piece of PKS; then putting it on a slightly heated surface for some time and then rubbing with a piece of cotton to collect excess polishing agents was enough to restore its look.

IV. RESULTS AND DISCUSSION

Research shows that the residual nuts shells from palm oil processing plants are further mechanically crashed to extract the seeds or kernels. These crashed shells are known as the Palm kernel shells. Palm Kernel Shell can be processed into various dimensional grades to suit specific applications of which jewellery is no exception.

➢ *Conversion strategies*

Notably, Researchers identified two major conversion strategies namely: the random conversion and the deliberate conversion strategies. In all these, various procedures were identified for each strategy. It is realise that by virtue of the

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crushing machine and the mechanise fret saws both strategies can be executed both manually and mechanically. Moreover, both the random and deliberate strategies have unlimited outcomes that are post determined and predetermined respectively. As illustrated in figure 2, the random conversion produces unlimited varieties of shapes and size that may be sampled and finished for costume jewellery (Plate 7). The deliberate strategy on the other hand produces varieties of regular shapes determined by the shape of the shell (adopting the full shell or splitting then in halves, quarters, etc.). These shell come with unique and interesting forms that can be adopted as shown in Plate 9. The other aspect has to do with the sampling of shell to execute predetermined geometric shapes as shown in Plate 8. The conversion into these geometric shapes however, produces other residual shapes that can also be either amorphous or geometric. As part of these residues are PKS grits that can also be integrated for jewellery.

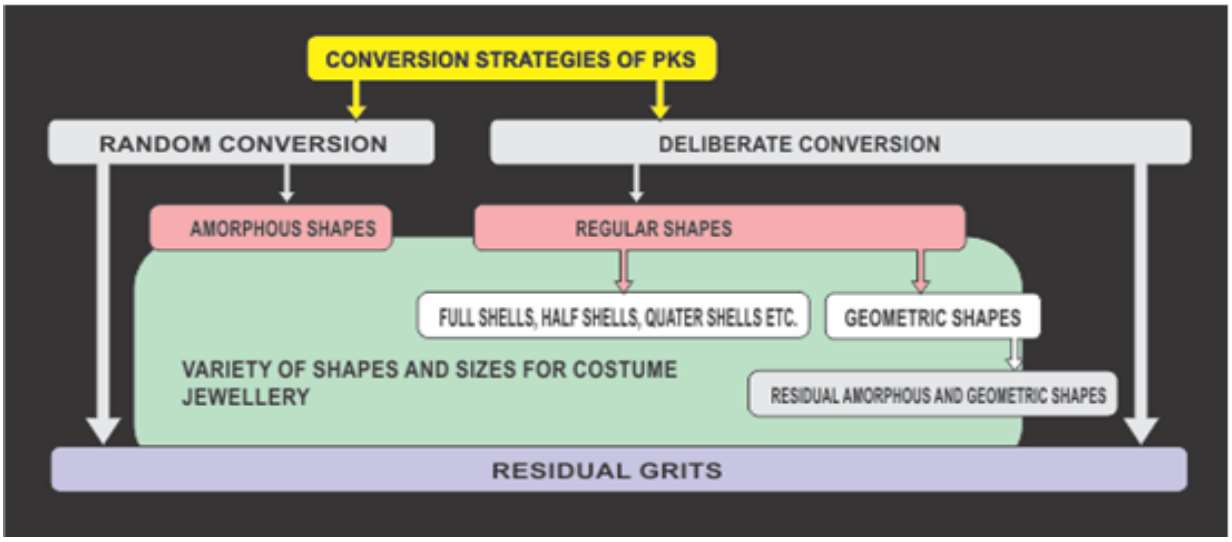

Fig 2:- Conversion chart of PKS for jewellery making

The Irregular characteristic of the palm kernel shells is an interesting factor in using the PKS for costume jewellery. This notwithstanding, irregular characteristic of the PKS creates a variety from the norm of uniformly shaped designs to unique and exotic jewellery designs. In this, palm kernel shell shapes are maintained as they appear from the crusher but only treated to render them ergonomically friendly. Presenting the shell whole but yet devoid of kernel nuts, thus making it less weighty, odour and rot free was obtained in the natural environment after the kernel shell has gone through decay processes. Regarding the fact the allowing the shell to decay for some time is not prudent enough, the full shell conversion is one of the most importance successes of this study.


Plate 7: Finished varieties of amorphous shapes and sizes for the random conversion

Plate 8: Regular shaped from the deliberate strategy

➢ *Responds of shells*

Shells by their nature tend to crack and break easily, especially when they are too dried. The tenera type of shells found to possess too thin shell wall and flaky and can easily be crushed with little force. Unlike the tenera, the dura type of PKS have enough shell body making it possible to be held firmly in a vice for further processes like sawing, clamping, abrasion and drilling. Still, the dura type of PKS possesses very thick shell walls which varies from 1.5-3mm in thickness and can sustain cracks till excessive pressure is mounted to split it apart.

Plate 9: Converted full shell with interesting features

➢ *Sample jewellery from the converted PKS*

As shown in Plate 10 below are two sets of jewelleries (a bracelet, a necklace and a pair of earrings) executed from the results of the experiments above. The first set (A) is composed from the random conversion. This are connected with a transparent nylon cord to place emphasis. In the case except for the metal finding, the PKS is the main material. The other (B) is made up of the deliberately converted PKS integrated with glass beads and again, metal findings. The two works are seen to be complete in themselves. The PKS appears good when used solo as well as in integration with other materials.

Plate 10: Sample jewelleries produced from the random (A) and deliberate conversion (B)

V. CONCLUSION

Costume jewellery even though made of cheap materials, are not always cheap. This can be attributed to the designer/artist, the time consumption in the material conversion and general production time. Researchers noted that processing PKS is cumbersome and therefore time consuming.

Preconception of PKS jewellery to be produced is vital prior to the conversion approach to employ. Ideally, selection of PKS units for jewellery must be considered in conformity to achieving desired results especially in the case of geometric shapes. Most abrasives require rigorous activities, therefore the need to firmly hold the shells while abrasion takes place. The tenera type of PKS cannot sustain the various actions and processes above, the PKS is taken through to make it ready for jewellery. This makes the dura type, the best option for jewellery. Furthermore, the dura type of PKS has enough shell body making it possible to be held firmly for further processes like sawing, clamping, abrasion and drilling. Besides, the thick shell wall makes it more resilient as it can sustain through excessive pressure even with a crack. It is also concluded that palm kernels shells is a good biomass resource and is a viable material not only in the engineering industries but also for costume jewellery and related areas in fashion.

RECOMMENDATION

It is recommended to costume jewellers to explore the conversion of other materials for jewellery creation to widen the scope and variety. It is also recommended that bonding and lamination processes be explored in PKS for the possibility of wider but levelled surface areas to eliminate the size limitation. Moreover, other conversion technologies such as the laser technology are recommended in further studies. Also, non-poisonous, odourless and Derma friendly finishing and preservation materials such as wax, petroleum jelly, and shear butter are recommended for the finishing of PKS.

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