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Utilization, Processing, Grading And Manufacturing Process Of Laminated Cane Handles *(Calamus Manan)*

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Abstract: *During the middle of the first decade this century, bat makers began innovating with handle designs, altering and going over through the high quality of material that is predominantly constructed and produced from rattan (also known as cane wood). The handle is made from cane with strips of cork or rubber dividing the cane into sections running the length of the handle, this construction has been designed to give the handle suitable damping and stiffness properties. By having good physical properties like moisture content, density, and mechanical properties like flexibility, stiffness, durability, lightness and having natural strength to resist the capacity of force produced by the ball impacting over 100mph, due to these characteristics that are needed into the cricket bat handles, rattans are considered as unique multifunctional raw materials for the manufacturing and construction of cricket bat handle by the different sports manufacturing industries.*

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I. Introduction

Cricket bat handles have been manufactured in the same manner for over 168 years. The process, from the time of harvest, may have become a little more mechanised over the years, but is still essentially the same as it was in the 1850's (Laver & Wood, 2017).

Cricket bats were originally made out of a single piece of wood including the handle (Gunn & Moore, 2001). This meant there was no shock attenuation when the bat struck the ball. The bat would have jarred in the hands of the batsman every time they hit the ball. To overcome this problem, bats were made out of two pieces of timber, usually just another piece of willow spliced into the handle.

In the 1850's there was another evolution to the handle, with cane used to minimize the 'sting' of impact and provide flexibility (Barty-king, H., 1979), later on solid Manau Cane, being introduced in 1853 (Colleyer, 1993). This subsequently improved the balance of the bat, but still did not adequately attenuate the shock. In 1856 canes were split and laminated back together with rubber between the canes (Edlin, H., L., 1973). This technique dealt with the jarring, and the 1850's technology has stood the test of time.

This paper presents a state of art report on largest rattan genus (Calamus), exported from Southeast Asia, mainly used by cricket bat manufacturers in India. This report specify history and utilization of raw rattan, their importance of processing and grading, important applications, uses and finally this report furnish a profound and handy knowledge incorporating all steps involved in manufacturing process or making of laminated cane handles from raw material and also identify the research needs.

HISTORY OF RATTAN UTILIZATION

There is a long history of rattan utilization in Asia and Malaysia. Rattans were pulled from the forest and traded down rivers to coastal entrepreneurs who marketed them on to traders in Singapore (Dransfield, 1992). Export of raw rattan cane are sourced from Southeast Asia especially in Indonesia, Malaysia & Singapore (Manau or Sarawak) and also harvested from the jungles of Sumatra.

The term rattans (also canes) is collectively applied to the long, slender, pliable and joined stems of certain spiny, trailing or climbing palms belonging to subfamily *Calamoideae* (J Dransfield. 2002) that also includes tree palms such as *Raphia* (Raffia) and *Metroxylon* (Sago palm) and shrub palms such as *Salacca* (Salak) (Uhl & Dransfield, 1987). There are 13 different genera of rattans that include in all some 600 species. Rattan is also known as manila, or malacca, named after the ports of shipment Manila and Malacca City, and as manau (from the Malay rotan manau, the trade name for *Calamus manan canes* in Southeast Asia) (Johnson, Dennis V. 2004). The largest rattan genus is *Calamus*, distributed in Asia except for one species represented in Africa. The climbing habit is associated with the characteristics of its flexible woody stem, derived typically from a secondary growth, makes rattan a liana rather than a true wood.

Commercially the finest quality canes that dominate international market are species of Calamus, e.g. C. Maman, C. Caesius and C. Trachycoleus. Owing to strength and resilience, rattans are used for making handle of hockey sticks and cricket bats. A good example is the First Division of Sarawak Cane, where up to twelve different species of rattan have been cultivated, supplying in a variety of cane colours and texture that are integrated into high quality cane put them to countless practical use and aesthetic artefacts. Their utility has been based on a unique combination of features such as abundance (in past), strength, low weight, durability, lustrous finish and beauty for the use of particularly in the making of household articles, furniture, tool handles, lifting heavy items and in bridge construction, sports equipments etc.

II. Manufacturing Process Of Laminated Cane Handle

Processing and Grading of Raw Rattan

The canes are imported and transported in 2 basic thicknesses, thick and thin pole lengths of around 3 metre and graded by straightness and evenness of the stranding. They are initially cured or boiled in oil improve the strength properties of rattan cane (Yudodibroto, 1985) after that the canes are washed and air-dried in an open area for several weeks. Before being graded the canes go through the process of sulphur fumigation in a chamber with external container burning sulphur. The fumigation process uses the sulphur fumes to bring out the best of the canes' colour, while at the same time as killing any borer that may be present in the cane. The fumes are carried into the chamber by a flue, and the canes are smoked overnight, sometimes up to 24 hours, until an even colour is obtained. After that the canes are graded according to the Stem diameter and evenness of diameter along the length (Razak, W., Tarzimi, M., & Arshad, O., 2001). Then it was cut down into the pieces of 1.5 metres (60 inches) in length for further actions.

Process of Making Laminated Handle

The best pieces of cane that was thick in diameter and straight with even strands along the length are chosen for this study. The most popular pattern used for making handle from large diameter cane for long or short in length had been typically consist of 4 pieces of cane with 3 rubber inserts. Between the cane section rubber or cork is inserted before the handle is glued, sanded and spliced together using twine (Edlin, H., L., 1973). Cane for the short handles is firstly sawn to the right length of 480 mm and then three cuts are made along the length, then the cane was split and separated into 4 pieces. The first cut, straight down the middle of the cane along the length and the second and third cuts are made either side of the middle cut from top to bottom of the cane.

Now, the faces planed to ensure a good gluing surface and glued together with three cork or rubber laminations used for shock absorption. A single piece of cork/rubber of 170 mm long and 0.5 mm thick is then placed into the middle cut and remaining two piece of rubber/cork of 160 mm long and 0.5 mm thick is then placed into either side of the middle section. A wedge is jammed into the middle cut allowing glue to be applied thoroughly, followed by a piece of fibreboard of 60 mm in length, Two more pieces of latex bonded cork in rectangular strips of 70 mm in length of 2 mm thick and width half the diameter of the handle are then glued together and positioned within the handle composite along their thinnest edge are then applied with glue and used to fill the other two cuts.

The handle is tied up and left to dry for 24 hrs, Once dry the handle is untied, next is to cut the remaining wedge out from the cleft, that is positioned within the centre of the handle 'sandwich' to approximately 80% of its length from the final element to the handle. The reason for including the wedge is to increase the depth of the handle towards its base as many bat models exhibit a deep cross section towards the shoulder of the bat. The handle needs to accommodate this deep cross section to ensure a continuous surface over the back of the blade for following machining. The freshly glued handles are stacked and wedges are used to separate the handles and provide some compression to aid the adhesion of all elements.

Process and Technique Involved for Finishing and Shaping of the Handle

Once the glue has cured the handles are cross cut to the exact length and sawn to the required handle length and set aside for machining because when the laminated handles get there they will be about half to twice as thick as the finished handle.

The first stage of the manufacturing process is to turn the handles on a lathe, which reduces them down close to the width required to go into a bat. The top part of the handle is then shaped according to the constraint measurements. The circular profile of the handles is machined between centres on a copy-shaping machine with a rotating cutter and the handle is rotated slowly to produce a round section. Handles are turned to an appropriate size however, various profile patterns exist for the different sizes for example, and the handles may be turned to produce either long or short in length and round and oval in shape.

In the second stage, the base of handle is ready for cutting the splice and sawn so as to it is fitted through the precise splicing of the handle into the blade. A splicing saw is used to cut the deep V into both blade

and handle, using special jigs, this cut needs to be carefully made so the join between the handle and the blade fit together tight and perfectly fitting is vital to achieving both balance and performance of the bat.

On the third stage, the splice of handle and blade has been cut then the handle can be fitted in to the blade using a mallet. Before fitting against each cleft the handles are checked and make sure that it has reached to the base of the joint then, the handle are aligned to set slightly forward of the blade, according to the bow and the particular characteristics of the blade and glued together by using PVA adhesive to ensure a strong joint is made. The bat is then clamped and left to dry/cure for a minimum of 15 hours or an overnight. After the due course of time, the adhesive is strong enough for further machining.

On the fourth stage, the bare Cane handles are wounded / covered with a layer of traditional linen/ cotton thread which is applied on a custom made binding lathe. The bat is mounted in the lathe which is controlled using a foot treadle; the handle is brushed with glue and whipped with the twine which provides strength to the splice and throughout the length of the handle. The winding process begins at the top of the handle and the string is stapled upon reaching the shoulders of the bat. It is believed that the string adds structural support to the handle increasing flexural rigidity and also the tension applied during winding acts to compress the handle reinforcing the integrity of glued components.

On the fifth and final stage, the rubber grip is added to the handle on top of the wound string, increasing the diameter of the handle and gives a surface with substantial grip against the batsman's gloves. The tubular rubber grip has a diameter smaller than the handle and so must be strained to fit the handle. This is achieved through expanding the rubber tube over the inside of a larger diameter pipe by removing the air between the two. The handle is then positioned inside the pipe and the vacuum released, the rubber attempts to regain its original shape tightly enveloping the handle.

Each handle is then weighed together with the accompanying rubber handle grip to measure the mass of the finished product. The handles are stamped to register according to their shape and size, corresponds to the mass of the bat.

III. Discussion

The source of the material used for the making of cane handles from South East Asia. (Grant, C.1998b) suggested that the handle offers the most scope for improvements in bat performance. However, improvements to the handle remain relatively unexplored (John & Li, 2002). So, we have experimented with making handles with the constraint measurements on selected geometrical parameters (Katiyar, Murtaza, & Ali, 2018a), although we also purchase raw materials of handles in their most basic form and then they are processed, shaped and finished according to the need we make our handles with careful craftsmanship to reduce the chance of oddness into the handle's profile for determining the volume of the referenced handle (Katiyar, Murtaza, & Ali, 2018b).

IV. Conclusion

The first solid Manau cane handles were used in 1853, they were deemed to cause too much vibration which made the bat painful to hold therefore rubber laminations were introduced in 1856, the same handle materials as cane wood that has the tenacity and high in strength with rubber to dampen down the shock of the ball hitting the bat are used to this day. Three years later in 1856, handles took the form they have maintained until now. The handles that are used now a day that is similar to those were used in the 1850's. However, the procedures adopted in this current study are believed to be a more thorough investigation than was previously published literature. Therefore this study will identify the required materials and manufacturing process of handles which might offer an alternative or out-perform the cricket bat handle *(Calamus Manan)* that is currently used.

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