

# CONCEPTUAL FRAMWORK OF SCREW PINE LEAVES BIOCOMPOSITE FOR FURNITURE COMPONENT

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## ABSTRACT

The purpose of this paper is to provide a review of the literature and framework study of the screw pine leaves bio-composites for furniture components. In Malaysia, the material is commonly used in making the handicraft product, this study is executing the screw pine leaves to be proposed as one of the bio-composite material. The intention of producing the screw pine leaves bio-composite material is to apply it on the furniture component that is a high value added product, which could create a niche market on the material. The experimental method is used in the study. As the preliminary study, the screw pine leaves need to be recognized. The specific data of screw pine leaves bio-composite are collected from referring ASTM D3379 -75 Standard for tensile strength, while ASTM D256-06 Standard for impact testing. Then, the bio-composite screw pine leaves that reinforced with a biodegradable adhesive is applied to a furniture component. The study also validates on the market and specific data testing as tensile and impact test. The records are sorted into sections of material properties of screw pine leaves and validate data on the material properties of screw pine leaves bio-composite, and material application of the design. This study is expected to record all the specific data for future used, other than proposing a new furniture component design based on the screw pine leaves bio-composite material.

## Key Words

Material Properties, natural fiber, design furniture component, bio-composite material.

## INTRODUCTION

Screw pine leaves or Pandanus atropurpureus is an indigenous natural material that grow wild in all around South East Asia, is normally in wet area as swamp, riverside and beaches. According to M. Anem, 2012, the plant can grow wild up till five meters long and sharp leaves in dark green colour between five to ten centimetres width [1]. The unique surfaces of screw pine leaves is that the leaves only have one surface of wax while another surface are not. That is the reason why strong characteristic of the leaves made it valuable raw material for craft industries. Traditionally, the screw pine leaves weave crafts are living source for Malaysian rural area. However, due to the several reasons as crucial and fine on processing the raw material, the traditional weaved craft is getting slow down. The weaving process are the other reasons which can be considered as authentic crafts that need the utmost skills, care and quality material. To be compared to other South East Asia country, the craft is skill in Malaysia is getting down. In Malaysia, the approach of designing a new product is based on the niche market and the trends. The screw pine trees is easy to grow up in Malaysia due to the environment yet, the material has not been utilized in a proper way. Equivalent to the green design approach which is a trend in Malaysia design product, proposing a new bio-composite material could benefit in upscale the value of the plant. The records on material

properties of the screw pine leaves may contribute a lot on making the product based on screw pine leaves material in future.

## LITERATURE REVIEWS

M. Wu, H. Shuai, Q. Cheng and L. Jiang, 2014, study on green composite based on lotus fibers is to up come the global demands for environmentally friendly, and sustainable composites for industries fabrication such as textile, automobile and medical (p. 3358-3361) [2]. In certain industry, there is a waste from other natural product such as sago fiber clay for artwork that being studied by W. S. A. W. M. Daud, M. C. K. Yok, N. Abdullah, S. W. Jalil and S.M. Azmi, 2015 [3]. Their study of sago fiber creates a new type of clay for artwork, maximize the material used in making art in health and environmental friendly. They utilized a waste to be a new material is the same approach as making the screw pine leaves bio-composite as the alternative method to craft and furniture industry to utilize the material that's been advantageous to Malaysia. P.J. Kaur, K.K. Pant, S. Satya, and S.N. Naik, 2016, study on bamboo as future material; which the present paper explores the applications of bamboo in various applications included pulp, paper industry, building and handicraft are reported (p 27-34) [4]. At the same situation as bamboo, screw pine leaves in Malaysia also has been used for household utilities as woven mat, handicraft and basket. Therefore, to develop a natural material to be another level of material need and niche the market is not an impossible to screw pine leaves. Other than that, the adhesive or coupling agent that's been used in the study is affecting the mechanical properties of the natural fiber has been study by C.A. Kakou, F.Z. Arrakhiz, A. Trokourey, R. Bouhfid, A. Qaiss and D. Rodrigue (2014). Their result findings on morphological review shows that the coupling agent (maleated polypropylene) has improve the matrix- particle adhesion of the oil palm fiber reinforced high density polyethylene [5]. While, M. Zampaloni, F. Pourbogat, and S. Yankovich, 2007, study on the fabrication of kenaf fiber reinforced polypropylene, discussed in the manufacturing methods that need to consider the used of coupling agent that successful the fiber-matrix adhesion. Their study also included the percentage of the fiber content to create the composites proved to have superior tensile and flexural strength [6]. Another study by H.G.T.H. Jayatunga, 2014, that study on developing the biodegradable glove material based on natural rubber and screw pine leaves material. The compound in screw pine leaves that mainly contain almost 50% cellulose and also hemi-cellulose, lignin, starch, etc. has been used as the agent that enhance the microorganism in the soil to biodegradable the glove [7]. The study has shown that the screw pine leaves moisture content is high, and the lignin is eradicating through the raw material process. However, it is quite difficult to reduce the moisture content, thus, constructs the heat process could damage the leaves physical properties. The application of the material is depending on the study's aim. In this case, this study is about to focus on the producing the screw pine leaves bio-composite material for the furniture component application. M. P. Ho, H. Wong, J. H. Lee, C. K. Ho, K.T. Lau, J. Leng, and D. Hui , 2012, mention that, the properties of natural fiber reinforced polymer composites are generally governed by the pre-treated process of fiber and the manufacturing process of the composite. Some critical issues like poor bonding and degradation at the fiber interface and damage during the manufacturing process are the main cause of the reduction of the composite strength [8]. V.K. Thakur, A.S. Singha and M. K. Thakur, 2012, approaching the method on prepared the green composite material using the compression molding technique with different fiber content [9]. Hence, they can investigate the strength and weakness from the variable fiber content. There are also studies on improving the composite material in terms of security that adding the material value as the study by N. Zainab, A.R.K.A. Azlin, S. Nazlina, H. Hasnain, S. Norhaizat, JX. Teng, and V. Lawai, (2013). Their study is on producing the fire-retardant sound absorbing panels that made of sago waste bio-composite, despite on the study is making the panels is as standard as other product available in the market. From the intention of the study, the panels also showed the anti-termite properties makes the materials is better than other product [10]. Therefore, the study on certain focus may lead into other findings.

In design terms, D. Dascalu had mentioned about the various material of the urban furniture may influence the human psychic generates some physical or psycho-emotional effects. His study that shows that the selection can be less durable material yet easy to replace because the material texture is an extremely important feature in urban furniture. At the same time, the perception of the material texture generally takes place the visual and tactile stimuli that affects the reaction of the users such as gesture reaction, conscience reaction and conceptual and emotion reaction [11]. While, the invention by C. Wu, 2013, on paper-made composite furniture is an intense knowledge of the composite material be able to transform into furniture design. The stiff paper that has characteristic to withstand greater loading and pressure on the same function as conventional furniture made of wood, plastic and metal. The invention provides the greater visual appeal and ornamental efficacy [12]. There is also discussion on acknowledged the Malaysian identity in designing furniture. M. F. Ahmad, Z. Hasan and Z. Romli, 2015, state that other than design by using the local narrative images as motive, movement, philosophy and others, by using local material can also be considered as an instrument to portray national identity [13]. Thus, the approach on utilized on the screw pine leaves is a study that brought the material as Malaysian furniture material as Indonesia popular with their rattan and Japan with bamboo.

### **PROBLEM STATEMENTS**

There is lack specific data on mechanical properties of screw pine leaves to support its use in the development of new value added product. The lack of the material source of data, to be more specific the data on *Pandanus Atrocarpus* is rare. Most of the time, the leaves only been seen as a craft material in Malaysia. Even though popular as a traditional craft, the activity getting slower as the trends today is not meeting the needs of the craft product. Other than that, the production of the craft product needs a professional and skill that made the young generation not interested to continue the tradition. Thus, it is essential to make use of this underutilized plant since it is already well known as a Malaysia craft product. As mentioned by M. F. Ahmad, Z. Hasan and Z. Romli, 2015, Malaysia is striving for establishing a strong design in the furniture industry. Into those opportunities, this study could lead to the production of the screw pine leaves material.

### **METHODOLOGY**

Fig.2 shows the methodology flow of this study, as the arrangement refers to the research objective. The methodology approach in this study is an experimental approach. The specific data records on several sections; the material properties of the natural screw pine leaves, the material properties of the screw pine leaves bio-composite and the validation data on the material application into the furniture component. The preliminary study of the traditional raw material process. The process is treated process that dry the screw pine leaves without loss the physical properties of leaves. Documentation data on the material properties of the screw pine leaves through the tensile and impact test using the ASTM standard. The morphological study on the structural image of scanning electron microscopic also documented. The same documentation on screw pine leaves bio-composite. Therefore, both of the data can be compared. Comparison data is to prove the methods of processing and the bio-composite formula is the most effective. The experimental process of producing screw pine bio-composite material is completed to try and error, based on the data collected from the natural screw pine leaves material. The design of furniture component also an experimental process that study on the material application. The different character of mould will be used to identify the limitation of the material application.

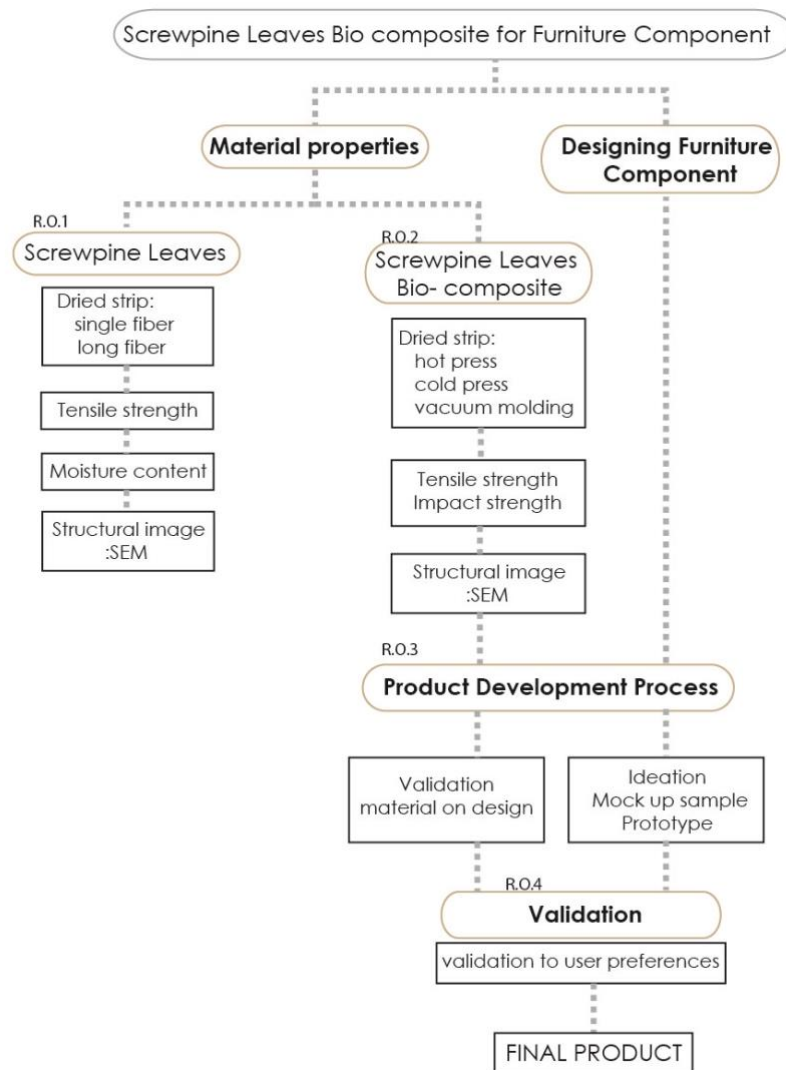


Fig. 1

### CONCEPTUAL FRAMEWORK

Based on the review, the conceptual framework on screw pine leaves bio-composite for furniture component is developed. Fig. 2 is presented the framework of the study on the screw pine leaves bio-composite study of furniture components. The framework is constructed by referred the literature review and discussion related to the objective of the study. As goes through the flow of the research methodology, the framework is separated into three sections;

#### i. Natural fiber: screw pine leaves

This section is considered the preliminary study in understanding the material, the origins and other consideration. The usual process prepared by the society is listed into several steps that created a treated screw pine leaves material. The consideration of the process is affecting the material properties. The process is begin with the selection on the right leaves, cut down from the trees. The leaves torn is removed, and all the collected leaves are gathered around and cut into the same size. The next steps are the scorching the leaves using a small heat. Then the leaves are going to smoothen by using a tools called 'lurut' by native before the leaves is divided into a certain size of strips. The strip size is dependable, it varies from 5 mm by 1 inches. The strips are tied up together,

and will deep soak in water for 2 days. This step is important to remove the chlorophyll in the leaves results the leaves being white colour and easy to absorb other colour in the colouring processing. In the study, the material used is the screw pine leaves that already been treated.

### ii. Screw pine leaves bio-composite.

In order to propose a bio-composite, the selected binder and coupling agent is vital. Other than that, the process of producing the screw pine leaves bio-composite also the key of the study. The method and technique should consider the technology that affordable to propose to industry. The mechanical properties of the screw pine leaves bio-composite is accumulated in the study. The refer study on the tensile strength are by P.K. Ilankeeran, P. M. Mohite and S. Kamle, 2012, which is the standard review on ASTM D3379-75 [14]. While the impact testing standard review, are a study by E. Ozen, A. Kiziltas and D. J. Gardner, 2013, that conducted according to ASTM D256-06 [15].

### iii. Design application.

The study on processing the material, on the same time, the design application of the material is acknowledged. The experiment constructs are to gain both of the data. Therefore, the application of the material is immediately result. While, the validation is completed section that review the material durability, aesthetic value, and comparison material between the screw pine leaves and screw pine leaves bio-composite.

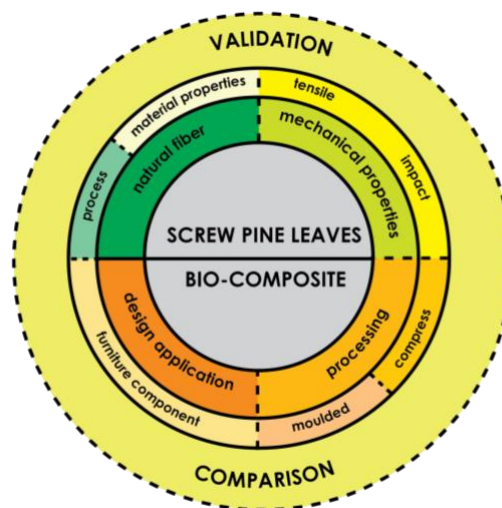


Fig. 2

## CONCLUSION

Screw pine leaves bio-composite for furniture component is a study that aims to utilize the underutilized screw pine plant. Other than that, the study also expected to record the specific data on screw pine leaves mechanical properties to support the material usage in future. The intention study is to acknowledge the material to society that this underutilized plant is a material that is useful to develop new stage of Malaysia identity in furniture design. The target on designing the furniture component based on screw pine leaves bio-composite is to verified the material applied as a part of the validation demonstration other than comprehend the limitation of the material. Moreover, the framework developed from the review is a guideline and overall illustrations regarding the study.

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