

Composite Floor Chair Waste Mangrove Fruit Flour

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Abstract. *The craft industry is one of the drivers of the economy and trade in Indonesia. One of these handicraft industries is utilizing the potential of mangrove forests as an economic function. That is managed with expertise and creative, innovative, and commercial ideas to foster interest and encourage people to develop innovative ideas for mangrove potential in line with current technological developments. The potential availability of raw materials is very abundant, so innovation is needed that leads to the use of propagule as a composite reinforcement material. This innovation is carried out to model a floor chair made of propagule (Rhizophora mangrove fruit). This model uses a mixture of resin and propagule powder. The innovation results show that it can be modelled on the MangKoe floor chair using a hand lay-up molding system. This chair can withstand a load of up to 70 kg, and the result of this innovation is named MangKoe.*

Keywords - Propagul, mangrove, rhizopora, floor chair, MangKoe

INTRODUCTION

Mangroves are plants that are used to withstand seawater abrasion. The use of mangroves that are known by the community is still rare, where mangroves are used as barriers to sea waves and abrasion. The resources owned by mangrove plants are numerous, from stem leaves to fruit. One of the current communities uses the natural colour of mangrove stems as batik dyes. Besides that, people also use mangrove fruit, often called propagules, as an alternative material for flour substitutes. Propagule flour can be used for various processed snack products [1]. In the manufacture of mangrove flour, there is waste, namely mangosteen skin, so that the waste can be processed into derivative products, one of the derivative products is the manufacture of floor chairs [2]. It is necessary to provide an alternative to socializing for the public, small and medium enterprises, or the millennial generation. Experiments can be carried out on the potential of this Rhizophora mangrove through educational, interactive, and recreational approaches, as well as prosperous coastal communities with mangrove trees in the area [3].

The manufacture of this MangKoe lesehan floor chair is based on the ergonomics of the lesehan sitting position which has several sitting positions including sitting with your legs crossed (cross-legged) with the body leaning or not leaning because sitting on the lesehan tends to change the position of the sitting style [4]. In addition, the position of other sitting styles, namely, stretched. The condition of a person when sitting on the floor causes several discomfort factors such as tingling, aches, back pain which has an impact on standing difficulties as a result of sitting too long, and occasionally wanting to lean back to relieve soreness [5]. So it is necessary to design a floor chair design. The design of this floor chair uses SolidWork Software by paying attention to several aspects, namely ergonomics aspects that focus on a person's fatigue point when doing activities [6].

Based on the description above, it is necessary to design a supporting facility for sitting lesehan, so that the body remains in a perfect position when doing the lesehan sitting position. The basic design of the lounge chair uses ergonomic aspects, the data taken are the measurement of sitting upright height (UH), which is 82 cm, body shoulder width (SW) is 60 cm, sitting shoulder height (SH) is 62 cm, and the length of the popliteal buttocks (PB) is 60 cm [7]. The materials used have prerequisites: they are environmentally friendly, safe, and practical. In addition, it must also be durable, solid, and easy to clean [8]. The material that will be used is the waste of mangrove fruit peels that are dried in the sun to reduce the water content to an average water content of 12%. Then it is inserted into the hammer mill tool in the manufacture of powder [9]. The powder is mixed with chemical resin and printed on the mould that has been made.

Utilization of the potential of mangrove forests as an economic function that is managed with expertise, as well as creative, innovative and commercial ideas. So as to foster interest and encourage people to develop innovative ideas for mangrove potential in line with current technological developments.

Mangrove

Mangrove plants are natural resources in the coastal environment that have the potential that has not been used optimally by the surrounding community. People generally do not know in detail about the use of mangrove trees, especially as food reserves, namely by utilizing mangrove fruit as a substitute for flour, and the sap can be used as

batik dye. A collection of several mangrove trees is called a mangrove forest. Generally, a mangrove forest can be defined as a forest that grows in coastal areas with ups and downs of sea waves, especially on beaches near river mouths and protected by lagoons. Another characteristic of mangrove forests is that they can live in high salinity (salt water). At high tide, the mangrove forest area is flooded [10]. Mangrove forests have ecological functions: a food supplier for marine biota, a tidal wave barrier, a coastal abrasion barrier, and a waste absorber. In addition, the mangrove forest functions as an eco-tourism destination that can help support the lives of coastal communities by processing mangrove fruit as flour [10].

Mangrove trees in some areas are used as drinks and medicine, and mangrove forest areas as a living ecosystem for various types of fish, crabs, shrimp, and shellfish so that coastal communities can use them as fishing grounds. Some people use the mangrove tree as wood for boat construction. It is used as firewood, as raw material for charcoal/briquettes, and the leaves are used as fodder for goats. Some are made with natural dyes and paper.

Biocomposite

A biocomposite is a composite material formed by a matrix and reinforcement of natural fibres. Such materials often mimic the structure of the living material involved in the process, maintaining the matrix's strengthening properties but always providing biocompatibility. Utilization of *Rhizophora* mangrove species as a composite reinforcement material. So far, propagules have only been used as mangrove seedlings and replanted as abrasion barriers. This potential, the availability of raw materials for innovation, is directed to utilizing propagules as a composite reinforcement material.

Material

The quality of the initial materials determines the success of a furniture design. The material used must consider several aspects: economic and functional aspects of aesthetics. Furniture materials are divided into two parts based on their formation elements, natural materials such as natural fibres and wood. Artificial materials such as synthetic fibres, plastics, and metals are divided into two parts based on their composition elements. The materials that can be used as furniture, the material is wood, plastic, textiles, metal, and stone [11].

In making floor chairs, natural materials, namely fibres from mangrove fruit or propagules, are used. Propagules are mangrove fruits that have germinated. There are several types of mangrove fruit, namely *Vivipari* and *Cryptovivipari*. *Vivipari* is a seed germinating while still attached to the parent tree, and the sprout has come out of the fruit. At the same time, *Cryptovivipari* is a seed that has germinated while still attached to the parent tree but is still covered by the seed coat. Dried propagules can potentially be used as biocomposite materials. Dried propagules are still rarely used or have not been developed, so they are still not known by the general public.

Ergonomics Aspects

Ergonomics is a discipline that includes safety, security, and comfort. Ergonomics is also concerned with optimization, efficiency, health, safety, and human comfort at work, at home, and in recreational areas. The study of ergonomics examines the interaction between humans, facilities, and their environments with the primary goal of adapting the work atmosphere to humans [6].

Ergonomics aspects that are considered are analyzing and considering the interaction between humans and their products and work environment. Human activities when using products in the form of posture and body movements will have an impact on the condition of the human body. A movement that is not in accordance with the human body system will cause discomfort and even cause pain or disturbance to the human body. In designing a product, it must pay attention to ergonomic aspects so that it can provide user comfort and satisfaction. In addition to ergonomic aspects, visual aspects of shape, product size (anthropometry) and colour, and product materials must also be considered [6].

The Expected Shape of the Floor Chair

The shape of the floor chair and its structure is expected to make the user safe and comfortable when using it, besides that it is also able to hold the backrest against the support, is able to withstand the side loading of the floor chair, and has resistance to movement from the user.

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METHODS

The stages of product design and manufacture are:

- 1) Define parameters. At this stage, the process is carried out, namely looking for information related to the process and verification technology used in product manufacture. Process technology and verification are carried out to determine the parameters of the final result of the configuration of the floor chair product.
- 2) Perform a tensile test. A tensile test is carried out to determine whether this propagule composite is suitable for use as a floor chair product that produces a leaning strength of 70 kg.
- 3) Design. At this stage, the parameters of the selected process and verification technology are adjusted using SolidWork software.
- 4) Product Manufacturing. At this stage, the manufacture of products that have been designed, created, and evaluated begins. The use of Solidwork Software to create a floor chair model by looking at the characteristics of the design that can be processed.
- 5) Design details. At this stage, documentation is made as technical drawings of the designed floor chairs. Then make a floor chair product (prototype).

Process Flow

Table 1. The process of making MangKoe Chair



1. Propagule harvesting process



2. Propagule collection



3. Propagule Extruder Process



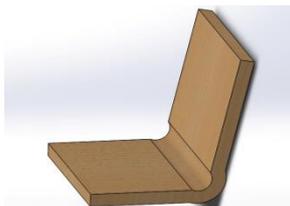
4. Pelleting propagules



5. Floating Process



6. Propagule flour/powder



7. Chair model



8. Chair molding



9. MangKoe floor chair results

RESULT AND DISCUSSION

Utilization of mangroves as an alternative to natural wood materials, experimenting with the potential of this rhizophora mangrove, through an educational, interactive and recreational approach, and can improve the welfare of coastal communities where mangrove trees are found. In the manufacture of mangrove flour there is waste, namely mangosteen skin, so that the waste can be processed into derivative products, one of the derivative products is the manufacture of floor chairs. The manufacture of the lesehan floor chair is based on the ergonomics of the lesehan sitting position which has several sitting positions with a leaning body position. So it is necessary to design a floor

chair design. The design of this floor chair uses solidwork by paying attention to several aspects, namely ergonomics aspects that focus on a person's fatigue point when doing activities.

Product design with Solidworks Software, SolidWorks software is used to create floor chair product design models. The Solidworks software was chosen because it can create floor chair models and computational calculations to find the strength or reliability of the modelled floor chairs, as shown in Figure 10. The modeled floor chairs are quite simple because the desired design is as simple as possible to be easily stored and easy to use by the user (users).

The results of the design of the lesehan chair using ergonomic aspects, namely sitting upright (SU) 82 cm, body shoulder width (SW) of 60 cm, sitting shoulder height (SH) 62 cm, and popliteal buttock length (BL) of 60 cm. The material that will be used is the waste of mangrove fruit peels that are dried in the sun to reduce the water content to an average water content of 12%. Then it is inserted into the hammer mil tool in the manufacture of powder, the powder is mixed with 40% chemical resin and printed on the mold that has been made. Then from the results of the design, it was tested by giving an average adult load of more than 70 kg. on a reclining floor chair that is simulated on solidwork software. The load test results obtained the value of

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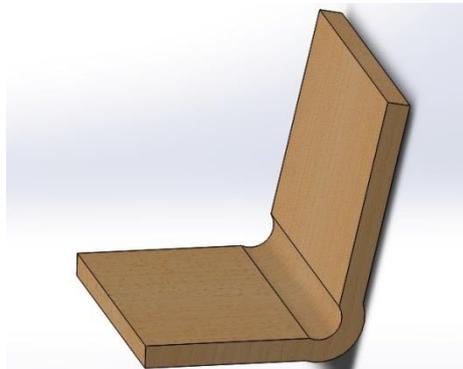


Figure 10. The modelled floor chairs

Figure 11 shows that the analysis of the distribution of stresses caused by the load given to the chair, namely the tensile strength at the point of emphasis at an angle there is a stress that is held by the material of 70 kg, so that the yield strength of the stress load when a mangrove fiber composite material is obtained reduced its elastic properties by 19.9 N/m².

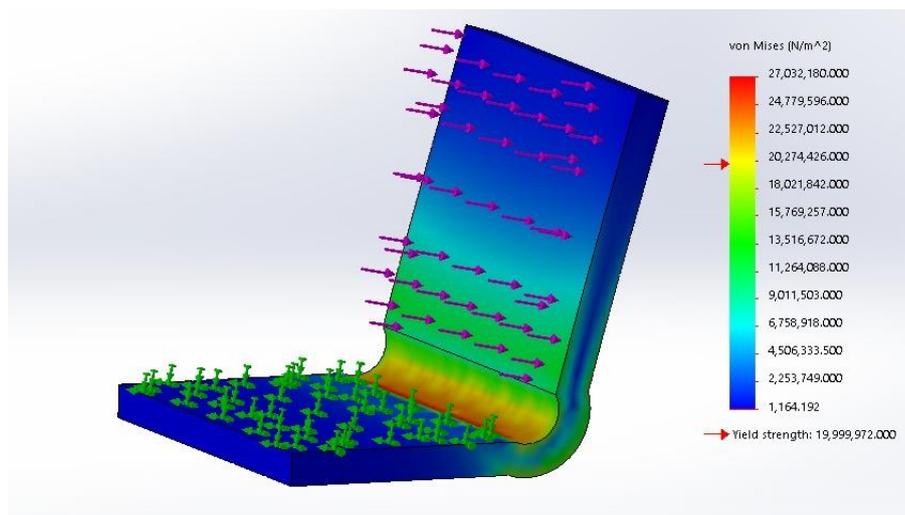


Figure 11. Loading distribution Analysis on the chair

Research has been carried out on mangrove flour waste, namely the skin from mangrove fruit (propagul) from the Rzhopora mangrove species. The waste is used as a composite material with an application, namely the lesehan floor chair which is used for people to recite so that there is a backrest on the activity. As for the process of designing the form of this lesehan floor chair, there are several limitations that are made to match what is expected, as follows:

- a) Product considerations are to have a comfortable shape and structure and to provide a sense of relaxation.
 - 1) Product purpose. The product is made in the form of a sitting support facility.
 - 2) Working conditions. So that the body's condition does not get tired quickly according to use, such as reading, watching, studying
- b) Product limitation. It provides flexibility and comfort in using the product in a lying position.
Place factor: The place of use of the product is in the home environment, inside the house (indoor).
- c) Product Description
Target users for users who do lesehan activities
 - 1) Product size
The product's size generally adjusts to adults' anthropometric data, including the size of the body part used in the sitting position.
 - 2) Floor chair material
The material used is Rhizophora type of mangrove skin waste, brown.
- d) Product specifications
Product specifications are as follows:
 - 1) General Use : Home Furniture
 - 2) Specific Use : Living Room Chair
 - 3) Type : Living Room Furniture
 - 4) Appearance : Modern
 - 5) Folded : No Folded
 - 6) Style : Lounge Chair
 - 7) Size : As Details
 - 8) Material : Rhizophora mangrove fruit (propagules)
 - 9) Brand Name : MangKoe

The result of the design of this form is a lesehan floor chair product which is given the Mangkoe brand as shown in Figure 12.



Figure 12. Trademark

CONCLUSION

From the design of the lesehan floor chair that has been made, conclusions can be drawn including the following:

- a. The results of the chair design have gone through an analysis process using simulations on solidwork software where from the loading that has been carried out it produces a maximum stress of 19.9 N/m² with a loading of 70 kg.
- b. Lesehan floor chairs that have been made from natural material of mangrove fruit fiber (propagules) of the rhizophora type, will be better in terms of strength, as a substitute for wood material.

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