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# Creating Alternative Materials from Lime Peels

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## Abstract

The purpose of this research is to experiment with the processing of lime peel for use as a substitute material in design. There are three steps to conduct research: studying data from research papers; experimenting on processing lime peels for use as alternative materials and applications for creative designs. The results of the research showed that the lime fruit When cut transversely, the wall of the fruit is divided into 3 layers: the exocarp is sticky, thick, and has oil glands; the mesocarp is thin, resembling a mitten or white pulp; and the endocarp is soft and consists of many small sacs and water inside. In addition to being nutritious and rich in nutrients, especially vitamin C, and having antibacterial potential, there are also fibrous components, which are abundant in the middle skin wall with white pulp, which can be processed by the process of making mulberry paper. The resulting material will look like a translucent sheet. It has a unique color and texture from the fibers, but it is hard, similar to animal leather materials, which, from these properties, is applied as a substitute material for leather in the art of stamping leather. It is also a guideline for the efficient use of resources. It can reduce the use of natural resources and reduce the amount of waste. It is also an environmentally friendly material by combining the knowledge and wisdom of making paper and creativity to solve waste and environmental problems.

**Keywords:** Alternative Materials, Creative, Lime Peels

## 1. Introduction

Materials can be considered one of the most important elements in design. Designers often use the analysis of material characteristics as a design point (form follows material) and process it into a modern product. The combination of materials and design has demonstrated creativity and created new works that look unusual and beyond expectations. The trend of conservation and caring for the environment is another important inspiration in the choice of materials by designers. (Niamsap, n.d.)

Creating new materials for design is a process that focuses on combining innovation. (Zapfl, 2024) to create materials that meet the needs of aesthetics and functionality. Recycling of waste materials such as industrial waste. Food waste or agricultural waste. Improving the properties of the original material, such as increasing durability or changing the surface of the material to suit the design. Functional Design: Developing materials to meet specific applications such as waterproof, flexible, or translucent, with the trend of creating new materials often with the concept of environmental friendliness as an important factor.

Environmentally friendly alternative materials are developed to reduce environmental impact throughout the life cycle of use, such as biomaterials such as bioplastics from corn starch, pineapple fibers, or banana fibers; recycled materials such as PET plastic bottles or recycled paper; and other materials that are more sustainable. Renewable materials such as bamboo, hemp, or coconut husks, and upcycled materials such as rags, wood chips, or agricultural waste. These materials, in addition to being able to be used as a substitute, also reduce the use of natural resources. Reduce greenhouse gas emissions and support the circular economy, which is an important approach to modern design (Intrachooto, 2023)

Lime peel natural materials left over from daily consumption and in the processing industry are often seen as worthless and discarded as waste without being utilized. It is also a waste of resources that can be used to create value sustainably. Lime peel has interesting elements such as mesocarp fibers that are sticky and elastic, as well as essential oils that help with antibacterial properties and reduce unpleasant odors (The Institute for the Promotion of Teaching Science and Technology, 2024). The use of lime peels in research is also an example of reducing the amount of waste and supporting the circular economy. The materials obtained also reduce dependence on natural resources. Create a positive impact on the environment and promote long-term sustainable design practices.

### **1.1 Research Objective**

To experiment with processing lime peel for use as a substitute material in design

## **2. Body of paper**

### **2.1 Methods**

Content Scope

- 1) Study the characteristics and properties of lime peel.
- 2) Study the process of processing waste materials with handicrafts.
- 3) Study on the application of alternative materials.

Scope of creation

Experiment with processing lime peel as a substitute material for design work.

The research process is as follows:

- Step 1: Study and data collection
- Step 2: Experiment with processing lime peel as a substitute material for design.
- Step 3: Application of lime peel materials for design

## **3. Results**

Step 1: Study and collect information Study information on characteristics, properties, and processing techniques from various sources, including online media. Academic articles and research articles found that

1) Lime consists of 3 layers of fruit walls: exocarp, which is sticky, thick, and has oil glands; thin mesocarp, which resembles a mitten or white pulp; and endocarp, which is soft and consists

of many small sacs and water inside, and the rest is discarded into garbage, namely exocarp and mesocarp (The Institute for the Promotion of Teaching Science and Technology, 2024).



2) In terms of properties, it is nutritious, rich in nutrients, especially vitamin C, and has antibacterial potential (Jiang et al., 2022).

3) In terms of processing, it was found that the composition of the middle fruit wall (mesocarp) consists of fibers. It has a white pulp. When it is stirred, it looks like a thick liquid.

Step 2: Experiment with processing lime peel as a substitute material for design.

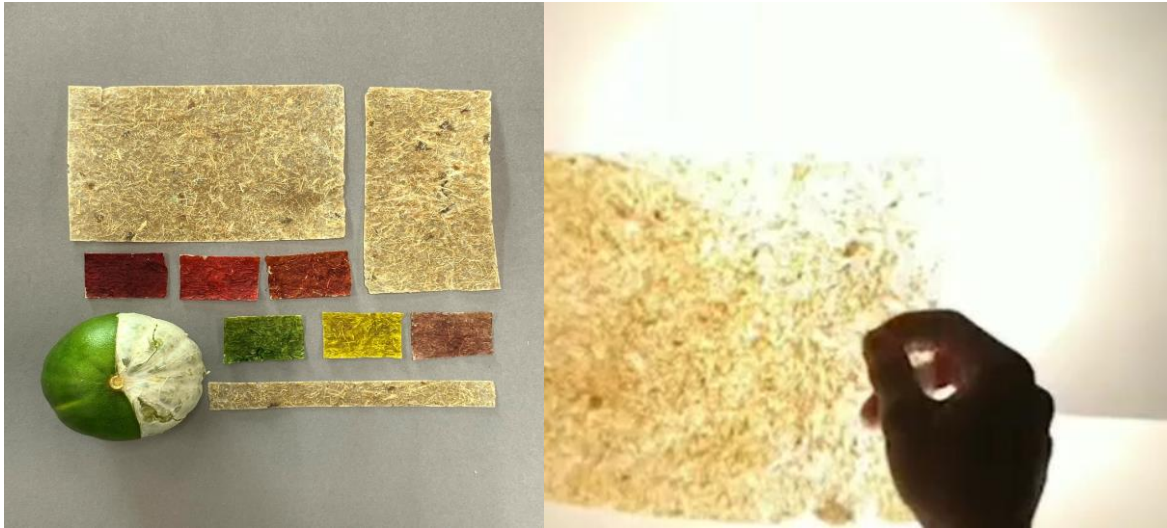
From the analysis of characteristics, properties, and processing, it is found that the possible process is to make a mulberry paper, which has an experimental process as shown in Table 1.

Table 1: Processing of lime peel with the process of making mulberry paper

ingredient	process	Results	qualification
mesocarp 100%	1) Peel the lime peel only the mesocarp. Rinse with clean water. 2) Blend with a blender. 3) Put it in the frame and sift it into the water to spread the pulp evenly. 4) Put it in the sun when it dries and then peel it off.		- transparent - There is a pattern formed by fibers. - Light brown color. - Hardness. - Moderate bending
mesocarp 80% exocarp 20%	1) Remove the lime peel, rinse with clean water. 2) Blend with a blender. 3) Put it in the frame and sift it into the water to spread the pulp evenly. 4) Put it in the sun when it dries and then peel it off.		- transparent - There is a pattern formed by fibers. - Light brown in color. There are black spots. - Hardness and crispiness - Unable to bend

From Table 1, it is found that the appropriate ratio and properties that can be used as a substitute material is to use only the mesocarp of the lime peel.

*Figure 1: The result of the material from lime peel*



### Step 3: Application of lime peel material for design

From the material properties obtained. It is characterized by translucent sheets. It has a unique color and texture from the fibers. It is hard and can be moderately bent, similar to animal leather materials, so it is applied with the art of stamping leather as shown in Figures 2 and 3.

*Figure 2: Application process in the art of stamping leather*



*Figure 3: Prototype of materials and products from lime peel*



#### 4. Conclusion

1. The part of the lime peel that can be used as the best substitute material is the mesocarp, which has the characteristic of having fibers that can be soldered together by themselves (no binders are required). In addition, lime peel contains antibacterial substances. As a result, the resulting material is not moldy.

2. Processing is the process of making mulberry paper using the mesocarp of 100% lime peel. Rinse with clean water and blend with a blender. Put the frame on and sift into the water to spread the pulp evenly. Put it in the sun when it dries and then peel it off.

3. The resulting material is a translucent sheet. There is a pattern formed by fibers. It has a light brown color, is hard, and can be moderately bent.

From the conclusions obtained. It was found that lime peel can be processed into a sheet-type substitute material with properties similar to animal skin. In addition to being able to be developed into environmentally friendly alternative materials. It is also a guideline for the efficient use of resources. It can reduce the use of natural resources and reduce the amount of waste. It is also an environmentally friendly material by combining the knowledge and wisdom of making mulberry paper and creativity to solve waste and environmental problems. This research process is in line with the research on the innovation of processing native plants into creative products "Local way of life, Khiri Wongkot" with the participation of the community

to create community innovation based on the philosophy of sufficiency economy (Inkue, 2022) and research the properties of saltwater plants for use as materials in sustainable design (Inkuer, 2024), which is the use of indigenous materials available in the community to create added value by taking into account the concept of sustainability. This is to bring the waste problem to create new value (Butkhot, et al., 2021). It is also a value-added that combines knowledge and creativity using a design process that can be a sustainable solution to environmental problems.

### **Suggestion**

1. The resulting ingredient ratio is only a preliminary experiment. If the ratio is developed, it will be possible to obtain materials with more good properties.
2. The resulting piece is just a prototype. If it is developed into a product that is in line with the current way of life, it can be developed into a commercial development.

## **5. Acknowledgment**

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