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Pineapple Leaves Box: For Cosmetic Product

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Abstract : *Ananas comosus*, or pineapple, is a common tropical plant with coalesced berries. Pineapple leaf fibres have a high potential for use as an alternative raw material in the box industry due to their mechanical properties, renewable resource, and low cost fibres. The study's main objectives are to look into the requirements for using and improving natural cellulosic plant fibres in pulping and box production, to recognize the various issues associated with using natural plant residues in pulp and box production, and to look into the prospects of various natural cellulosic plant fibres for pulp and box production. Pineapple leaves were pulped using a chemical pulping method called soda pulping, and the pulp obtained was tested for chemical composition, which included lignin content (11.5%), ash content (1.2%), pulp yield (15%), and cellulose content (65%) for pineapple leaves. Overall, the results showed that pineapple leaves have a lot of potential as pulp and box fibre alternatives. This pineapple leaves box can be a very useful product in the long run because the majority of respondents agree that this product will be standing in the future especially in minimizing the problem of the post-harvest agricultural system in the pineapple sector in Malaysia.

Keywords: *Ananas Comosus*, Box Production, Soda Pulping, Cellulose Content

1. Introduction

Ananas comosus, or pineapple, is a common tropical plant with coalesced berries. Pineapple is a common fruit that can be used in a variety of ways. There is a lot of land dedicated to pineapple farming, which results in agro-waste materials such as leaves. For example, only half of each pineapple fruit is used for food and beverage production, while the other half is wasted as fruit peel and leaves. Wood is a major raw material in the production of boxes all over the world, which has resulted in significant deforestation, which has a direct negative impact on our environment. As a result, alternative raw materials for box production, such as pineapple leaves waste, have become necessary. These wastes are high in lignin and cellulose, making them an excellent source of allied fibres. Furthermore, waste disposal is a major issue in these industries due to the high lignin and cellulose content of waste leaves,

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which is difficult to degrade, resulting in pollution and environmental damage. Non-wood natural fibres are important resources for meeting the growing demand for pulp and box products.

Pineapple leaves are a cellulosic agro-waste with a high cellulose content that is abundant in pineapple industries. Pineapple leaf fibres have a high potential for use as an alternative raw material in the box industry due to their mechanical properties, renewable resource, and low cost fibres. In Malaysia's box manufacturing industry, the use of pineapple leaf fibre is still relatively new. This box is intended to improve or add to the products made from natural fibre box-based materials as an alternative to environmental problems such as tree felling without close supervision. Pineapple leaf fibre (PALF), on the other hand, is a non-wood fibre that can be used to make boxes. Packaging production is a massive industry. Given the scale of the industry and the pervasive position of packaging in our lives, the potential for packaging to have a detrimental effect on the global environment is immense. Thus, the objective of we making the packaging boxes from the pineapple leaves because of the responsible fiber sourcing. We more prefers to use or raise the amount of recycled materials in our products.

2. Materials and Methods

2.1 Materials

Moisture analyzer, sieve 0.4mm, soxhlet apparatus, conial flask, oven-dry, 7% sodium hydroxide, laboratory steel blender, hydrogen peroxide, beaker

2.2 Methods

2.2.1 Sample preparation

In the laboratory, each sample was air-dried before being chipped into small pieces with cutting tools such as a knife and scissors. Using a moisture analyzer, the moisture content of the samples was determined. A portion of the dried samples was ground, and the size was determined using a sieve with a mesh size of 0.4 mm. Each of the ground samples was saved for further analysis. According to Tappi Standard Test Methods, the chemical composition of pineapple leaves (lignin, ash, cellulose content and pulp yield) was determined. The ground pineapple leaf were subjected to ethanolic extraction for about 6 hours using a soxhlet apparatus prior to this determination.

2.2.2 Pulping process

The chemical pulping method was used to pulp chipped pineapple leaves (soda pulping). A 1000 ml conical flask was filled with about 200g of the raw material (oven-dry weight), which was then placed in a pressure pot with enough water. The solution was poured into the conical flask after 42 g of pulping chemical was dissolved in 600 ml of water (7% sodium hydroxide). The volume of water in relation to the weight of the raw material was 3:1. The total time spent pulping was 180 minutes (3hours).

2.2.3 Pulp washing and preparation

The pulp was thoroughly washed under running water to remove any remaining chemicals, and the pulp samples were defiberized in a laboratory steel blender, which acts as a wet disintegrator, for 5 minutes before sieving through a screen.

2.2.4 Pulp bleaching

A measured amount of hydrogen peroxide was added to a weighed amount of dried pulp in a beaker. The beaker was then heated for about 20 minutes on a hot plate, after which the pulp colour had changed to white.

2.2.5 Production of handmade paper

Using a handmade paper mould and deckle, paper sheets were made from both bleached and unbleached pulps. Pulps (fibres) were dispersed in clean water, and the fibres were extracted

from the water using a paper mould. After that, the paper mould with the fibres was air dried in an oven for about 3 hours. To improve the smoothness of the paper, the samples were pressed with an electric hot iron after drying.

2.2.6 Box making

Use of corn starch as a glue in making the box. Dry it approximately in 30 minutes.

3. Results and Discussion

The results and discussion section presents data and analysis of the pineapple leaves box study. This section is consist of the requirements for using and improving natural cellulose plant fibres in pulping and box production, the issues associated with using natural plant residues in pulp and box production, and the prospects of various natural cellulose plant fibres for pulp and box production.

3.1. The requirements for using and improving natural cellulose plant fibres in pulping and box production.

Table 1: The result of pineapple leaves contents

Agro Waste	Pulp Yield (%)	Cellulose (%)	Ash Content (%)	Lignin Content (%)	Moisture Content (%)
Pineapple Leaves	15	65	1.2	11.5	81.6

Pineapple leaves contain cellulose, which is a major chemical component of the fibre wall. The cellulose component of the fibre inside non-wood materials, which makes it stronger, is an important parameter for suitability of a raw material for pulp and box making, and the quality of fibre extracted depends on the cellulose contents, hemicellulose, and holocellulose. Increased cellulose content results in stronger fibre, which improves the quality of the box formed. Pineapple leaf has a low lignin content of about 12%, as shown in the Table 1. The main benefit of low lignin content is the use of non-wood materials in pulp production, which requires less chemical for pulping and acts as an adhesive to hold cellulose fibres together. Lower lignin content makes it easier to remove lignin from the pulp, and the resulting box is of higher quality than non-wood alternatives.

Based on Table 1, pineapple leaf has a lower ash content (1.2%), indicating the absence or presence of other materials, either separately or in combination. The low ash content of pineapple leaf pulp suggests that it has the potential to produce high-quality box. The moisture content of pineapple leaves is extremely high (81.6%). The mechanical and surface properties of the box produced will be affected by the high moisture content, indicating less dimensional stability against the grain. From a dry state to saturation, cellulose fibre can swell by 15 to 20%, resulting in a change in dimension stability. As a result of the change in dimension, the dimensional stability of the box will deteriorate, resulting in undesirable cockling and curling. It is because the structure and strength of the box are dependent on it, a high-quality box requires excellent dimensional stability against the grain.

3.2 The issues associated with using natural plant residues in pulp and box production

3.2.1 Environmental current issue

According to Amirul Azan Mohd Sufian et al. (2020), the paper that we are used today is made from wood as a raw material. The production from that product creates a negative effect on the deforestation problem. There are 45% of industrial paper production were reported to have produced a paper in global. Other than that, 38% came from the USA, 15% from Canada and 7.5% from Japan, and 6% from Sweden country for that related to the paper manufacture.

This shows that we need to minimize the usage of paper-based from wood. Another alternative for producing paper by using non-wood fiber is conducted by the other country such as China they use wheat straw and Malaysia use pineapple leaves.

The previous report showed that the issue of environmental pollution in the crop waste process is open burning. It can release the harmful chemical likes polychlorinated dibenzofurans (PCDFs), polycyclic aromatic hydrocarbons (PAH's), and polychlorinated dioxin. It is dangerous if living things inhale a large number of toxic gases without any protection. This activity can cause health effects because of chemical properties called carcinogens gases where free release in the environment. It can form cancer in the human body and disturbing to the cellular metabolic processes. Thus, it can emit carbon dioxide (CO_2) gasses into the atmosphere. Global warming can happen when there has an increase in temperature that affects the greenhouse. Other than that, it can affect milk production by the animal because they also breathe with the same air. In this case, the carbon monoxide and carbon dioxide presented can change the hemoglobin structure in the body and cause to death of hemoglobin.

3.2.2 Mix old paper

The previous studies found that the pineapple leaf that mixes with waste paper has higher tensile strength than the paper that only contains pineapple leaf fiber known as PALF. The old newspaper can strengthen the paper. However, the ash content in the product presents many chemicals, mineral matter, and metallic which means that it was not a good property of new paper here. The PALF has better properties because of its more natural and low ash content. It gives the paper a similar behavior to oil-paper because the water absorption rate is low. This good substitute for conventional oil paper that uses product from plastic and cause to the bad pollution [9].

3.3 The prospects of various natural cellulose plant fibres for pulp and box production

Recently, deforestation has become one of the hotly debated issues around the world due to the widespread problem of deforestation to produce paper or box. In an effort to address this issue, various alternatives have been introduced to produce paper or box such as using agricultural waste. Agricultural waste from pineapple plants such as leaves and bark can be used as environmentally friendly products. Tropical crops, pineapple is not only high in vitamin C, but its leaves are also high in fiber. Realizing the uniqueness of the pineapple tree, we took the initiative to make full use of the leaves of the plant in box making. As a result of our research, we conducted a research and development (R&D) study on pineapple leaves and found that it can be commercialized as a basic material in box making. This box making technique does not use any chemicals and undergoes a natural process. We choose pineapple leaves because of its various benefits including having a high fiber content, strong and more durable. If this fiber can be made of paper, it thus helps reduce environmental pollution. This is because most gardeners do not use pineapple leaves but only take pineapple. Usually, pineapple leaves are discarded or burned. It reuses discarded leaves from the locally abundant fruit pineapple, to make a specialty box that can be used in packaging. Pineapple not only helps reduce waste in agriculture and deforestation associated with paper made from trees, it also helps local pineapple farmers in the country as it gives the leaves a new purpose and value, driving additional revenue.

Various novelty product can be made by using agriculture waste, such as pineapple leaves. Pineapple leaves which is one of the alternatives to fiber-producing plants that have only been used as a fruit as a source of food, while pineapple leaves themselves are not used to waste the actual fact that it is also potential. Therefore, the surplus of pineapple leaves continues to be continuous so that it has enough potential to be used as material for paper and box makers that

can provide added value. The characteristics of this box have a unique that is a material specially made from pineapple leaves, long lasting, free from chemical, light weight and clean from any contamination. In the manufacture of this box, it is necessary to consider the added value or economic value in the form of art industry products that are practical and have a beauty value.For examples like healthy industry, paper industry, packaging industry and textile industry [10].

3.3.1 The potential of pineapple leaf as a paper

According to Amirul Azan Mohd Sufian et. al (2020), he said that pineapple leaves paper is high strength leaf fiber that contains lignin, cellulose, and hemicellulose. It is suitable to produce a product like paper because of their chemical composition is 85.7% of holocellulose and 66.2% of cellulose. The natural fiber is fine silky, small structure, hydrophilic, and has a fiber length is high mechanical strength. Despite that, the material is abundant in agriculture, low cost, easy to through processing by machine because of low energy consumption, and has unique characteristics. This shows that it has a chance to be box based on pineapple leaves.

3.3.2 Qualities of pineapple leaf paper with existing paper

The chemical composition of pineapple fiber is similar to wood which is a good selection as a raw material for manufacturing paper [1]. This shows that the quality of the paper is higher than wood because it is more strong. The factors influencing paper quality is weight, brightness, environmental-friendly concept. Moreover, the existing paper production concept uses conventional bleach by chlorine element that can produce an abundant chlorinated organic compound which is called chlorinated dioxins. This compound has high toxicity and give a bad effect on the environment and usually use to preserve the quality and color of the paper.

The pineapple is more persistent than tress because the paper does not crack or worsen like the papers from tree fiber. The concentration of cellulose is more and stable than wood production. It is because the tree only has 30% cellulose and need to remove 70% of the chemical toxic usage. Pineapple fiber has 85% cellulose content and lower lignin than wood by 5-24% lignin whereas wood has 20-35%. It shows that the pineapple fiber can easily remove the pulp before change into the paper. The pineapple leaf has the same properties as a wood material [12] . It also can be written, be torn, and absorbed moisture if it will be added to the old newspapers. However, the thickness and features can be limit to use as packaging boxes only [11].

3.3.3 Made coloring paper by the pineapple leave fibre

As mentioned by M Djazman Addin S (2018), pineapple leaf fiber can also make the color art paper by using auxiliary materials such as tapioca, Titanium dioxide (TiO_2), and Sodium hydroxide (NaOH). The physical appearance can compete with the art paper in the market It also can added value product. It was free of chemicals, more strength, and high quality.It enhance the strength and stiffness of the crystalline chain in the product that can allowed the usage for biodimedical, paper and aerospace in industry [5].

3.3.4 Pineapple crown extraction recycle

Pineapple crown fiber has similar properties and composition to pineapple leaf fiber. However, it is not widely used and not consider in many applications. The natural fiber contains cellulose which is most abundant in the natural polymer as a cellulose natural ingredient in the earth [2] and it is a low cost, chemical stable, biodegradability, non-toxicity, availability, renewability, and biocompatibility [7]. Some of the matrix starch are biodegradable, which allows the production material and gives benefits to the user and environment for example

packaging application. It also can be as high added value and eco-friendly as containers. Thus, it can be expanded to other products because it is abundant and inexpensive to solve agricultural problems [4].

3.3.5 Chitosan film based pineapple leaf for packaging food

Pineapple leaves fiber that added with the nanocellulose to the chitosan matrix can improve the packaging firm to become a biodegradable packaging of plastic [2]. It is non toxic, can be shaped into firm, antibacterial activity and biocompactible polymer.The pineapple leaf pulp can reduce the use of plastic, landfill and waste stream with biodegradable packaging [6]. The research and development in paper made by the pineapple fiber show that it also has the potential to produce as incorporation of pineapple-based composite in packaging box production.

4. Conclusion

Pineapple leaf fibre is widely used in tropical areas and is easy to extract from the leaves. Pineapple leaf fibre in composite materials is a novel source that is cost-effective, environmentally friendly, and recyclable. The findings of this study show that pineapple leaves are a good non-wood raw material for making boxes. The study demonstrates the suitability of agricultural waste materials in our environment as a pulp and box-making alternative to wood in order to protect and conserve our environment from deforestation and its associated effects. Because of its high cellulose content and low lignin content, pineapple is also a high-potential substitute in box production, according to the study.

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