



Ignored Bounty: Creating value from bioresources

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ABSTRACT

The leaves of trees and plants significantly impact the environment, people, and even the world. In addition to the various diseases affecting these parts of many types of plants, these problems have a vast effect throughout 10, 20, or even 100 years and cannot be solved by any straightforward method. This is because the leaves are withering every day and causing daily effects. Leaf problems can be reduced or alleviated by material modifications that can be applied to add value or overall benefits. The authors have therefore studied and researched how leaves can become a value-added item, and what steps must be taken. This study will positively impact people, the environment, and the planet. The authors have developed an idea of a value-added and beneficial change that does not negatively affect the environment. This is especially good for the people, who will be able to earn money and still use their sustainable resources. The process started with sketching out all of the possible ideas that might solve the problems. Then, the most suitable concept was selected and developed into several prototypes. After some improvements, the final prototype was successfully manufactured.

1. Introduction

Regarding leaves, there is currently a trend in which people want to save the world and help restore the environment, including creating green cities, all of which are advantages of returning to nature and wanting to preserve the environment for the improvement of human life and the world. These are the current events that invite one's desire to do something in order to be able to heal or protect or, in contrast, vice versa, as there are several factors that can cause such currents to be ignored without being picked up. Therefore, we have an idea to adopt the trend that wants to save the world by supporting the methods or ideas to create change that will help maintain a balance and create more value for the materials.

2. Objectives of the study

- 1) To investigate the hidden potential lying in the leaves and to convert them into valuable products.
- 2) To study the various bio-based materials being developed and investigate the possible applications.

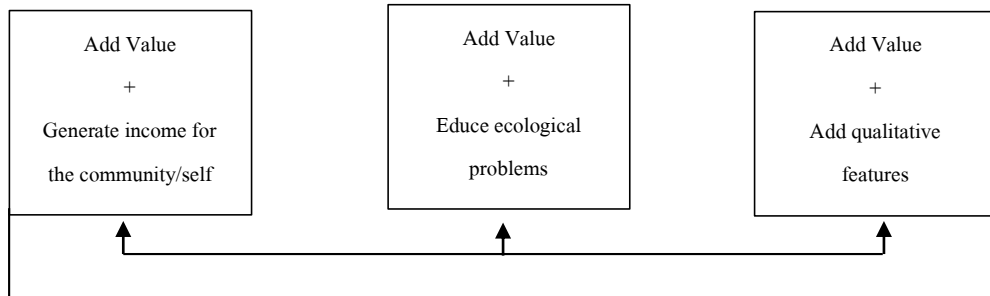


Figure 2 Conceptual framework or theory used as a research model

3. Materials and methods

3.1 Leaves

Fall defoliation and leaf cover provide many benefits: they reduce solar heat and water evaporation from the soil, and tiny living things and roots can grow. Moreover, in the long term, it will form a skin-like layer on top of the soil and make it come alive.

3.2 Fertilizers

Compost is organic or natural fertilizer that is obtained from the removal of plant residues.

3.3 Benefits of compost

- 1) Helps increase the amount of organic matter in the soil, which makes the soil fertile.
- 2) Helps change the condition of the soil from clay or sandy soil to loam, making it easier to till.
- 3) Helps to conserve moisture in the soil more effectively.
- 4) Makes the soil aerated.
- 5) Increases the efficiency of using chemical fertilizers and thereby reduces their use.
- 6) Stimulates some plant nutrients in the soil that are difficult to dissolve to be readily soluble in water, which results in improved nutrition for plants.

7) There is no harm to the soil, even if used in large quantities over a long period of time.

8) Helps to adjust the environment by eliminating solid waste and water weeds.

3.4 Biodegradability

Biodegradation involves being naturally biodegradable due to the action of microorganisms such as bacteria or fungi into biodegradable components without harming the ecosystem. For example, leaves are biodegradable and after three months, become fertilizer that can improve the quality of the soil. Moreover, biological bacteria or fungi originate in each region of the world.

3.5 Recycling natural resources

Recycling is an environmentally friendly activity that helps reduce waste disposal requirements and promotes the goal of resource sustainability. Sustainability provides for our current resource needs without sacrificing the resources needed by future generations. Recycling also protects natural resources and reduces environmental



damage caused by mining, logging, and the processing of raw materials. Furthermore, recycling saves energy because processing recyclable materials generally consumes less energy than the collection, transportation, and processing of raw materials. Recycling protects our environment because it reduces the demand for landfill space, and it helps to keep our air cleaner. In addition, recycling is good for the economy. Recyclable materials are essentially a national resource. Resources are wealth; wealth creates business, and business, in turn, creates jobs, stimulates the economy, and increases tax revenues.

3.5.1 Energy savings

According to the University of Pittsburgh, “The energy required to manufacture paper, plastics, glass, and metal from recycled materials is significantly less than the energy needed to produce them from virgin materials. Additionally, providing recycled materials to industry (including collection, processing, and transportation) typically uses less fuel than supplying pure materials to industry” (University of Pittsburgh, 2014).

3.5.2 Helping to protect our environment

The University of Pittsburgh noted that, “Manufacturing goods from recycled materials typically requires less energy than producing goods from raw or virgin materials. When people reuse goods or products made with less raw material, less energy is needed to extract, transport, and process raw materials and less energy is required to manufacture products. When energy demand decreases, fewer fossil fuels are burned, and less carbon dioxide and other pollutants are emitted. Recycling keeps materials out of landfills where they can introduce contaminants into groundwater systems. Recycling and waste prevention divert materials from incinerators, reducing greenhouse gas emissions, ash, and other pollutants caused by waste combustion. Recycling, composting, and diverting organic wastes from landfills reduce the methane released if these materials decomposed in a landfill. Recycling also increases the storage of carbon in forests. Trees absorb carbon dioxide from the atmosphere and store it in wood in carbon sequestration. Recycling paper products and waste prevention allow more trees to remain standing in the forest, where they can continue to remove carbon dioxide from the atmosphere” (University of Pittsburgh, 2014).

Survey data collection

Data was collected by observing the degradation behavior of leaves as well as interviews with those involved in the cases of communities affected by leaves that have fallen on the ground, such as neighbors with large trees or the middle of a community with large trees, and the leaves strewn on the road causing the aftereffects. Advice on solving various problems was provided, and solutions were analyzed and summarized.

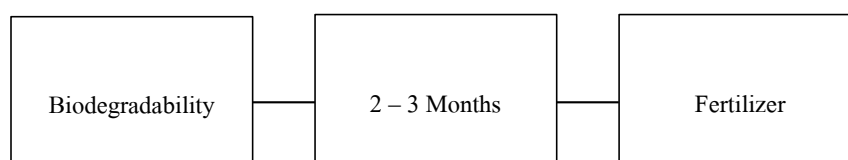


Figure 3 Decomposition process

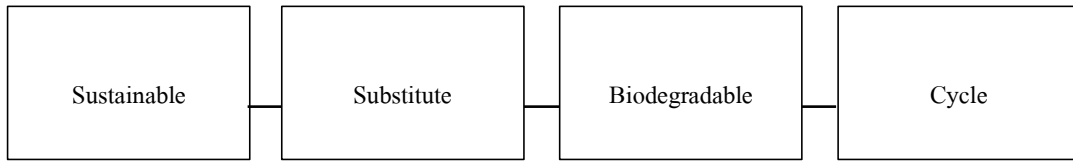


Figure 4 Conceptual principals for the design

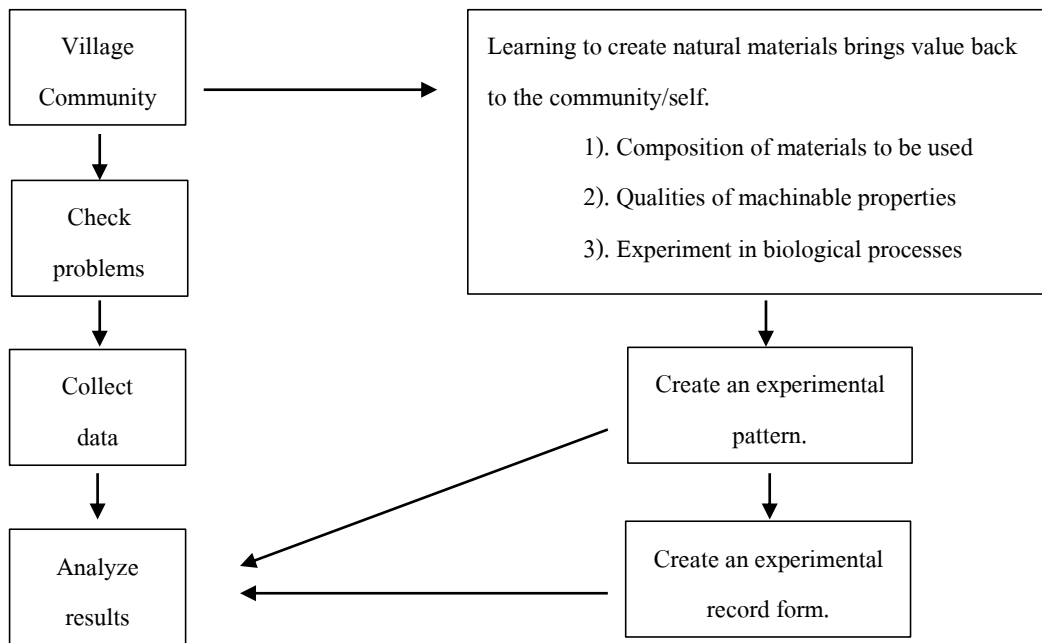


Figure 5 Show the relationship between the conceptual research framework

Leaves are naturally readily available and have fertilizing properties. Such properties must be coupled with the nutrients needed by plants and soil in order to optimize the whole environment, such as adding manure to increase the microorganisms involved in the decomposition or coconut husks to increase soil fertility, which directly affect the plants.



Figure 5 The primary materials used to make natural fertilizers



Rice contains all of the minerals needed by plants, and fingerroot is associated with a fungal disease caused by moisture that comes from rice. Both parts are essential and depend on each other to form a natural glue along with the minerals that promote plant growth.



Figure 6 Rice



Figure 7 Fingerroot

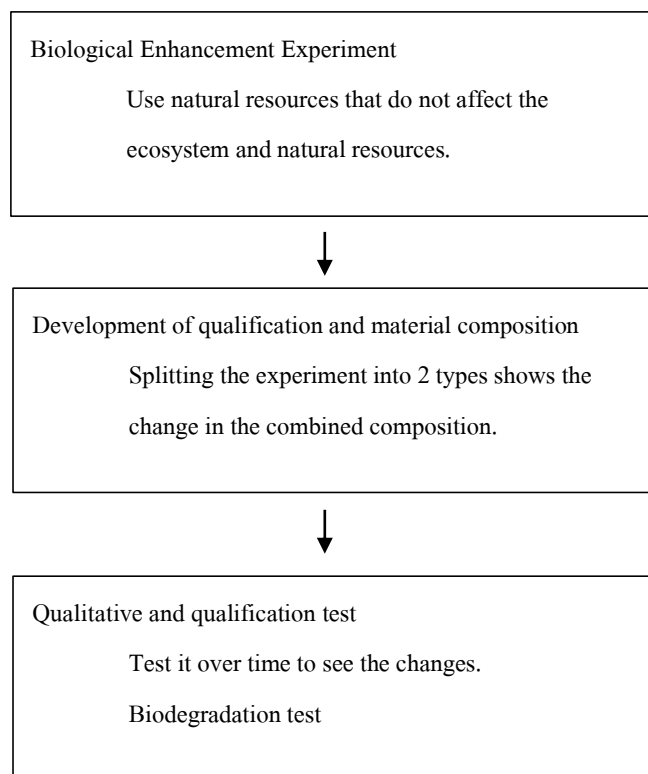


Figure 8 Experimental research concept

4. Results

From the experimental results investigating the composition of rice and glutinous rice flour, Figure 9 shows degradation of glutinous rice, and Figure 10 shows the degradation of rice, with the same experimental period but different results. Rice began to decompose faster than glutinous rice flour during the one-month trial.



Figure 9 Degradation of glutinous rice



Figure 10 Degradation of rice

The design principles emphasize creating natural products that can replace the items that are currently used in order to reduce the problems caused by the leaves. Although some of the impacts are minor, there may be a significant impact if it continues for a long time. Furthermore, the natural products may be able to provide natural benefits and create a way to increase the income for the community or solve the problems caused by the leaves. This may generate revenue in a large area and be the most helpful leaf recycling starting point. As a result, it is a sustainable problem-solving process and can also be a good substitute for materials. The authors collected sketch ideas and mockups, all of which represent different ideas that will be described in detail below.

From the research, it was found that to make the leaves decompose quickly, it is necessary to take into account the microorganisms that are the agents that cause the decomposition of the leaves by adding these microorganisms to the mixture and considering the nutrients that are suitable for the plants to digest. Therefore, regarding the decay of leaves, all components must be suitable and maintained in the best condition without damaging the trees or their roots, and they are all natural materials that provide a great source of nutrients for the trees to grow. The ideas of the sketches were developed using the paper mache technique that can be molded into any desired shape.

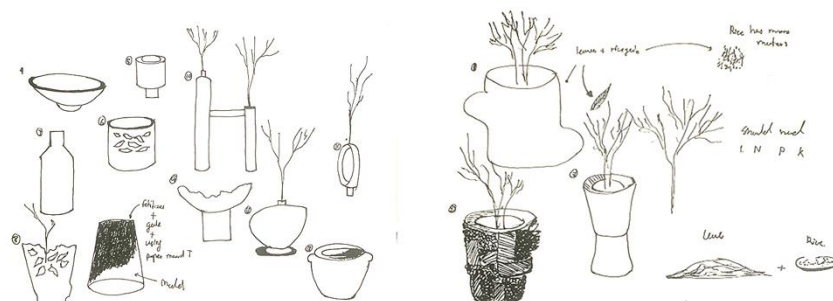


Figure 11 Conceptual principals for the design

The concept of the paper mache technique that can be molded into various shapes and dimensions was used. This also indicates the uniqueness of choosing things that are not normally used to bring benefits. Applying this technique helps promote the quality that matches the concept of sustainable nature in the future.



Figure 12 Paper mache technique results

Packages, concepts, and designs that are resource-saving use natural materials that biodegrade over time in order to reduce problems.

The design considers the users who can adopt it for further use or as a support for the product in the future.

- 1) It does not pollute the environment, which can reduce global warming and pollution.
- 2) It biodegrades naturally.
- 3) It provides both direct and indirect ways to help society with solving problems.

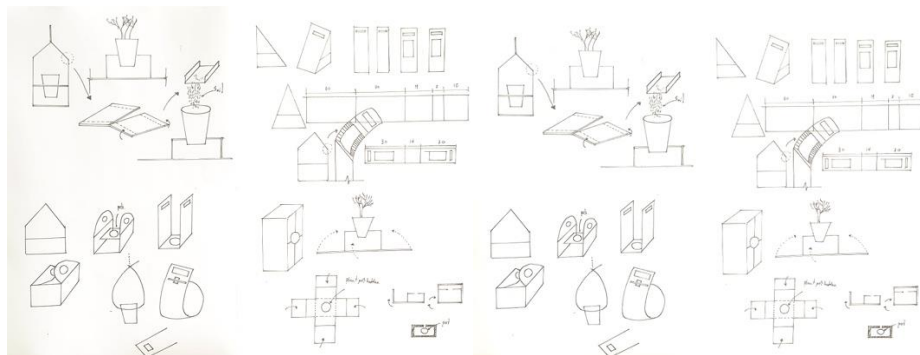


Figure 13 Conceptual principals for the design

4.1 3D Model of the packaging

It is a natural design, and the material used is 100% natural in order to avoid environmental impacts and air pollution. The design process is simple and can be done manually, through which, in the future, it will also be able to decompose by itself over time.

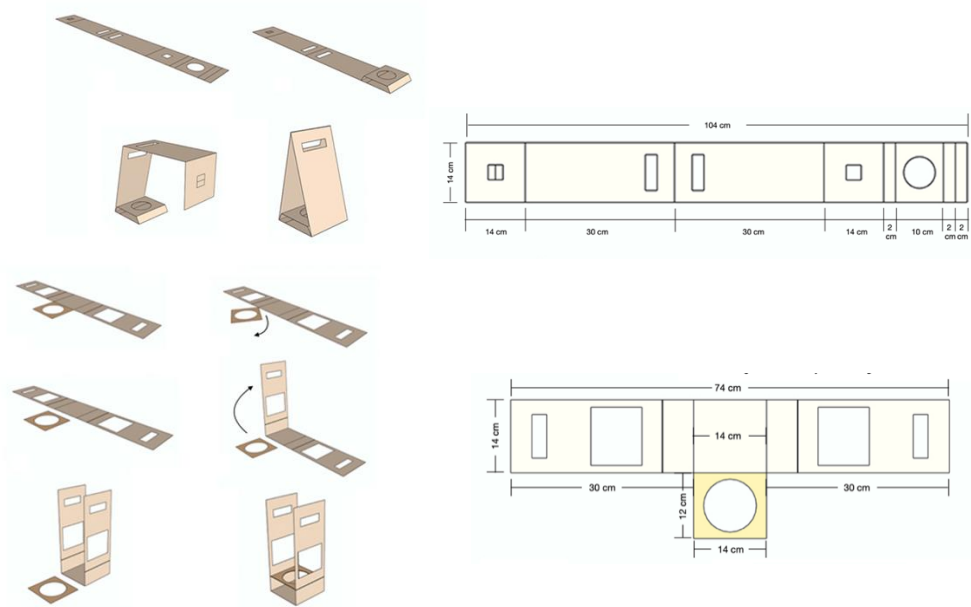


Figure 14 Packaging of the products

4.2 Logo

Regarding the logo design, the authors considered the trees' growth cycle as a symbol of rising up and used the colors that are involved, creating a new perspective born step by step in growth. The authors' color theme uses dark brown and green to indicate the states that are being interpreted. One letter of the alphabet, P, was applied in a vertical and an upside-down format. The vertical P is like a fertile plant, and a green tone was used for this letter of the alphabet. The upside-down letter P is compared to the soil or fertilizer, providing nutrients, and the letter of the alphabet is shown in a dark brown tone. The brand's name comes from the Thai name PUY, which refers to fertilizer, and PRUKSA, a word meaning "a tree". When combined, it becomes PUY PRUKSA.

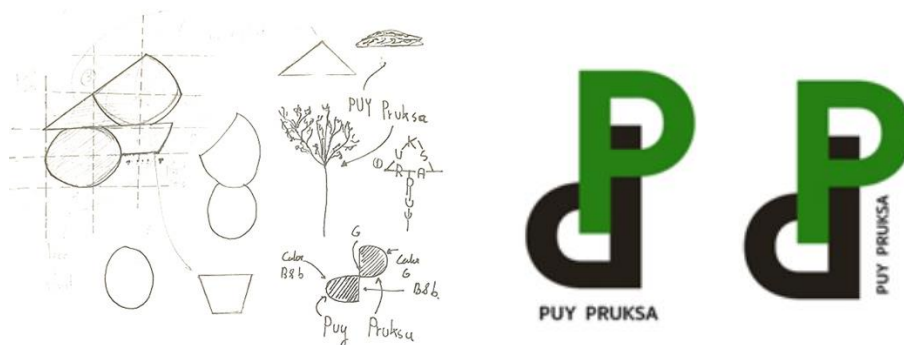


Figure 15 Logo of the product brand



Packaging and branding are important points that generate customers' interest. When considering the use of natural materials, we often tend to overlook them although the package and the branding indicate the value of the product. Therefore, we would like to present a new approach that can be adapted to be the most helpful and valuable because everything is a readily available material, which will cause the customers' demand to increase over time.

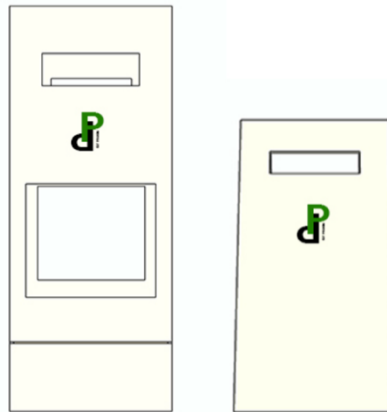


Figure 16 Packaging and branding

4.3 Final products

For the last step, the natural glue process was started in preparation for the paper mache technique, and then, it was mixed with the natural fertilizer. Following this, it was possible to mold any shape according to the basic design and add the appropriate decorations to make it exciting and attractive. Making a natural pot must emphasize the complete features of the plant, and the design or decoration can be adjusted as needed for the best beauty and quality. This model presents the unique results suitable for customers who want to reduce their financial expenses and help the environment. All of the details show the efficient use of resources in exchange for saving the environment and reducing the occurrence of many ecological problems.



Figure 17 Final products



Figure 18 Final products



Figure 19 Final products

This research is directed toward maintaining the balance of natural ecosystems. Compared to using plastic pots to plant a tree. From data and experiments using natural materials mixed with biological experiments. Initially, the comparison between pots made of natural materials and ordinary pots made of plastic materials. There are many different factors

1. Natural materials are biodegradable and do not create problems for the ecosystem and the environment.
2. Natural materials can reduce costs or budget.
3. Natural materials can increase the quality of saplings, which is about to do with total efficiency.
4. Natural materials are easy to find and can be done by yourself or generate income for small communities.



Compared to the plastic pots that are already used. It can be said that using natural materials to be processed has a better effect than using plastic pots. Plastic pots are a wasteful resource; for example, buying plastic pots to grow young plants, what costs do you have to pay?

1. Mineral fertilizer suitable for young seedlings that want to grow efficiently
2. Monthly expenses for fertilizing
3. Calculation of time and growth This is an important factor for the effective growth of young plants.

The comparison of the two materials is based on the author's comparison of experiments and research to strengthen the concept of environmental conservation and the desire to restore nature from all human-caused problems.

5. Conclusions

By conducting this research study, we found that using natural materials and processing is something that everyone can successfully conduct and do for themselves. Because natural materials are not very complicated, their use is another important way that we can help the environment. The design must consider the benefits to plants and the environment in order to enhance the quality of the plants and reduce the root causes of the ecological problems.

Picking up and collecting the natural materials is the first step in helping the environment: 1) It reduces the waste that causes problems. 2) It helps to generate income for the community or individuals through processing. 3) Saving the planet in the right way involves many factors, and this is another factor that can have a positive impact. For this reason, this thesis has been created as a base and an inspiration for participating in environmental conservation.

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