Creative materials from lotus stems

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ABSTRACT

Project of Creative Materials from Lotus Stems. The purpose was to study the features, properties, and benefits of the lotus stem. The research method was to explore and study information about the characteristics, properties, and benefits of the lotus stem from research documents. Online media and experiments were conducted to process lotus stems into creative materials. The results indicated that the lotus stalk, which was an agricultural waste material, was high in fibers and cellulose. Processes such as spinning, bleaching, natural dyeing, papermaking, and compound mixing were conducted; it was found that boiling for 3–6 hours helped to soften and separate the fibers well. Spinning made the fibers fine and evenly distributed. Bleaching improved the brightness and durability of the material. These processes affected the fiber's fineness, translucency, durability, and unique pattern. Despite the limitations of complex processes and quality control, the lotus stem was considered a highly potent alternative material. It could reduce waste, add value to local resources, and be in line with the BCG (Bio-Circular-Green Economy) approach, which could be extended to commercial production in the future.

Keywords: Creative Materials, Lotus Stems, Natural Materials

Introduction

Lotus is an aquatic herbaceous plant that is important in nature. The royal lotus flower grows well in wetlands such as swamps and fish ponds. Northeast and Northern Thailand It has tens of thousands of rai of farmland and has a clear harvest season. This geographical region makes it possible to plan for continuous harvesting (Noimai et al., 2021). In addition to being an economic crop that generates income from selling fresh lotus flowers for worship or processing them into food products such as dried lotus pollen and lotus seeds. Various parts of the lotus tree can also be used for a variety of purposes, especially the "Royal Lotus Stem," which is the part of the plant that connects the leaves and flowers. Lotus stem fibers also have a microstructured structure that allows them to withstand tensile strength and tear resistance. (Zhang et al, 2022). This feature makes it suitable for use in handicrafts and textile industries (Pornitibun et al., 2025; Yusuf et al., 2024; Cheng et al., 2018). However, despite the fact that the lotus stalk has many properties and potential, post-harvest management is still an important problem that needs to be solved.

After harvesting the flowers and seeds of the royal lotus, Lotus stalks are discarded without serious use, especially in commercial farming areas such as central Thailand, where more than 50,000 tons of lotus stalks are discarded annually Lotus stalks left in water sources or lotus plantations If allowed to rot, it will cause a bad smell and emit methane, which is a greenhouse gas, while burning will exacerbate the problem of PM2.5 dust and air pollution Such problems not only create an impact on the environment but also reflect the loss of high-potential biological resources. In addition, in many Asian countries such as India, Vietnam, and China, there is a problem of waste from aquatic plants and agricultural materials that are not used, resulting in loss of opportunities to create added value and causing environmental impacts (Chulacupt et al., 2023; Han et al., 2025)

Expanding the lotus stem from waste materials into creative materials and commercial products. It can create multi-dimensional value, both reducing the amount of agricultural waste and reducing environmental impacts. Adding value to local economic crops Identity preservation and dissemination Cultural through design, as well as expanding economic opportunities to both domestic and international markets. This approach is in line with Thailand's BCG Economy (Bio-Circular-Green Economy) policy that aims to use bioresources efficiently. It is also linked to the Creative Economy Development Strategy that pushes local wisdom and innovation to create high-value products. (Aishwariya & Thamima, 2024; Ahirwar et al., 2024) Therefore, the use of lotus stems in this way not only helps to supplement the income of the community but also is part of driving the country towards a sustainable economy and increasing competitiveness on the world stage.

Research objectives

1. To study the characteristics, properties, and benefits of the Royal Lotus Stem.
2. To create materials from the lotus Stem.

Research methodology

This research is based on a creative design process. In solving waste and environmental problems using a systematic research process. To increase new options or methods with the following research steps

Step 1: Study and collect data on the Royal Lotus Stem

Review the related information in books, articles, journals, and research.

Step 2: Experimental processing and creation of the process of forming lotus stems into creative materials.

The scope of this study is divided into the following:

Content Scope:

1. Research about the features, properties, and benefits of the royal lotus stem.
2. Study the process of processing the lotus stem.

Design Scope:

Creative materials to use for product design

Findings

From the study of the characteristics, properties, and benefits of the lotus stem, it was found that

1) The outstanding feature of the lotus long stem is that it is an agricultural waste material that consists of high fibers and cellulose, making it tough, flexible, and lightweight; it can also be processed into translucency when produced into a paper-like material.

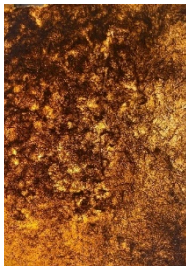
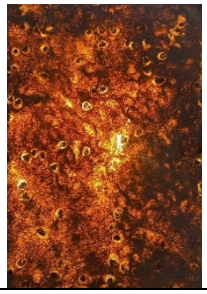
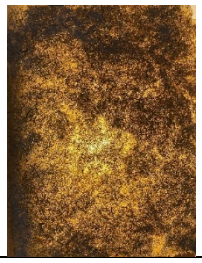
2) Features It has been found to have a high water-holding capacity due to the internal air pockets and cellulose and lignin fibers that help the stem to be strong and durable, helping to strengthen its cohesion and prevent tearing. And it has breathable and moisture-wicking properties. Translucent fibers structure It can support pressure and bending to a certain extent. It is suitable for processing and biodegradable naturally and can replace synthetic materials.

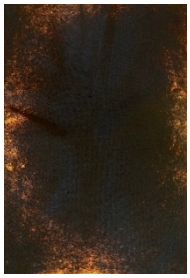
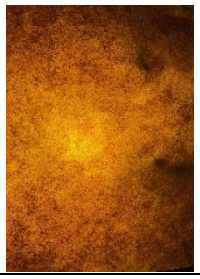
3) Benefits: Lotus stems can be developed as creative materials to be used in the design of a variety of products, including handicrafts, textiles, and lifestyle products, as well as reducing the problem of agricultural waste and environmental impacts. Create added value for local resources and support the development of the creative economy at the community and national levels. This is in line with the BCG Economy (Bio-Circular-Green Economy) approach that emphasizes the cost-effective and sustainable use of biological resources.

Experiment on processing lotus stems into creative materials

Based on the analysis of characteristics, properties, and processing, it was found that the lotus stem can be processed by the process of making mulberry paper, which is an experimental process as shown in Table 1

Table 1. How to process lotus stalks by making mulberry paper

process	result	transparent	strong	advantage	weakness
Boil 3 hours > coarse blend > Filtration			good	It doesn't take long. The fibers are quite soft and acquire a fair amount of fibers and are translucent, with a fibrous pattern.	The fibers are not very fine. It is poorly distributed and uneven.
20% Material Increase Boil 3 hours > coarse blending > Filtration			good	It has an exotic texture. Unique, translucent, and patterned.	It may take more time to mix the materials, making the process more complicated.
Spinning > Filtration			little	The fibers are finer and well dispersed, translucent.	The fibers are stiff.
Boil 6 hrs > finely blend > Filtration			good	The fibers are finer and better dispersed, with translucency.	It takes a long time to boil. Affects production time

process	result	transparent	strong	advantage	weakness
Boil 6 hours > blend finely > mix colors > Filtration			good	the desired color and fine fibers are obtained; transparent	Adding color can complicate the process and cause uncontrollable color changes.
Boil 6 hours > fine blend > blend with 20% co-material > Filtration			very good	The properties of the fibers can be improved by mixing other materials. transparent	The process becomes more complicated, and there may be problems in mixing the materials together.
Boil 6 hours > finely blend > bleached 30 minutes > Filtration			good	Fine fibers have a uniform color. transparent	The process is more complicated.
Boil 6 hours > blend finely > bleach 60 minutes > Filtration			good	Fine fibers and a uniformly lighter color are obtained. transparent	It takes longer to bleach, which makes the whole process time-consuming.

From Table 1, it can be concluded that there are several methods of processing lotus stalks that give different results. Boiling and spinning affect the fineness and distribution of the fibers. While adding materials or dyeing helps to create uniqueness but is a more complex process. As for bleaching, it affects the uniformity and tone of the fibers. The fineness, durability, or uniqueness of the material obtained from the royal lotus stem.

Table 2. Processing methods by compound mixing process

process	result	strong	advantage	weakness
Grinding and spinning 80% fibers, 15% tapioca starch mixed and mixed. Grieserin5%		good	The pattern, color, and viscosity of the fibers can be adjusted as needed.	Less tensile and scratch resistance It takes a long time to produce. There are also water resistance limitations.

From Table 2, it can be concluded that processing by mixing compounds is tapioca starch and grieserine. It is lightweight, flexible, and suitable for lifestyle product designs, but has limitations in tensile and scratch resistance. Some production processes are complicated. It takes a long time and can be difficult to control color or shape stability in the long term.

Table 3. Molding method by structural and dipping lotus stem fibers

process	result	transparent	strong	advantage	weakness
Wrap the fibers around the structure and dip them in the pulp water.		✓	very good	Tight structure, reduce cracking or flaking, and get a clear structural shape.	It takes more time to do it. Fiber consumption, the surface may not be smooth.
Dip the structure so that the fibers stick directly.		✓	good	Easier and faster to do. Thin surface is obtained. Less fiber is used and economical.	Less strength The structure is not tight. The shape is not as sharp as the threaded wrapping.

From Table 3, it can be concluded that the lotus stem is boiled and blended until the fiber is obtained. Then, it is molded into the structure in 2 ways: Type 1: Wrap the fibers on the structure first and dip the membrane to make it strong and firmly adhered to it. The shape is clear and suitable for work that requires durability, but it takes a lot of fiber and time. Type 2 uses a structure dipped into the membrane. It's easy to do. Economical, less fibers It is airy and light, suitable for decorative work, but low strength.

Conclusions and Discussion

Conclusion of Research Results

According to the study, the lotus stalk, which is an agricultural waste material, has a high potential to be processed into creative materials for the design of lifestyle products. Spinning, bleaching, dyeing, mulberry paper making, compound mixing, and molding.

1. Boiling and blending It has a direct effect on the fineness and strength of the fibers.
2. Bleaching and staining improve brightness, color, and consistency.
3. Mixing other materials allows for new textures and properties, but the process becomes more complicated.
4. There are two main ways to mold with the structure: wrapping the fibers, making the resulting material stronger and more durable. It's easy to do. Economical, but the strength will be less.

In conclusion, the results of studies and experiments have shown that the lotus stem can be further developed into a beautiful material. Strong, environmentally friendly, and unique, in line with the BCG economic approach

Discussion of Research Results

1. The results of the experiment confirm that the properties of lotus stem fibers, including toughness, light weight, and natural patterns, make them suitable for creating new materials for lifestyle designs.
2. The choice of processing method affects the end properties of the material, such as emphasizing strength, wrapping the fibers, or emphasizing translucency by dipping the structure without wrapping the fibers first.
3. Mixing other materials such as mulberry paper, natural flour, or other plant fibers can add new properties, but the formula must be adjusted to meet the actual production standards, and bleaching improves aesthetic value. It is necessary to find a balance between beauty and sustainability, and natural dyeing is in line with the trend of eco-friendliness and sustainable design, but there are limitations to colorfastness.
4. Some of the manufacturing processes are complex and time-consuming, but they show the opportunity to develop into sustainable substitutes. Reduce the use of wasteful resources and help solve the problem of agricultural waste.
5. This research is in line with the trend of using natural materials in the fashion and lifestyle products industry that emphasizes sustainability and environmental friendliness. This is in line with the research on the application of rice as a material in lifestyle product drsign , which presents the process of adding value to rice by creating a new product to the market and maximizing the benefits of existing resources in a cost-effective manner (Taranurak et al., 2023).

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