

MAKING GREASE PROOF PAPER FROM PSEUDO BANANA STEM

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ABSTRACT

The banana pseudo stem has many domestic uses. It can be obtained from a banana tree conveniently after gathering the fruit. Our objective is to prepare grease-proof paper from the pseudo stem of banana tree which would be more durable than the conventional paper and to see if the process was feasible, viable and cost effective.

Banana pseudo stem contains a very large percentage (12-15%) of lignin and around 60-65% cellulose. Lignin is a complex organic polymer which is usually found in the cell walls of trees especially in the bark. Lignin provides support and rigidity to the tree and doesn't rot easily. Lignin used to make paper must be depolymerized, which can be done using NaOH or Na₂S. Therefore, if paper is prepared with a relatively higher lignin content, it would be much more durable and less permeable.

Keywords: Durable, Grease-proof, Lignin, Paper, Pseudo-stem, NaOH, Non-Permeable.

1.INTRODUCTION

Paper plays a very important role in our lives and over the years we have become more and dependent on it. Paper has been around for centuries in various forms but it was mostly made from tree barks.

Different plant fibers have different cellulose and lignin content; therefore appropriate plant fiber is used as per the needs. The traditional paper is made from wood pulp which comes from softwood trees such as spruce, larch, pine, hemlock and fir; and hardwoods such as aspen, birch and eucalyptus.^[1]

These types of fibres are ideal for making paper to write on or an absorbent paper like tissue paper as they contain very less amount of lignin and more cellulose. On the other hand, fibres obtained from banana stem, jute and coconut make the paper stronger, less porous, less permeable and more durable due to higher lignin content which makes it ideal for food packaging and for wrapping purpose.

1.1. What is pseudo banana stem?^[2]

The trunk of the banana tree is not actually the trunk. Trunk usually refers to the woody and hard part of the tree but a banana tree doesn't have a woody trunk.

What appears to be the trunk is actually the stalk of the flower. The banana flower originates from the top of the banana tree and then its stalk/stem grows longer which makes it hang to the side. The stalk of the flower develops inside the trunk all the way from top to bottom. Therefore, the trunk which actually is the flower stalk is called a pseudo stem.

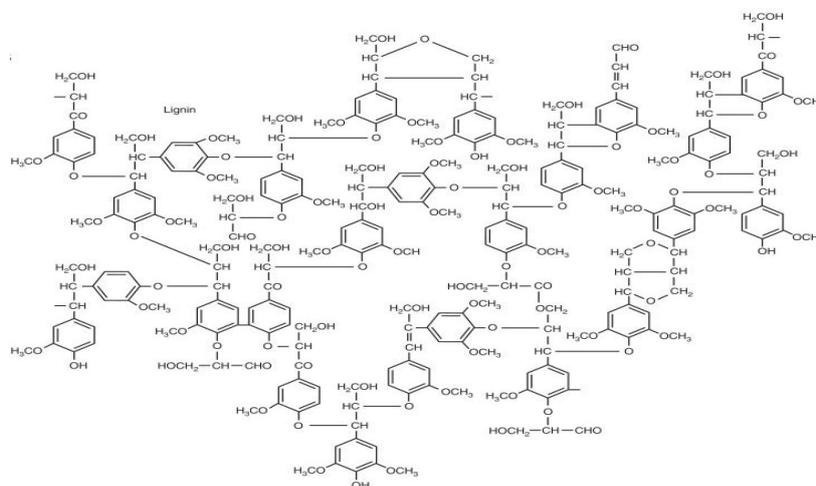


1.2. Lignin^[3]

Lignin is an amorphous phenolic compound. It's a complex long chain biopolymer.^[3] It's an amazing compound which can potentially replace petroleum based products like plastic, resins and adhesives.

Lignin is not very useful as it is, but depolymerized lignin has many applications.^[3] De-polymerized lignin has lesser molecular weight, lesser steric hindrance, hence has a higher reactivity. This depolymerized lignin shows improved properties. It's hydrophobic to some extent, it also acts as a fast curing/hardening resin. Lignin doesn't rot easily despite being an organic compound which is found in most of the trees.^[3]

These properties of lignin make our paper longer lasting and more durable.



2. PROCEDURE^{[4][5][6]}

We bought banana stem from a local farm. After cleaning the stem properly, the outer layers of the stem are removed to obtain the center/ core of the stem.

The core was then peeled using a vegetable peeler to get strips of the stem. These strips were then placed in sunlight so that excess water is lost.

The strips were then placed in an industrial oven for 4-5 hours at around 200°C. This process can also be done by placing the strips in sunlight and drying them over the course of 4-5 days.^[6]

The dried strips were cut in pieces of length 1.5-2cms and cooked in 12-15% NaOH solution for 2 hour in a breaker. A dark brown pulp is obtained after cooking.^{[5][6]}

The pulp was cleaned thoroughly with water to remove any NaOH present and remove the excess dissolved lignin.^{[5][6]}

The pulp was grinded in a household mixer with 500ml water to form a slurry. The pulp was then poured on a mesh/net which separated the pulp from water. The mesh was flipped onto a cotton cloth and pressed with hand to remove excess water. This cloth was placed in sunlight to dry. Once the cloth was completely dry, the paper was carefully peeled off from the cloth.^[6]

The process used to prepare the pulp included cooking the dried banana stem in NaOH solution for 90-120 minutes. This process is used to separate lignin from cellulose fibers.

A Dark brown pulp is obtained through this process which can be directly used to make paper or it can be bleached in order to get a white finished product.^[5] After bleaching, a white pulp is obtained, but during this process some of the lignin is further lost. In spite of this the end product is quite durable. The different uses of banana stem consist of manufacturing grease proof paper, fibre, board, writing paper and tissue paper.



2.1. Test for Grease Proof property

2.1.1. Steps

- 1] Pour some oil on the finished product (banana stem paper).
- 2] Place it on an ordinary paper and leave it on for 10-15 minutes.
- 3] See if there are any spots of oil on the paper it was placed on.

2.1.2. Results

The paper we prepared did not let any oil pass through. The paper under the banana stem paper showed no marks of oil whereas ordinary paper soaked up all the oil and was completely ruined.



3. CONCLUSION

The finished product is grease-proof and has a plastic like texture. It is almost completely impermeable to oil and doesn't absorb water for a considerable amount of time. These results were achieved by keeping the lignin content high which made the paper less porous and more like plastic.

The process is cheap and no complex machines are required. The process requires only common chemicals like NaOH and bleaching powder.

The final product is of very good quality and can be sold in the market in various forms. The paper can be prepared very easily and in a very short time. Strength, texture, durability & smoothness of the Paper produced in this process is marketable.

This paper is ideal for food packaging, paper bags, card board and textured papers. The pulp can also be molded into different shapes which will give a very strong and a smooth finished product (like paper Mache).

This paper can be made in rural areas very easily which will support the farmers and act as an additional income.

Banana stem is a cheap and easily available raw material and is ideal for making paper pulp for the production of various types of paper. The process of making pulp is economically viable. The pulp can be prepared and processed easily and doesn't require any complex machines, which means that this is ideal for small scale as well as large scale industries.

The paper prepared is dried under sunlight which makes this process very energy efficient and reduces the overall production cost.

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REFERENCES

- [1] [https://en.wikipedia.org/wiki/Pulp_\(paper\)](https://en.wikipedia.org/wiki/Pulp_(paper))
- [2] <http://www.promusa.org/Morphology+of+banana+plant>

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- [3] <https://www.sciencedirect.com/science/article/pii/S2238785414000982>
- [4] *Lakhan Singh, Dr. TarunKantiBandyopadhyay, Handmade paper from banana stem,*
<https://www.ijser.org/paper/Handmade-paper-from-banana-stem.html>
- [5] *Jaya Bharat Reddy Marella, SairamMadireddy, Anudeep NaiduMaripi, Production of Pulp from Banana Pseudo stem for Grease Proof Paper,* <http://ijergs.org/files/documents/Production-of-Pulp-6.pdf>
- [6] <https://youtu.be/OZ8Zx2cqBJo>