Production of Paper from Banana Steam

[1] Miss. Ashwini Kharde, [2] Dushing Sunita, [3] Agale Abhishek, [4] Anap Samath , [5]Jawale Kunal

[1]*Professor, Pad.Dr.V.V.Patil Polytechnic Loni*

[2345]*Student, Pad.Dr.V.V.Patil Polytechnic Loni*

Abstract- **Banana stem is easily collected from banana trees. The stem is used as a waste product and used in domestic cooking purpose. Mainly chemical process is used to collect the cellulose from the lignin. Lignin is separated from the lignocelluloses. It is removed after cutting of banana stem in small pieces and then stem is blowing inside the digester at a high pressure and successive use of sodium hydroxide or sodium sulphide. The fiber is molten and making pulp. This pulp is used to prepare the tissue, bloating and tracing paper. This process of pulp and paper making is economically viable and it is energy saving as sun ray is used for drying purpose.**

Key words: Banana, pulp, paper, energy

I. INTRODUCTION

Today banana stem is used as a source of raw material for preparation of a paper pulp. This pulp is used to prepare different types of paper such as tissue, bloating, tracing and writing printing paper. After harvesting, the farmer cuts the banana trees and throws away enormous amount of these stems into the fields because after harvesting the fruit, there is no significant use of banana trees. Constructing a tissue paper through the banana stem will be good for farmers because after harvesting the fruit there is no use of this but using the banana stem for the production of tissue paper will help the farmers get some money and will increase their interest in culminating banana crops. Several industries manufacture the tissue paper using bamboo, hardwood, softwood and jute etc. as the raw material, because it contains very good percentage of cellulose. On this basis, banana stem acts as a very suitable alternative raw material, containing very good percentage of cellulose. In Manufacturing of the tissue paper, lignin creates the problem because it cannot be easily separated due to the intermolecular linkage of cellulose. Lignin is a combination of phenolic groups and it interconnects with the cellulose and the resultant bond is very strong.

In making a pulp, we generally know the three processes i.e. sulphate process (also known as kraft process), sulfite, and soda process are suitable. In addition, various chemical, mechanical processes can be used in production of a tissue paper through the banana stem, kraft pulp process is preferred. A dark brown pulp is obtained through this process. After that through the bleaching process, a white pulp is obtained and this pulp gives a very good strength tissue

II. PROCESS OF MAKING PAPER

Banana paper production involves using the fibers from banana stems or peels, which are processed to create a pulp, molded into sheets, and dried to form paper.

1. Raw Material Preparation:

Harvesting: The banana stems or peels are collected as the raw material.

Fig 2.1 Harvesting

Cutting: The Banana steam is cut into smaller pieces.

Fig 2.2 Cutting of Banana Steam into small Pieces

Cleaning and Washing: The cut steam if banana is washed to remove dirt. Cleaning is carried out fresh water.

Fig 2.3 Cleaning of Fibre

2. Pulping:

Cooking: The dried fibres are cooked in water with a small amount of sodium hydroxide (NaOH) to loosen the fibres and remove lignin.

Fig 2.4 Addition of NaOH

Fig 2.5 Cooking of Fibre

Beating: The cooked fibers are then beaten to separate the individual fibers and create a pulp.

Washing: The pulp is washed to remove any remaining chemicals and impurities.

3. Paper Making:

Molding:

The pulp is mixed with water and poured onto a screen or mold to form a sheet of paper.

Fig 2.6 Mold to from Paper sheet

Blending:

The Mold fibre is blend through mixer to from thin concentrate solution.

Fig 2.7 Blending

Drying:

The wet sheet is then dried, either by air drying or with heat, to form the final paper. The drying is carried out her by solar heat (Sun drying)

Fig 2.8 Drying

Finishing:

The dried sheets can be rolled between rollers for smoothness and then cut into the desired size and shape.

4. Additional Considerations:

Handmade vs. Machine Process:

Banana paper can be produced both by hand and using machinery, with similar steps involved.

Blending with other fibers:

Banana paper can be blended with other fibers, such as recycled paper, to improve its strength and properties.

Sustainability:

Using banana stems and peels for paper production is a sustainable practice, as it utilizes agricultural waste and reduces reliance on traditional paper sources.

III. PULPING PROCESS

Pulping is the initial step in paper production it involves converting raw materials like wood/steam or recycled paper into a fibrous pulp by removing lignin and other impurities, which can then be used to create paper sheets or tissue paper.

1. Types of Pulping:

Mechanical Pulping:

This method uses mechanical force to separate wood fibers, such as grinding wood logs into pulp.

Ground wood Pulping:

A traditional method where wood is ground between stones to create pulp.

Chemical-Mechanical Pulping:

Combines chemical treatment with mechanical action to improve fiber quality and paper properties.

Chemical Pulping:

This method uses chemicals to dissolve lignin, the substance that binds wood fibers together, and separate the fibers.

Alkaline Pulping (Kraft Pulping):

Uses an alkaline solution (like caustic soda) to treat plant fibers and create pulp.

Biological Pulping: Uses microorganisms (like white-rot fungi) to selectively delignify wood before chemical or mechanical processes.

2. Key Steps in Pulping:

- Raw Material Preparation: Wood is chipped, and recycled paper is prepared for pulping.

Pulping Process:

Mechanical Pulping:

Wood is mechanically ground, often with water, to separate fibers.

Chemical Pulping:

Wood chips are treated with chemicals in a cooking process to dissolve lignin and separate fibers.

Pulp Washing and Screening:

The pulp is washed to remove residual chemicals and screened to remove impurities and oversize fibers.

Pulp Refining:

The pulp is further refined to cut the fibers and roughen their surface to enhance formation and bonding.

Pulp Bleaching (Optional):

The pulp can be bleached to lighten its color using chemicals.

Pulp Storage:

The pulp is stored in a slurry form before being used in the paper-making process.

Drying:

The pulp is dried after being formed into a sheet of paper.

III) RESULT:

Banana paper production involves using the fibers from banana stems or peels, which are then processed to create a pulp and subsequently, paper. This process can be done both manually and with machinery, and

results in a natural, fibrous paper with a warm, sandy color.

Fig 3.1 Paper Sheet

Benefits and Advantages:
Sustainability:
Banana stem paper utilizes a readily available agricultural waste, reducing reliance on trees and promoting sustainable practices.

High Strength and Durability:
Paper made from banana stem fibers can have a higher tensile strength and burst factor compared to paper made from recycled pulp.

Environmentally Friendly:
The process of producing banana stem paper generally requires less water and chemicals compared to traditional paper production, reducing environmental impact.

Economic Viability:
Banana stem is a cheap and easily accessible raw material, making the production of banana stem paper economically viable.

Versatile Applications:
Banana stem paper can be used for various applications, including writing paper, wrapping paper, and even specialized products like banknotes and baby pampers.

Potential for Rural Development:
The production of banana stem paper can create employment opportunities in rural areas and contribute to local economic development.

Characteristics of Banana Stem Paper:
Cellulose Composition:
Banana stem fibers are rich in cellulose, which is the primary component of paper.

Fiber Properties:
Banana stem fibers have a high slenderness and flexibility ratio, making them suitable for paper production.

Water Absorbency:
Banana paper can have good water absorbency, similar to paper made from bagasse.

Abrasion Resistance:
Banana paper can demonstrate good abrasion resistance.

IV) CONCLUSION:
Banana stem is a cheapest and easily available raw material as a source of making paper pulp for the production of various types of paper. The process of making pulp is economically violable. The lignin separated from cellulose with the help of chemical treatment.
The making of paper is handmade. Sun ray is used for drying operation of paper mat. So energy is consumed from nature and according to economic standpoint it is profitable.
Strength and quality (brightness, formation, softness, smoothness) of the Paper produced in this process is marketable. Process cost is very low.

REFERENCES

[1] Gopal Rao, M. and M. Sittig, Outlines of chemical technology 1997. 3: p. 352-360.
[2] Manish, K. and K. Deepak, Comparative study of pulping banana stem. International Journal of fiber & textile research, 2011. 1(1): p. 1-5.
[3] Akpakpan, A.E., et al., Influence of cooking variables on the soda and soda-ethanol pulping of nypa fruticans petioles. Australian journal of basic and applied sciences. 2011. 5(12).

[4] Vfizquez, G., et al., Acetosolv pulping of pine wood, kinetic modeling of lignin solubilization and condensation. Elsevier science limited, 1996. 59.
[5] Alves, A., et al., Analytical pyrolysis as a direct method to determine the lignin content in wood. Journal of analytical and applied pyrolysis, 2005. 76.
[6] Kalita, D. and T. Goswami, Greaseproof paper from banana pulp fiber, Indian journal of chemical technology, 2008.
[7] Bilba, K., M.-A. Arsne, and A. Ouensanga, Study of banana fibers botanical composition, thermal degradation and textural observation. Bioresource Technology 2007. 98: p. 58-68
[8] Ampulski, S.R. and D.P. Torken, Process for applying chemical paper making additives from a thin film to tissue paper. United states patent, 1993. 9. Phan, V.D. and D.P. Trokhan, Soft absorbent tissue paper with high permanent wet strength. United states patent, 1993.
[9] Aracri, E. and T. Vidal, Xylanase and laccaseaided hexenuronic acids and lignin removal from specialty sisal fibers. Elsevier Ltd. All rights reserve 2010.
[10] Kuo, L.-s. and Y.-l. Cheng, Effects of creping conditions on surface softness of tissue paper. Tappi journal peer reviewed paper, 2000.
[11] Bourne, P.J. and D.S. Bajwa, Evaluation of rice hulls as a lignocelluloses substitute in wood plastic composites. Biological & agricultural engineering. 2007. 7.
[12] Bridle, L.K. and J.B. Kirkpatrick, An analysis of the breakdown of paper products (toilet paper, tissues and tampons) in natural environments, Tasmania, Australia. Journal of environmental management, 2004: p. 21-30.
[13] Baumberger, S., et al., Use of kraft lignin as filler for starch films. Elsevier science limited, 1997. 59. 15. Herbert, S., Book review handbook of pulp WILEY-VCH Verlag Gmbh & co. KGaA, Weinheim.