



PRODUCTION OF ECOFRIENDLY PENCIL

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Abstract. This eco-friendly product, pencils made from sugarcane bagasse, a byproduct of the sugar industry. In a world grappling with environmental concerns, finding sustainable alternatives to traditional products is crucial. The pencil industry, which relies heavily on wood, contributes to deforestation and resource depletion. This paper explores the development and potential environmental benefits of sugarcane bagasse-based pencils. The process of creating sugarcane bagasse pencils involves converting agricultural waste into a valuable resource, thereby reducing waste and conserving forests. The aim of this work is the production of paper from bagasse by applying the chemical process to produce pulp using NaOH as an alkaline reagent the mass percent of bagasse to NaOH solution is varied to be 10, 12.5, and 15 %, the temperature of reaction is changed 121°C, These pencils offer an eco-friendly alternative to conventional wood pencils, addressing issues of sustainability and resource conservation. They are not only biodegradable but also contribute to carbon sequestration through the cultivation of more sugarcane, making them an environmentally responsible choice.

Keywords: Ecofriendly, Sustainable, Deforestation, Agricultural, Sugarcane bagasse, biodegradable.

I. INTRODUCTION

Sugarcane bagasse is the fibrous residue left behind after sugarcane is crushed to extract its juice. It consists of dry pulpy fibers and is a byproduct of the sugar and ethanol production processes. Bagasse is often used as a renewable source of energy in the form of biofuels or as a raw material for producing paper, compost, and biodegradable products. It's an environmentally friendly alternative to some traditional materials, especially for single-use items. This sugarcane bagasse can also be used to produce paper and any sustainable biodegradable product (Bagasse can be molded into various shapes and forms to create biodegradable products such as plates, cups, and food containers. These items are eco-friendly alternatives to plastic and foam products).

Sugarcane or *Saccharum officinarum* is cultivated in considerable amounts in tropical countries. In year 2022, about 181.18 million metric tons of sugarcane were produced in agricultural field over worldwide. It is also used in sugar manufactories and alcohol manufactories. But it cannot be consumed or used entirely by those manufactories as about 30 pulpy

stringy residue is produced after being employed in those manufactories. These ruminants are called bagasse. The bagasse is used in multiple operations including paper diligence, as feedstock, as biofuel, etc. and many more. (2)

- **Bioenergy:** Bagasse is a significant source of bioenergy. It can be burned directly as a fuel in boilers to generate steam and electricity, which is often used to power the sugar mill itself. In some cases, surplus electricity can be supplied to the grid.
- **Biofuels:** Bagasse can be used to produce biofuels like ethanol. The fermentation of the sugars in bagasse yields ethanol, which is used as a clean and renewable fuel, both in the automotive and industrial sectors.
- **Paper and Pulp:** Bagasse fibers are used to make paper and pulp products. Due to its fibrous nature, bagasse can be processed into various types of paper, including writing paper, cardboard, and tissue.
- **Animal Feed:** In some cases, bagasse can be used as animal feed, particularly for ruminants like cattle.



While it's not as nutritionally rich as some other feed sources, it can be a supplemental or low-cost option.

- **Soil Conditioner and Compost:** Bagasse is rich in organic matter and can be used as a soil conditioner or added to compost to improve soil structure and fertility.
- **Biogas Production:** Bagasse can be used in anaerobic digestion processes to produce biogas. This biogas can be used for heating or electricity generation.
- **Construction Material:** In some regions, bagasse has been used as a building material, particularly in a compressed form for construction applications.
- **Bio-Based Chemicals:** Bagasse can be a source of bio-based

Sugarcane bagasse is a cellulosic material which is also called as lingo cellulosic material. It's a kind of waste material, which may have some uses. Since it contains quite a fair quantum of cellulose, this cellulose can be uprooted, and that cellulose can have different operations. The stringy accoutrements may also be used as filaments in the cloth and civil engineering sector, too though they may need some unique treatments before being used. More specifically, this bagasse can be used to support compound accoutrements for creating a completely new type of material. The main advantage of using bagasse is, its pure waste material, and if this material can be employed in any operation indeed after a many simple pre-treatments, the process still produces a veritably provident product, and the product will surely be completely or incompletely biodegradable, which is quite an important factor these days. (3)

Paper is made from factory filaments i.e., cellulose which are set up in wood. To use cellulose, it must be converted into pulp and before being used for the process of manufacturing. To begin the papermaking process, recovered filaments is tattered and mixed with water to make pulp. The pulp is washed, meliorated, and gutted, also turned to slush in a beater. We can make pencils from this paper, which is terrain friendly. With the help of this terrain

friendly pencil, we can plant seed and make every single element of pencil worth. (5)

The pulping is the process performed to convert the hard raw accoutrements into a soft-filaments to insure easy fabrication and conformation of the final product. At first, the hard raw accoutrements are pre-treated via washing and crushing, also the pulping process begin. It is carried out through one of the following ways that differ in their yield, functional cost and quality of product. (1)

Objectives

Sugarcane bagasse is the fibrous residue left behind after extracting juice from sugarcane. It's collected from sugar mills or farms where sugarcane is processed. The collected bagasse is cleaned to remove impurities like dirt and sand. It is then chopped into smaller pieces to make it easier to handle. To enhance the pliability and strength of the bagasse fibers, they are mixed with eco-friendly binders. These binders could be natural adhesives like starch or eco-friendly resins. The binder helps hold the fibers together during molding. The newly molded pencil casings are carefully dried and cured. This can be achieved through air drying or low-temperature baking, ensuring that the casings harden and maintain their shape without the need for excessive energy consumption. Once the casings are approved for quality, they are ready for assembly. Graphite cores, capsule with plant ash and seed, and any additional components are inserted into the casings to create complete pencils.

2. II. MATERIALS AND METHODOLOGY

• Making of paper from sugarcane bagasse:

1. Collect sugarcane bagasse (Crushed sugarcane)
2. Wash it to remove dirt and stones.
3. Grind the bagasse.
4. Cook it in pressure cooker with caustic soda and water.
5. Bleaching process: 1st bleach with chlorine dioxide,
2nd bleach with hydrogen peroxide.
6. Add calcium carbonate for capacity and smooth paper.

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7. Make a thin layer of matter, and a mat is formed.
8. Dry it naturally or with the help of dryer.

- **Making of natural gum:**

1. Collect the gum. [Edible tragacanth gum (degradable)].
2. Mix it with equal amount of water and boil it.
3. At a specific consistency turn off the flame.
4. Use the to stick.

- **Making of organic pencils:**

1. Take a graphite piece
2. Stick the formed paper to the lead of graphite and roll it to a specific diameter.
3. Stick the paper with the help of gum.
4. Let it set.

- **Making of compartment for seed:**

1. We can make the space to hold the seed at the bottom of pencil with help of piece of paper to hold the seed and stick the edges of the open space.
2. We also use seed tape to tape the seed at bottom of the pencil.
3. We can also use enteric coating or gelatin to make a capsule cap like structure to fit the seed inside.

4. Stick the seed to the bottom and our pencil is ready.

III. RESULTS

We selected bagasse for production of pencil because bagasse is majorly grown crop in India. Waste and environment management is current need of the world and for this purpose we have to use each and every virgin and non-virgin material of the environment. The disposal of this material also polluted the soil, underground water and lead to health problems. We see then pencils as a sustainable and endless source of creativity itself. Bagasse rice straw and other natural components we can use in this work. This pencil is an eco-friendly design. Pencil that recycles discarded bagasse and turn it into paper as well as pencil.

The conclusions drawn from this study are as follows:

- After the formation of pencil, we did a test to see if seed really germinates from the bottom compartment of the pencil.
- The second last compartment which is filled with mixture of sawdust and plant ash in 1:1 ratio, degrades ones in contact with water and soil.
- Environment friendly pencils were produced successfully.



Fig.1. Collection of samples.



Fig.2. Bagasse of sugarcane



Fig.3 Sample before drying.



Fig.4 Bagasse to paper production



Fig.5 Dry film of paper.



Fig.6. Final product

IV. DISCUSSION

We selected bagasse for production of pencil because bagasse is majorly grown crop in India. After Brazil, India is the 2nd largest sugarcane producing country in the world. The fibre material used as fuel in sugarcane industries. Waste and environment management is current need of the world and for this purpose we have to use each and every non-virgin material of the environment. The disposal of this material also polluted the soil, underground water and lead to health problems. We discuss various types and formats of papers is to be craft paper based on its appearance

We tested our product on the basis of quality:

- Basic wight
- Tensile strength
- Tearing strength
- Burst strength and burst index



V. CONCLUSION

In conclusion, when compared to rice straw, wheat straw, and cotton stalks, sugarcane bagasse is utilized as a raw material in paper manufacture since it has the longest fiber length. Consequently, the kraft process is applied to produce pulp using NaOH as an alkaline reagent. Thus, the mass percent of sugarcane bagasse to NaOH solution is varied from 10 to 15 %, the temperature of reaction is changed to 121°C, and the reaction is performed for several values for retention times ranging from 15 to 20 minutes. It was found that, by performing the reaction at 121°C for 15 to 20 minutes using a solid to liquid ratio of 1:1, the maximum perfect amount of pulp was obtained, which was 56.8 g of pulp for each 100 g of sugarcane bagasse. After that, the generated paper was characterized with respect to basis weight, tensile strength, tearing strength, and burst strength and they were found, which are all in the range of commercial kraft paper.

REFERENCES

1. Atchison, J. E. (1962). Bagasse becoming a major raw material for manufacture of pulp and paper – background, present status, and future possibilities. *Proceedings of the ISSCT Conference*: 1185–1211
2. Curran M A (2006). Life Cycle Assessment Principal and Practice, National Risk Management Research Laboratory, *U.S Environmental Protection Agency*, Cincinnati, Ohio 45268.1-15.
3. Fress N, Hansen M S, Ottosen L M, Toenning K, Wenzel H (2005). Update of the Knowledge Basis on the Environmental Aspects of Paper and Cardboard, Environmental Project No 1057, *Danish Environmental Protection Agency*, Copenhagen, Denmark
4. H.Hajiha and M.Sain, "Chapter 17: The use of sugarcane bagasse fibres as reinforcements in composites," in *Biofiber Reinforcement in Composite Materials*, Canada, Elsevier, 2015, pp. 525-549.
5. P. Bajpai, "Chapter 12: Pulping Fundamentals," in *Biermann's Handbook of Pulp and Paper*, Third Edition ed., vol. 1, India, Elsevier, 2018, pp. 295-351.
6. R. Nagpal, N. Bhardwaj, P. Mishra and R. Mahajan, "Cleaner bio-pulping approach for the production of better strength rice straw paper," *Journal of Cleaner Production*, vol. 318, pp. 1-9, 2021.
7. Merrild et al., 2008; Murphy & Power., (2007); Schmidt et al., 2007; Holmgren and Hening, 2005; Dias, 2007; Wiegard, 2001; Fu et al., 2005 and Dias et al., 2002). In their research they discovered that energy and water consumption, Greenhouse Gases (GHG) and methane emissions, chlorine and raw materials used for non-virgin papers is less than virgin material.
8. Z. Zhang, A. Gonzalez, E. Davies and Y. Liu, "Agricultural Wastes," *Water Environment Research*, vol. 84, no. 10, pp. 1386-1406, 2012.