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Research on the process of making paper from bagasse at laboratory scale

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ABSTRACT

In the new era, paper is still the main source of raw materials for daily life and production activities. Therefore, the research team explored recycling paper from bagasse to reduce waste and limit the depletion of available resources. The main material is bagasse with binders of aloe vera, corn starch, and CaCO_3 in certain proportions to create paper products. From the methods of data collection, experiment, quality control, and meta-analysis to make paper from sugarcane applied to daily life. The disintegration test showed about three hours of paper dissolving in water. The product is tearable and has good adhesion. The product is handmade, so the thickness can be adjusted depending on the purpose of use. The product has a certain curvature and high strength. In addition, it is possible to create from this recycled paper into products that are applied in life such as decorative cards, bags, etc.

Keywords: bagasse, paper, recycling

1. Introduction

Currently, with the rapid development of people, the demand for paper products is increasing day by day. Paper is used in almost all fields from research and construction to the environment. This also causes deforestation to increase rapidly, leading to resource depletion and environmental pollution. In addition, wastewater from the paper industry contains high toxicity due to complex mixtures from the paper production

process that affect the surrounding environment. Meanwhile, the amount of bagasse in sugar factories is very abundant but there is no reasonable treatment solution, so it causes serious impacts on the environment such as odour, and the activity of microorganisms is increasingly affected. to human health... This amount of sugarcane waste contributes to the serious environmental pollution situation and requires many practical solutions to solve the problem.

Recognizing the importance of the problem, we learned about using recycled products and using waste materials to both reduce deforestation and limit environmental pollution. Therefore, the topic "Research on recycling bagasse into paper and application in life" was carried out. The goal is to find ways to create products from bagasse that are environmentally friendly and, in part, will be cheaper than other types contributing to making the environment cleaner and reducing the amount of excess bagasse released by sugar factories into the environment. Research results are also the basis for developing new products with high practical applicability and high economic potential.

2. Methods

2.1. Primary and secondary data collection methods

Learn the concepts and definitions related to bagasse (Nguyễn Việt Hưng, 2012) and binder materials (Thục Nhân, 2005) to understand the properties and characteristics to use the appropriate recycling method.

Collecting and researching documents through books, newspapers, and research articles at home and abroad on the Internet... articles with contents related to products recycled from bagasse and other materials other (Priy Brat Dwivedi, 2017).

The methods and processes of making products as well as the advantages and disadvantages of the products, the biggest advantage of the production of applied products from bagasse are to reduce the negative impact on the environment and reduce the waste of resources.

2.2. Experimental method

To make a finished product, the raw materials to be performed are detailed as follows:

TABLE 1. Statistics of materials (Source: made by students)

STT	Material	Amount
1	Bagasse	50g
2	Vera	140ml
3	Ray	1
4	Mold	1
5	CaCO ₃	40g
6	Baking Soda	100g

7	Pot	1
8	Brass	1
9	Grinder	1
10	Knife	1
11	Weigh	1
12	Drag	2
13	Corn Starch	20g

To make a finished product, the process is as follows:

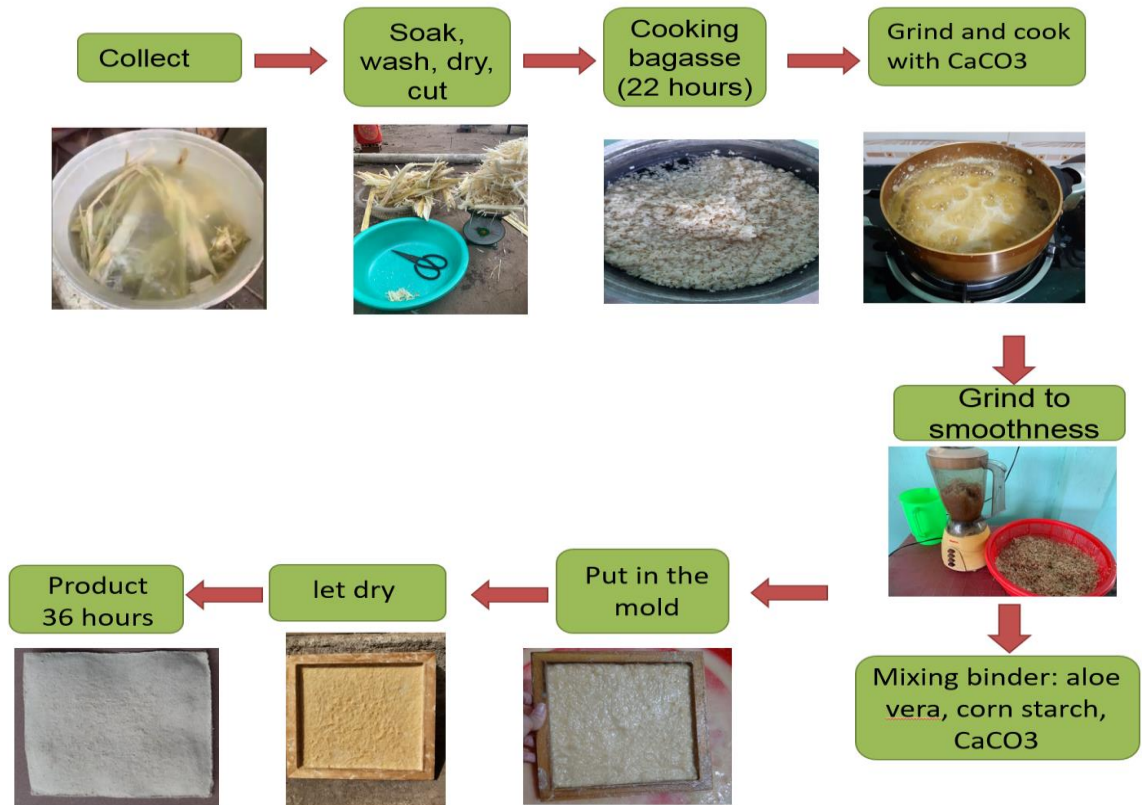


Figure 1. Implementation process (Source: made by students)

Implementation steps:

Step 1: Collect bagasse material from waste trucks

Students mobilized and collected bagasse at sugarcane juice sales locations in Thu Dau Mot City.

Step 2: Wash and dry the ingredients

Students collect materials to an agreed location, soak for about two hours to remove impurities, and help ensure product quality.

Rinse with clean water several times and proceed to dry the bagasse.

After drying, cut the bagasse into small pieces so that when cooking is soft and easy to handle in the next steps.

Step 3: Cook sugarcane

Students cook the bagasse for 22 hours, during the cooking process often add water, stir well and watch to avoid burning. After the first six hours, change the water to make sure the sugarcane is out of sweets. Because when cooking for a long time, the sugar in the cane will secrete, making the bagasse mixture yellow. At the same time, after changing the water, baking soda will be added to shorten the cooking time and whiten the bagasse. Every 6 hours, the water will be changed once to ensure that the sugarcane is not discolored when it comes out. This is the most important stage that determines the quality of the finished paper. Cane cooking time is decisive for the finished product, the longer the cooking time, the higher the adhesion of the paper and vice versa.

Step 4: Blend and cook with CaCO₃ (Priy Brat Dwivedi, 2017)

After cooking, proceed to rinse with clean water many times the purpose to ensure that all the sugar in the bagasse is removed. Continue, add the bagasse just washed into the blender, add a sufficient amount of water and proceed to grind the mixture so that the bagasse can easily absorb ingredients when cooking. Cook the sugar cane with 20g CaCO₃ for 30 minutes. Sugarcane after boiling will be washed with water many times to help bagasse achieve the highest purity.

Step 5: Grind until smooth (Priy Brat Dwivedi, 2017)

Bagasse, after preliminary processing, will proceed to grind bagasse many times until it reaches a certain fineness to make products. This stage will decide whether the finished product will have a certain smoothness and meet the requirements when done.

Step 6: Mix the adhesive

Do the job of mixing the mixture including bagasse, *aloe vera*, CaCO₃, and *corn starch*. Below are the ingredients for making two sheets of paper with sizes 20x20 and 25x34. The mixture includes 50g bagasse, 140ml aloe vera, 20g corn starch, and 20g CaCO₃.

+ For *aloe vera*: First, cut *aloe vera* from the tree and leave it for about half an hour to help get rid of the yellow sap. Then proceed to clean by rinsing and peeling. Proceed to take the *aloe vera* mucus with a purposeful spoon to make the most of the adhesive's mucus.

+ For *corn starch*: Take 20g of powder and dilute it evenly with warm water to ensure that the mixture dissolves evenly when stirring.

+ For CaCO₃: dilute 20g CaCO₃ with water to get a dilute CaCO₃ solution

+ For bagasse: Use pureed bagasse

Step 7: Create shape:

The mixture is put into a mold to shape, and the product is brought to a place with suitable sunlight to dry until dry. The mixture put into the large mold will create a large

plate product, the small mold will create a small plate product. Depending on the size of the mold, different products can be created.

Step 8: Let dry

After pouring the mixture into the mold, students proceed to dry the product for 8-10 hours, the drying time may be less or more depending on the weather and sunshine.

Step 9: Products

Decoration and design for eye-catching. In addition, the product can be used to create decorative products.

2.3. Product quality inspection method

Conduct using manual measures to evaluate the quality such as toughness, smoothness, thickness, thinness, and curvature of the product. Test the paper's decay by using two bowls containing the same water, one will soak the bagasse paper and the other will soak the plain paper. After that, we can conclude the disintegration time of bagasse products compared with plain paper. From there, the conclusion is the quality created when recycling.

2.4. Methods of analysis and synthesis

Conduct analysis and synthesis of collected documents, and field surveys, thereby evaluating and analyzing the research area. Analyzing the ingredients in bagasse, stable binders to ensure environmental friendliness, synthesizing secondary documents to learn about raw materials, recipes, and errors in the research process.

Combining experimental methods and product evaluation to conclude product quality. Finally, give an objective analysis of applied products from bagasse recycling and product quality.

3. Results and discussion

Scientific significance

The research results of the topic are of reference value for future studies related to the issue of using waste products to recycle into useful products in life. The aim is to reduce the amount of waste and raise awareness about environmental protection.

In addition, the results of this study can be applied to other industries such as the paper industry, the packaging recycling industry, etc. Developing into larger scales to be able to bring recycled products from bagasse reach more people.

Practical significance

The research results of the topic have practical application, helping to find a recipe to recycle bagasse into applied products and develop this formula to create many other

products in life. The successful recycling of many new products also contributes to increasing economic viability, expanding the development model to bring these bagasse products closer to life. The recycling of packaging from waste products such as bagasse also contributes to reducing environmental pollution and saving national resources.

Novelty and creativity

The research paper has found another formula to create environmentally friendly bagasse application products and reduce the amount of waste from bagasse on the environment. Currently, there have been domestic (Nguyễn Thị Liên, 2016) and foreign studies (Parizad Sheikhi, 2011) on the issue of utilizing bagasse materials to recycle and help people's lives. However, most of these studies will go in the direction of industry that is not yet environmentally friendly. This study will use materials that are easy to find and can be done manually. The data as well as the results of this study will be the premise for future studies in the direction of utilizing waste sources while still protecting the environment. Help the country reduce the pressure on waste from bagasse as well as improve the economic value of agricultural waste.



Figure 2. Application products from bagasse paper

Observe solubility

Paper (product) is tested for disintegration by immersion in water. Materials needed are two bowls of water, bagasse paper, and plain paper. Test the paper's disintegration by using two bowls containing the same water, one will soak the bagasse paper and the

other will soak the plain paper. After three hours of soaking, the paper begins to disintegrate and can be torn by hand (pictures in the appendix). Because the paper is completely handmade and the binding materials are also natural, the paper will disintegrate faster than normal paper. Through the disintegration test process, the product is also tested for water permeability. Paper made from bagasse when soaked in water will also disintegrate and tear like other ordinary paper.

Sensory evaluation of product quality

Due to the long cooking time, the paper (product) when the finished product can be torn, has adhesion, and can be bent. All stages are made by hand, so the thickness of the product will be uneven, but it is also possible to make thick or thin paper depending on the purpose of use. Product color ivory white of sugarcane. Paper made from bagasse has relatively toughness and durability.

4. Conclusion

Research has successfully made paper from bagasse and applied it to life. Help reduce the amount of waste generated every day and protect the forest resources that are depleting. After many times of experimenting, a completely manual and easy-to-follow bagasse recycling recipe has been found. Paper has a certain curvature and is relatively strong. This raw paper application makes various products such as decorative books, packaging, coasters...

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