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Banana Pseudo-Stem Fiber: A Sustainable Face Mask

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Abstract: *The study is an experimental research design that focuses on fabricating a sustainable face mask made from banana pseudo-stem fibers. As the CoVid-19 is believed to be tiny enough to penetrate through face masks, therefore the aim of the product is to eliminate the virus that is piercing through gaps make from other types of masks. Nonetheless, the product will go through a process in which the purposive sampling method was used to select 5 different individuals who will participate on the interview about the banana pseudo-stem fiber as a sustainable face mask and the answers that the participants would provide will be then appraised and will look into by using the code and theme analysis. The results collected from the participants revealed the problems and issues being encountered when people are using face masks during the CoVid-19 pandemic are: (a) Skin irritations and (b) elastic bands snapping off. Furthermore, the factors that are being encountered in using a sustainable face mask are: (a) affordable in terms of acceptability in the market, (b)have the strongest fiber in terms of durability and, (c) is a good alternative to use during the pandemic in terms of efficiency. Delving deeper into the product and consulting professionals for the safety is highly recommended.*

Keywords—Banana Pseudo-Stem Fiber, face mask, Experimental Research, Code and Theme analysis

1. INTRODUCTION

During the previous years, the world has been battling plastic pollution. Furthermore, the pandemic has contributed to this problem because of the sudden demand and use of disposable face masks, gloves, and other equipment to ensure everyone's safety against the virus. Dues to this, thousands of synthetic masks will only pile up and take so long to decompose.

Bananas are among the most well-known and important plants in the world. Almost all parts of this plant can be used, namely fruit, leaves, flower bud, trunk, and pseudo-stem. The pseudo-stem fiber of the banana plant is similar to that of the pineapple leaf, sisal, and other hard fibers, but the pseudo-steam fiber is slightly more elastic.

Specialized and high-quality sanitation facilities goods such as baby diapers, textiles, and documents such as banknotes are the main uses of banana pseudo-stem fiber [1].

Banana pseudo-stem fibers can be used as a reinforcement material for artificial matrix polymers, because they are environmentally friendly, have a relatively low density and are available in abundance. The major factors that impact the mechanical behavior of natural composites are fiber length, fiber content, and chemical treatment [2]. Pseudo-stem bananas are crop waste that after harvest causes economic loss and environmental problems. Pseudo-stem, however itis high in dietary fiber and has health benefits [3].

Pseudo-stem fiber as a sustainable facemask supports a future of decreased waste, outstanding health results, broader job growth, and healthier and safer surroundings for both people and nature. Amid the pandemic, pseudo-stem fiber has a potential to be an alternative to plastic in making different personal protective equipment.

Moreover, pseudo-stem fiber from banana plants appears to have the same purpose as that the synthetic facemask that people use. Most of all, it helps farmers economically and the world environmentally. Pseudo-stem bananas are crop waste that after harvest causes economic loss and environmental problems.

2. RELATED WORKS

As the novel coronavirus or CoVid-19 is believed to be tiny enough to penetrate through face masks, protection offered by cloth mask may be too low. Surgical face mask production rates are rising due to fast transmission of the positive cases. Current studies are mostly stated out that microplastics pollution should be a big deal because of their enormous effect on the aquatic biota, and the entire environment [14][15].

Banana is a perennial monocotyledonous annual plant mainly cultivated for its fruits. It is a native from the hot–humid tropical and sub–tropical jungles of South–east Asia. Banana Pseudo-Stem is an annual renewable agricultural by–product with a potential for valorization in the production of paper, textile fibre or new bio–based materials. The plain-woven banana fabric is subjected to alkali treatment with different % of NaOH and its effect on mechanical properties like tensile, impact and flexural are studied and compared with that of untreated one. Low value industrial low-density polyethylene waste plastics and banana fibers made from agricultural waste are upcycled into affordable eco-friendly building products [4][25][21].

The banana pseudo-stem is a low-lignin-content ligno-cellulosic biomass that can be used for methane production. However, there is limited production information regarding methane production from the fresh banana pseudo-stem.

Banana fiber, a lingo-cellulosic fiber, obtained from the pseudo-stem of banana plant, is a blast fiber with relatively good properties. It has its own physical and chemical characteristics and different properties that make it a good quality fiber. Natural fibers have important properties such as low density, proper stiffness, mechanical properties, high disposability, and renewability [5][6][7]. Banana intensive production in tropical countries generates significant amount of post-harvest organic residues. Banana fiber is a lingo-cellulosic under exploited bast fiber, which obtained from the pseudo-stem banana plant (Musa Acuminata) [3][20].

Fibers have been used to reinforce concrete over the last few decades because fiber has the significant influence on concrete static and dynamic properties. There are several fiber reinforcement methods for improving the performance of concrete, which lacks in load carrying stability and soundness [19].

Various fiber lengths of banana pseudo-stem bagasse were dehydrated at various temperatures with and without forced air convection. The experiments were conducted in a screened bottom tray equipped with a dryer with rising air flow. The effect of dehydrated fiber size on the saccharification of the biomass with subsequent alcoholic fermentation of the must was investigate using two different concentrations of reducing sugars. Water-Soluble Extracts were obtained from banana pseudo-stems using as simple and robust deconstruction procedure [9][10][8]. Banana fibers extracted from banana leaves, stem, and stalk were used to remove acid green dye from aqueous solution. An environmentally benign superabsorbent hydrogel based on banana pseudo-stem has been synthesized by free radical graft co-polymerization of sodium acrylate and acrylamide on to modified banana pseudo-stem cellulose backbone using ammonium persulfate and N, N-methylene-bis-acrylamide(MBA) as initiator and cross linker respectively [22][12].

In the present experimental investigation, bio composites based on the short banana fiber(20wt%) and poly-lactic acid were fabricated using three different processing techniques, namely direct injection molding(DIM), extrusion injection molding (EIM), and extrusion compression molding(ECM).The thermal and medical characterization as well as dynamic mechanical analysis has been performed to understand and compare the performance of the developed bio composites. Demand for bioplastic, especially for food packaging, increases as the consumers become more aware of the destructive effect of non-biodegradable plastics. Nanocellulose from banana pseudo-stem has great potential to be formed as a bioplastic [16][23].

3. STATEMENT OF THE PROBLEM

The primary objective of the study is to establish the potential of banana into a pseudo-stem fiber face mask and to be specific the study is to find answers to the following questions:

1. what problem and issues are being encountered by people in terms of surgical masks.
2. What are the materials and processes in doing a sustainable or eco-friendly face mask?
3. Can the sustainable face mask be measured in terms of?
    - 3.1. Acceptability
    - 3.2. Durability
    - 3.3. Efficiency
4. What can the respondents recommend to improve the proposed sustainable face mask?

4. METHODOLOGY

This study is in pursuit of understanding the complications that were encountered upon implementing the usage of face masks made from pseudo-stem fibers from banana plants and if the processes examined were sustaining eco-friendliness. This study hence, is an experimental research that the advanced quality of experimentation is based on the fact that experimentation always changes situations, correlations and conditions[27]. Specifically, this study is a Pre-experimental research where groups are observed for when treatment is done as its goal is to discern if there will be changes made from its initial instance [26]

For the sampling method, Purposive Sampling would be implemented and used in this study which is a non-probability method. In this sampling technique, the researcher is the one who is in charge in selecting who their respondents are, hence, their judgement is in control.

Survey interview questions are used as a tool to gather data. When an interviewer, who coordinates the process of the conversation and asks questions and an interviewee, who responds to those questions are involved it is often referred as a survey interview. The interview can be conducted face-to-face, or in some cases over the phone. In yet, to be able to convey trustworthy information and for the latter to be effective, the interviewer must be responsible and exceedingly capable in avoiding loss and keeping confidentiality of the gathered data [28]. There would be 5 individuals whom are going to be chosen to take part in the interview prior to the product – banana pseudo-stem fiber as a sustainable face mask. The study also makes use of the Code and Theme analysis in order to process the gathered data. Thematic analysis is A tool for systematically defining, organizing, and providing insight into patterns of significance through a dataset. It helps the researcher to see and make sense of collective or mutual meanings and experiences by concentrating on context through a dataset.

5. RESULTS AND DISCUSSION

I. Problems and Issues being encountered in using surgical face masks

A. Skin Irritations

The answer of the participants revolves around the fact that surgical face masks are causing an allergic reaction to those people who have sensitive skin in which they had experience breakouts or acne. Respondent 2 indicated that "Surgical Face masks are very itchy on the face making it hard as well for me since my skin is sensitive, as I learned that face masks are made of cotton which can absorb natural oil coming from the face leaving my skin dry." As well as Respondent 7 stated that "As we all know that we are on the summer season and is always very hot and humid in the Philippines, wearing face masks became an issue for me because I have facial allergies and the mask makes it worse since it's a cloth that absorbs my sweat leaving my cheek area dry and making it itchy." Some of the respondents face acne or breakouts like what respondent 1 and respondent 4 indicated.

B. Elastic band Issues

Some respondents had also suffered in the elastic bands of the surgical face mask. "The elastic bands are not strong enough causing it to break while wearing the surgical face mask." (respondent 3). This was also backed up by respondent 8 that he finds it difficult to wear a mask without the band breaking every time he wants to put it on.

II. Materials and Processes of banana pseudo-stem fiber face mask.

A. Materials



Banana Pseudo-stem

sodium hydroxide

B. Processes

Step 1: Cut the Banana Stem in pieces specifically cube or squares


Step 2: Put 2kg of chopped banana fiber and 1 cup of sodium hydroxide


Caution: Sodium Hydroxide can burn your skin if ever is misplaced and touched accidentally. Get a helper and wear gloves when adding the sodium hydroxide

Step 3: Boil the mixture for about 20 mins in medium heat. Preferably like a simmer. After 20 mins your mixture should look like soft banana tissues. You will as well notice that the water would be brown.

Step 5: Rinse the mixture with water for 2 to 3 times before feeling the texture. Rinsing the water would wash off the chemical that was added for you to not burn your skin.

Step 6: After rinsing, proceed to blend the mixture to become puree or paste looking. Blend until you don't see any more solid particles.


Step 7: Get a sieve or a mold and deckle, basin or any tub and put a ratio of 1:1 of the fiber and water. Start sieving your fabric for the mask.

Step 8: after sieving put the fabric in the sun to dry. Put the fabric in a 90º position and let it dry for 3 hours.

Note: The time of drying will depend how thick or how thin the solution you are going to dry.

Step 9: Remove the fabric from the sieve and proceed to cutting, layering, and designing the mask.


Step 10: After sewing and layering the mask. The finished product would be similar to a surgical face mask.

III. Factors of a sustainable face mask

A. factors tackling Acceptability

a. Affordable

Respondent 3 has stated that the banana pseudo-stem fiber mask is “a good alternative for people who are less fortunate since banana trees here in the Philippines are a lot and people can harvest it to make the product making it more known for others to see and try it.” While respondent 4 also stated that “It would be acceptable seeing that the material used was banana and we all know we have many supplies in our country.” Some of the respondents were also expressing that it may be more affordable than a surgical face mask (Respondent 7)

b. Eco-friendly

Most answers focused on being an environment friendly product. Respondent 6 also said that “It can help lessen the waste coming from surgical masks that harms the environment.” While respondent 8 said that the product used are all organic and made out of natural resources. Some other respondents specified that the product has good

materials which come from natural resources that can help lessen plastic pollution happening since the pandemic started.

B. factors tackling durability

The factors that tackle durability were noted by the respondents which is the fiber being strong enough to hold the shape of the mask making it more resistant and more durable than plastic and respondent 8 stated that "The material of the mask is very strong and I can see that it will last long when wearing the mask." Respondent 7 also indicated that "stem fiber of bananas is considered to be strong and has been used for different applications." Most of the responses of the participants specifically respondents 3,5 and 9 clearly stated that the materials are good and are used today as a component for eco products making the fiber used a strong material to prove the strength and stability

C. factors tackling efficiency

a. Good alternative

Respondents 1,7 and 9 stated that the banana pseudo-stem fiber mask is a good alternative for surgical face masks but they still want the mask to be checked by professionals since they want to know the critique of others before it becomes implemented and be sold. Respondent 2 stated that "I am skeptical about the product since I mostly rely on surgical face masks' protection against the virus hence, I do not know if the protection given by the banana face mask would beat the surgical face masks." While respondent 9 specified that the mask came from natural resources making it an alternative solution since it would be biodegradable and can help lessen pollution.

b. Prevention of the Virus

As respondent 3 stated "I have come across a news that sometimes cloth or even the surgical face masks will not protect us from CoVid-19 since they said it is believed that it is small enough that the pores of the mask will let it penetrate through and enter our mouth therefore infecting us but since the banana mask is composed of a strong fiber, I can say that the virus will be filtered by this mask." While respondent 8 indicated that the mask will do a good job in blocking the virus since its material can be a great filter.

IV. Recommendation for improvements

A. Resize the mask

Most of the answers of the respondents consist of resizing the mask since it is too big and can cover almost the whole face. Respondent 8 stated that "Resizing the mask would be beneficial since it is too big, almost can cover the whole face." As for the other respondents they indicated that resizing the mask would look good and can be more beneficial, resizing the mask by an inch or two will let the mask fit in anyone's face (respondent 5).

B. Change the band

Respondents 3,4 and 6 stated that there is no need to cut an inch or two in the mask itself since they see that the problem is not the mask but the band. The band used was made as well from a peel of banana tree and considered organic although the respondents see that it would be itchy and painful in the ear, even if it is not the band should be reduced since it is too long or be changed into and elastic one. (respondent 4).

6. CONCLUSIONS

Researchers have drawn the following conclusions, that Banana Pseudo-Stem Fiber has the ability to be used as an alternative face mask, and that its use may benefit farmers financially. Using the information gathered: First, it is more affordable than a surgical face mask; second, it is more eco-friendly and can be a great option because it can reduce plastic waste created by surgical face mask, Third, since it is made of strong fiber, the Banana Pseudo-Stem Fiber Mask's filter can help us avoid the virus ; fourth, although it is efficient, it has problems or issues that can arise while using it, such as skin irritation and a weak band ; Lastly, it can be improve by resizing the mask and changing the band to elastic so that it can be more comfortable using it.

7. RECOMMENDATIONS

In the findings and conclusion of the given study, the researchers offer the following scope for the future research:

1. Dig in more about banana pseudo-stem fiber and its purpose
2. consider studying how does this stem causes economic loss and environmental problems
3. Provide more evidences proving that it is safe to use a product made with banana pseudo-stem fiber

For the limitation of the study, first; is the total number of respondents. The researchers suggest considering a higher count of respondents, to make the research more reliable and justifiable. Second, the researches should dig in more about such allergies to make the product safer to use. The researchers should also consider a different method in collecting responses. Also, they can try other ways of producing the product. In addition to these, they can also think of other useful product that can easily be fabricated.

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