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Design and Development of Convertible Lunch Bag Made Using Banana Fibers

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ABSTRACT: This research focuses on the sustainability of using natural fibers, particularly banana fibers, in the design and development of eco-friendly products required by working individuals. The study aims to evaluate the scalability and commercial viability of using banana fibers as an environmentally friendly material in the production of various products. The benefits of banana fibers include their biodegradability, which reduces the environmental impact. Additionally, the generation of four tons of biomass for every ton of banana produced creates potential for the use of this waste product in other applications. The cellulose-based composition of banana fibers offers an added advantage as they are natural and renewable compared to synthetic fibers like polyester or nylon, which have adverse environmental effects.

The pilot study conducted in Mumbai, India, identified that 50% of working individuals have their lunch at their desks, resulting in spillages that soil their workstations and devices. With the absence of regular housekeeping services, this creates inconvenience and health risks. Therefore, the study aims to design and develop convertible lunch bags that can serve as mats to address this issue. Five prototypes of convertible lunch bags into mats have been developed and evaluated for scalability and commercial viability. The study has developed and evaluated five prototypes of convertible lunch bags into mats, assessing their potential for commercial viability and scalability.

The use of natural fibers, specifically banana fibers, in the production of sustainable products like convertible lunch bags is a promising approach to reducing environmental impact.

INTRODUCTION: In recent years, there has been a growing awareness of the environmental damage caused by synthetic materials. As a result, there has been a great interest in developing natural materials that

can replace synthetic materials. This trend has led to an increase in the demand for commercial applications of natural fiber-based composites for various industries. Natural fibers are sustainable materials that are readily available in nature and have several advantages such as low cost, light weight, renewability, biodegradability, and high specific properties. The sustainability of natural fiber-based composites has seen a surge in their applications in various manufacturing sectors. One of the major advantages of natural fibers is their environmental friendliness. Unlike synthetic materials, natural fibers do not contain harmful chemicals and are easily biodegradable, thus contributing to a cleaner and healthier environment. All textiles are made of either natural or man-made fibers. Natural fibers are made from natural raw materials that can be classified according to their origin. Vegetable or cellulose fibers include important fibers such as flax (linen), cotton, and jute. Animal or protein-based fibers, such as wool and silk, are not bio-based.

In terms of uses, there are two general classifications of plants that produce natural fibers: primary and secondary fibers. Primary crops are those grown for their fiber content, such as jute, kenaf, hemp, sisal, and cotton. Secondary crops are those in which fiber is obtained as a by-product from other intermediate uses. Examples of secondary crops include pineapple, maize, culm, agave, palm, coir, and banana. The use of natural fibers in the production of sustainable products has gained a lot of attention due to their numerous benefits. These fibers have low environmental impact, are readily available, and can be used to make a wide range of products. Therefore, it is important to explore the potential of natural fibers in various applications to promote sustainable development and protect the environment.

Natural fibers provided comfort and protection from the environment in hot and cold climates. However, with the advent of industrialization in the 20th century, the textile industry underwent a transformation. The demand for synthetic fibers like nylon, polyester, acrylic, and polypropylene increased, owing to their durability and cost-effectiveness. Synthetic fibers were also preferred as they could be easily processed, and the production process could be standardized. However, the production of synthetic fibers relies on non-renewable petroleum products, and their manufacturing process is complex, involving high energy consumption and greenhouse gas emissions. Moreover, synthetic fibers have several negative impacts on the environment, including the release of microplastics into the environment, which pose a threat to marine life.

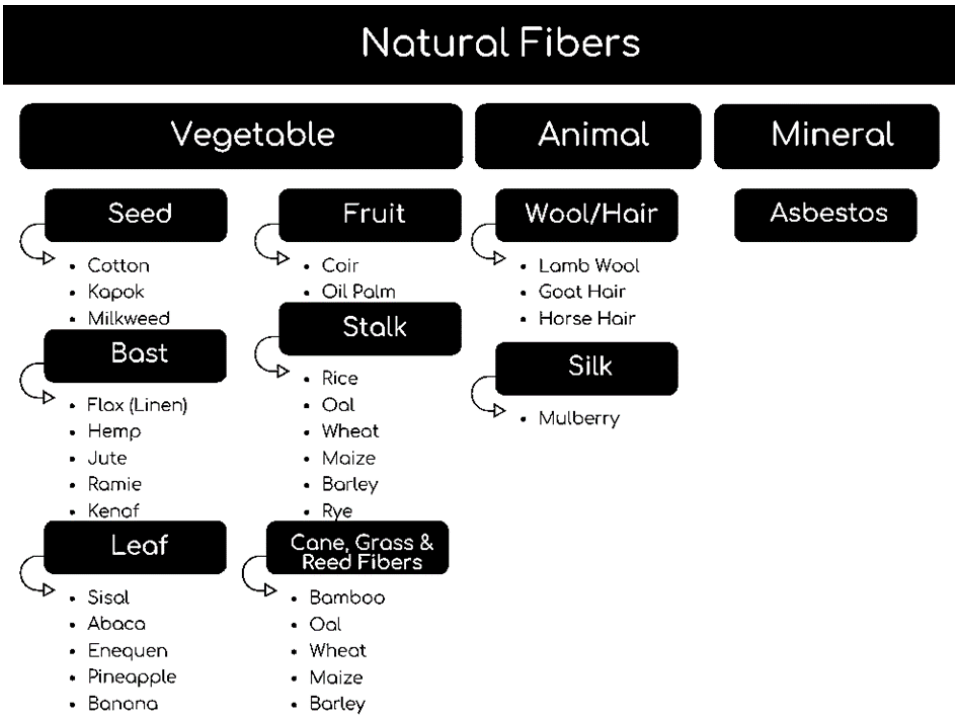


Figure No 1.1 Fiber Classification

The pseudo stem of the banana plant contain good quality textile fibers, commonly known as banana fibers. This fiber is another unexplored natural fiber used for the fashion and technical textile industry to develop sustainable products. than conventional alternative fabrics.

Banana plants are considered to be one of the most useful plants in the world. Almost all parts of this plant can be used, such as the fruit, peel, leaf, pseudo stem and inflorescence. The banana fruit itself is one of the most popular fruits that is a valuable commodity around the world. However, banana pseudo stems usually become biowaste after the banana fruit harvest is complete. So extracting fibers and other components from the stem and using them to create various value-added products. The fibers from the banana pseudo-stem can be extracted by a decorticator machine. The next processes are retting and degumming of the fibers. The fibers derived from the banana pseudo-stem can be made into several value-added products, such as rope, cordage, fishing net, mat, packaging material, paper sheets, textile fabrics, bag, table cloth, handicrafts, absorbent, polymer/fiber composites, etc. Additionally, other components derived from the banana pseudo stem can also be used. The central core can be used for making pickle, candy, and soft drink, whereas banana pseudo stem can be also use for mordant for fixing a color and organic liquid fertilizer, while the scutcher can be used for making compost. Ancient Hindu scriptures have described the banana tree as a kalpak vriksha (a plant that gives food, medicine, protection and clothing) suggests that it was known to make clothes from banana fibers. Perhaps the discovery of other spinnable fibers has made it less popular. Therefore, this neglected fiber, which is abundantly throughout India, can provide us with a natural fiber to make quality products.

According to research, a significant percentage of working individuals opt for fast food or unhealthy snacks due to their busy schedules and time constraints. This dietary habit can have adverse effects on their health, leading to weight gain, increased risk of chronic diseases, and decreased productivity at work.

To address this issue, packing fresh, home-cooked food in a lunch bag is a practical solution. A lunch bag with a personal lunchbox allows individuals to plan and prepare meals in advance, ensuring access to nutritious food while on-the-go. Moreover, carrying a lunch bag reduces the reliance on fast food and unhealthy snacks, which can have a negative impact on health in the long term. Not only does carrying a lunch bag with your own lunchbox promote healthy eating habits, but it also offers a range of other benefits. A durable lunch bag can fully protect your food from germs, ensuring food safety during transportation. It also reduces the need for single-use packaging, making it an eco-friendly option. In conclusion, carrying a lunch bag with your own lunchbox is a simple yet effective way to maintain a healthy diet and avoid unhealthy eating habits while being part of the working population. Investing in a durable and efficient lunch bag is a wise decision for individuals seeking to improve their health and overall well-being.

This research aims to understand the perspectives of working men and women with regards to their food habits and design and develop aesthetically appealing and functional convertible lunch bags to table mats made using Banana fibers which are aesthetic as well as functional to suit the needs of the working population.

The study has used various tools in the methodology like questionnaire to understand the food habits of the working population experimentation and design development for prototype making. The methodology used was convenient and snow-ball sampling method for the working men and women.

The questionnaire was conducted with 110 participants who fulfilled the following criteria:

- Working men and women based in Mumbai and working in Mumbai.
- Participants were included irrespective of their religion and socio-economics status.

On the basis of the data collected, experimentation to create designs for lunch bags was done of which four designs were finalized for the development of prototypes.

The results of the questionnaire form have been detailed below. The questionnaire consisted of 10 open ended questions which concerned around the lunch patterns of the participants on a working day.

1. Lunch patterns:

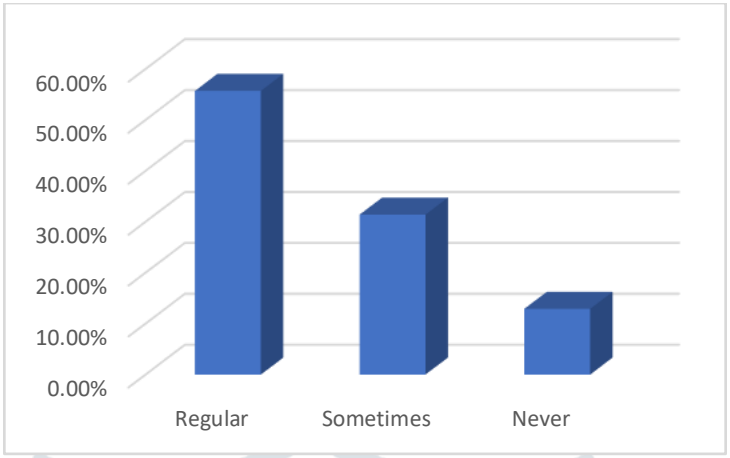


Figure No: 1.1 Lunch patterns

The above figure shows that 55% of the participants carry their lunch from home while the 31% carry sometimes and 13% do not carry packed lunch from home. This implied that more than 50% of the participants have the need for the right lunch bag.

2. **Frequency of having lunch on work table.**

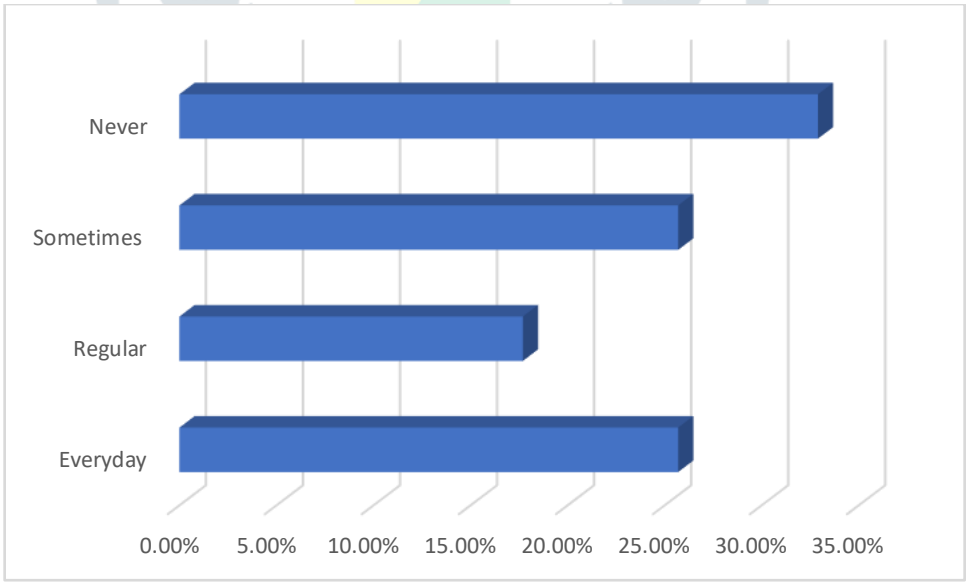


Figure No: 1.2 Frequency of having lunch on work table.

The above graph indicates that more than one fourth of the participants each have lunch on their work desk everyday and on an occasional basis while almost 16% of the participants regularly have their lunch on their workdesk. Only 33.3% never have their meal on their table.

3. **Preference towards the use of convertible bag which opens up as a mat:**

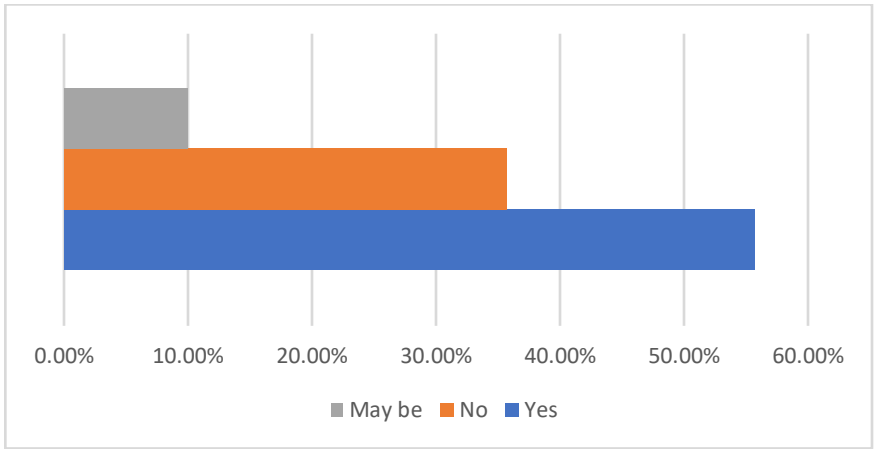


Figure No: 1.3 Preference towards the use of convertible bag which opens up as a mat

The question focused on two aspects, usage of convertible lunch bag as well as the use of banana fibers for the making of the lunch bag. The response to the question was encouraging showing that the 55.1% participants like to use a bag made of banana fibers which can be converted in to a mat for lunch, while the 36% participants are not sure of it and 8% participants are not interested.

4. **Cleaning of the lunch / work table after meals:**

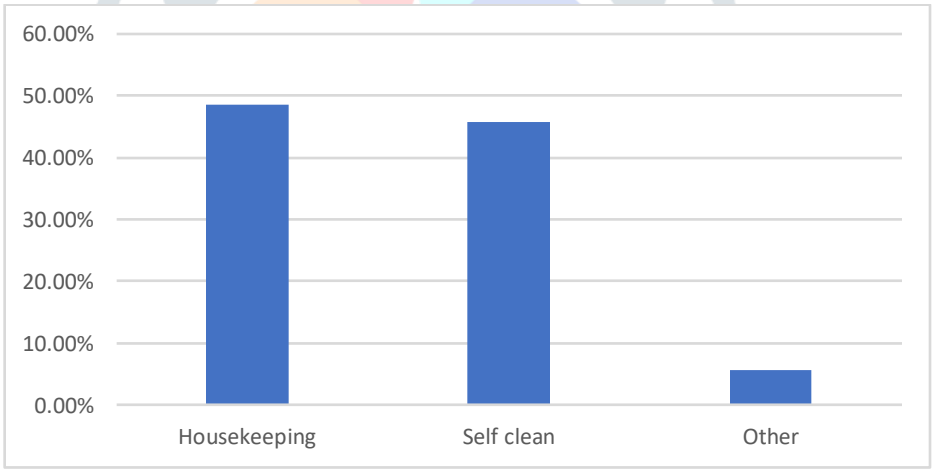


Figure No: 1.4 Cleaning of the lunch / work table after meals

The responses indicate that almost 50% of the participants have housekeeping services in their office to clean their lunch / work table on a regular basis. However, a similar percentage of participants do not have any designated housekeeping services and have to clean their lunch / work tables on their own. Around 5% of the participants have selected other, which may correspond to the participants not carrying lunch from home.

5. **Designated lunch bags**

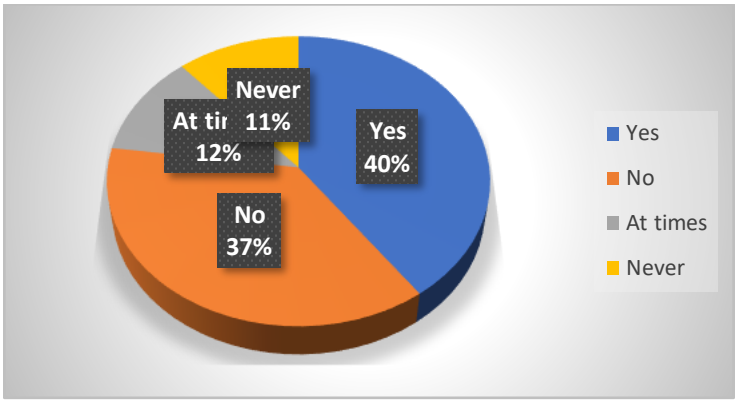


Figure No: 1.5 Designated lunch bags

The above pie chart shows that the 40% of participants have a designated lunch bag. Almost 12% of participants carry the same a similar bag for their lunch while the remaining participants do not have a designated bag to carry their lunch.

6. **Preference towards use of banana fibers for lunch bag:**

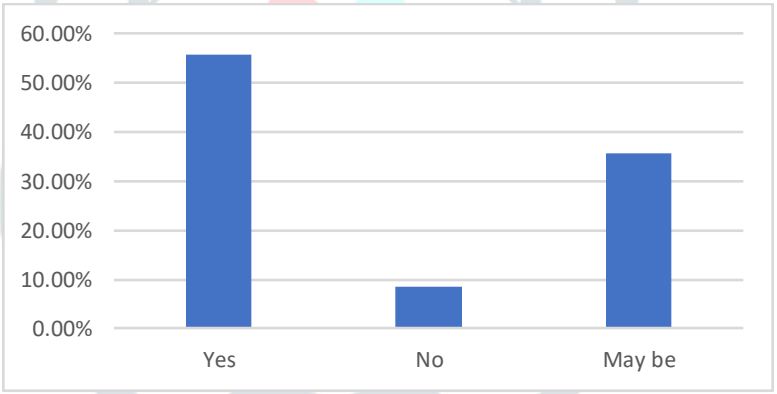


Figure No: 1.6 Preference towards use of banana fibers for lunch bag

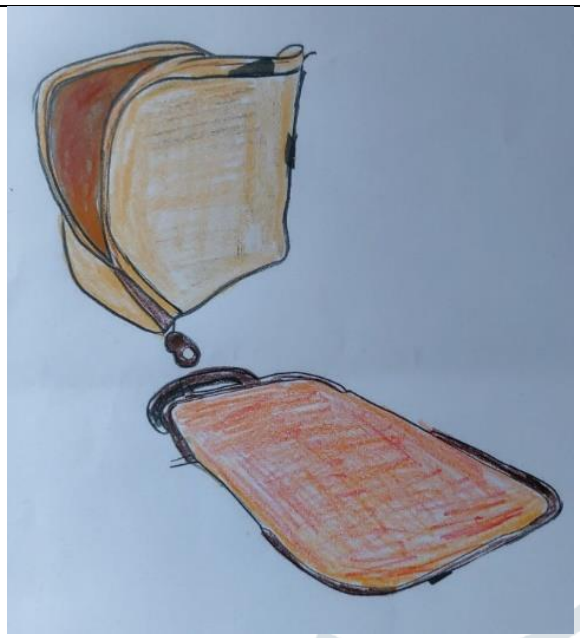
The figure above shows that the 55.1% participants like to use a bag made of banana fibers which can be converted in to a mat for lunch, while the 36% participants are not sure of it and 8% participants are not sure if the change in fibers will be beneficial.

Design and Prototype Development:

On the basis of the responses received from the participants through the questionnaire, a need to develop convertible lunch bags, which can be opened up like a table mat was realized. Such bags are not easily available in the market for sale. Hence the researcher felt a need to develop designs for the same, which could be used for making of convertible bags. The following designs have been developed by the researcher for which prototypes have also been made. The prototypes have been made using banana fibers along with plastic lining and zippers. The researcher also attempted to print / paint the bags with varied methods.

Table 1: Designs and Prototypes of convertible lunch bags:

	  
Design 1	**Prototype 1**
	  
Design 2	**Prototype 2**



Design 3

Prototype 3

Design 4

Prototype 4

Conclusion: The research was conducted in two parts, the first part focused on understanding the usage and preferences of the participants towards the lunch and associated factors. In the second part the researcher focused on creating several designs of which four designs were shortlisted to create prototypes. The convertible lunch bags have been developed using banana fibers. The study is beneficial from many perspectives, usage of banana fibers instead of synthetic fibers, ease of carrying lunch in specific bags, reduced need of cleaning after having lunch.

References:

1. **Md. Ferdus Alam** Banana Fiber: Properties, Manufacturing Process and Applications. Department of Textile Engineering Southeast University. February 18, 2021 by Mazharul Islam Kiron. https://textilelearner.net/banana-fiber-properties-manufacturing/ 12-10-2022

2. **Praveen Pandit,** Textile Value Chain Fibres and Yarns, In-Depth Analysis, News & Insights, Textile Articles Sep 29, 2020 Characteristics & Properties Of Banana Fibers. 22-10-2022

3. **Stephanie Steele**, Sustainable fashion collective, Banana fibers textile Monday, 3rd June 2019. https://www.the-sustainable-fashion-collective.com/2019/06/03/what-is-banana-fibre-and-how-do-you-make-textiles-from-it 08-08-2022

4. **Aayushi Kumar** Home Fibre Banana Fibre for Sustainable Fashion and Beyond, October 22, 2020 https://www.onlineclothingstudy.com/2020/10/banana-fibre-for-sustainable-fashion.html 15-02-2023

5. **Sewport** What is banana fabric properties and how it is made and where, by Sewport Support Team Jan 24, 2023 https://sewport.com/fabrics-directory/banana-fabric 17-02-2023

6. **Marris Journal** Slowly and Simple Natural Fibers: Good for You and Good for the environment. https://maarisstore.com/natural-fibers-good-for-you-and-good-for-the-environment/ 24-09-2022

7. **Jan E.G. van Dam Wageningen University**, The Netherlands Proceedings of the Symposium on Natural Fibres. Environmental benefits of natural fibre production and use. https://www.fao.org/3/i0709e/i0709e03.pdf 10-11-2022

8. **Asmanto Subagyo and Achmad Chafidz,** Banana Nutrition,Banana Pseudo-stem fiber: Preparation, Characteristics and Application, November 28th, 2018. https://www.intechopen.com/chapters/64570.