UNIVERSITI TEKNOLOGI MARA
Cawangan Negeri Sembilan
Kampus Seremban
Fakulti Pengurusan dan Perniagaan

FBM-SEREMBAN INTERNATIONAL INNOVATION COMPETITION (FBM-SIIC)

INVENTOPIA 2023

EXTENDED ABSTRACT BOOK

"IDEAS UNLEASHED: THE ULTIMATE INNOVATION CHALLENGE"

inventopiafbmsiic.wixsite.com/home

ORGANISED BY:

FACULTY OF BUSINESS AND MANAGEMENT
UNIVERSITI TEKNOLOGI MARA
NEGERI SEMBILAN,
SEREMBAN CAMPUS

eISBN 978-629-97586-8-6

PRODUCTION OF SANITARY PADS FROM BANANA STEM FIBRES

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ABSTRACT

On average, women normally menstruate within a span of 7 to 15 days each month, which makes sanitary pads a necessary item for them. In 2018, sanitary pads held a majority share at 79% of the feminine hygiene market. However, they have taken over landfills as one of the most common wastes, and they take a long time to disintegrate. To address this issue, this project was initiated to create eco-friendly sanitary pads using banana stem waste, which is a byproduct of the harvest. The project aimed to determine the maximum absorption of liquid and wicking capacity of the pads from banana stem fibre, and then compare them with that of commercial brands. Four types of pads were produced, which vary by the number of layers. The results revealed that the pads made from four layers of banana fibre sheet had the highest wicking ability and absorbed up to 70 ml of liquid, comparable to the commercial pad, Libresse. Hence, it can be concluded that the ability of banana fibre sanitary pads to absorb liquid is proven to be equivalent to that of commercial pads. By further exploring this study, banana stem fibre sanitary pads could have the potential to replace traditional pads, reducing waste from used sanitary products and banana trees.

Key Words: Banana Plant Waste, Banana Fibre, Sanitary Pads, Absorption, Wicking.

1. INTRODUCTION

During menstrual periods, women require a sanitary pad to absorb menstrual fluid and prevent leakage and discomfort. Numerous companies have produced a variety of sanitary pads based on women's preferences. Some of the successful companies are Kotex which is part of Kimberly-Clark brands and Essity which produces Libresse. However, the high percentage of plastics in most non-biodegradable pads which is around 90% might take 500 to 800 years for one to disintegrate. Thus, it could lead to uncontrollable disposal of sanitary pads if there is no movement from higher-ups. A lot of news has been circulating lately regarding the severity of environmental issues, which is concerning in the long run.

As the world is now looking for a green substitute, disposable pads are gaining popularity. For instance, an Indian company called Saathi Pads has introduced compostable and biodegradable sanitary pads using locally sourced banana and bamboo which only take 6 months to decompose (Kiran, 2022). In Malaysia, banana is the most-produced fruit and have been planted on almost 35,000 hectares equivalent to 24% of Malaysia's total fruit production (Tumin & Shaharudin, 2019). Furthermore, almost 60% of banana biomass is wasted after harvest. Rather than burning the banana plant waste after harvest or making it idle on the farm, the plant waste could be reused. Collecting banana plant waste from banana farmers might also benefit them because they will earn from such wastage. Therefore, this project intends to produce sanitary pads from the waste of banana trees, and it is implemented as a measure to reduce waste. The liquid absorbency of the produced sanitary pad

will also be determined and compared with that of the commercial brands.

2. MATERIALS AND METHODS

The main materials used for this project are the banana stems which were collected from an orchard in Kuala Selangor, Malaysia. Other materials including distilled water, sodium hydroxide, water and red dye were obtained from the Textile Technology Laboratory in Universiti Teknologi MARA Cawangan Negeri Sembilan.

The methods to produce the pads started with the process of separating the banana stem from its foliage, thoroughly cleaning them with tap water to remove all contaminants, and then cutting them into some sections. To extract fibre from the banana stem, it was first cut into several pieces and put in the banana fibre extraction machine. A 200 ml sodium hydroxide (NaOH) solution was mixed with banana stem fibre that had been cut into small pieces. Immediately the mixture was boiled for one hour at 100°C before being chilled for about an hour. After cooling, the mixture was poured into a mould with the desired shapes. The banana sheets were formed after the mixture had dried in the sun.

The pads were produced in four versions where the variation lies in the number of layers of banana sheets. Next, all the samples were tested for their maximum absorption capacity. While recording the time for every 30-second interval, 5 ml water was dropped on the pads each time until the pads began to leak. Additionally, 5 ml liquid was dropped on the pad to see how long it took to absorb all of it. This is also termed a revised wicking test where the aim is to measure how fast liquid can be absorbed into the fabric. The times were recorded until all liquid was absorbed in the pads. Red colour dyes were added to the liquid to ease visual observation.

Figure 1. Parts of the manufacturing process of sanitary pads from banana fibres – left: separation of the stem from foliage, right: drying the fibres under the sunlight.

3. RESULTS

The pads were made with four variations of various layers. Figure 2 shows the pads and the layers of banana fibre sheets.

Figure 2.: Left: banana fibre sheets, right: example of a finished product of sanitary pad from banana fibres.

Table 1 shows the properties of the banana fibre sanitary pads in which the weight and length for each banana fibre sheet were kept constant at 1.80g and 15cm respectively. To compare the performance of the produced pads, two types of commercial pads were also tested. The size of commercial pads is bigger which is 24 cm for both brands which is the common size available in the market.

Table 1: Properties of The Banana Fibre and Commercial Sanitary Pads

Number of layers	Weight (g)	Length of pads (mm)	Thickness (mm) (SD*)
1	1.80	15	1.10 (0.27)
2	3.60	15	2.25 (0.47)
3	5.40	15	2.80 (0.30)
4	7.20	15	4.04 (0.66)
Kotex	7.14	24	3.70 (1.00)
Libresse	6.93	24	3.16 (0.25)

SD* - standard deviation

Figure 3 shows the results of the maximum absorption and revised wicking test. Based on the graph, four layers of banana fibre sheet sample absorbed the fastest which was 0.78 ml/s. However, the first 3 samples were only able to absorb below 0.50 ml/s. Sample 4 also absorbs liquids quicker than Kotex and Libresse, which are known as common brands for sanitary pads in Malaysia. Kotex was only able to absorb 0.38 ml/s of liquid meanwhile Libresse is 0.45 ml/s. As per Table 1, the four-layer sample is the thickest among other samples, measuring 4.04 mm. This thickness affects the result as the thicker the sample, the more liquid can be absorbed in a given time (Memariyan & Ekhtiyari, 2010).

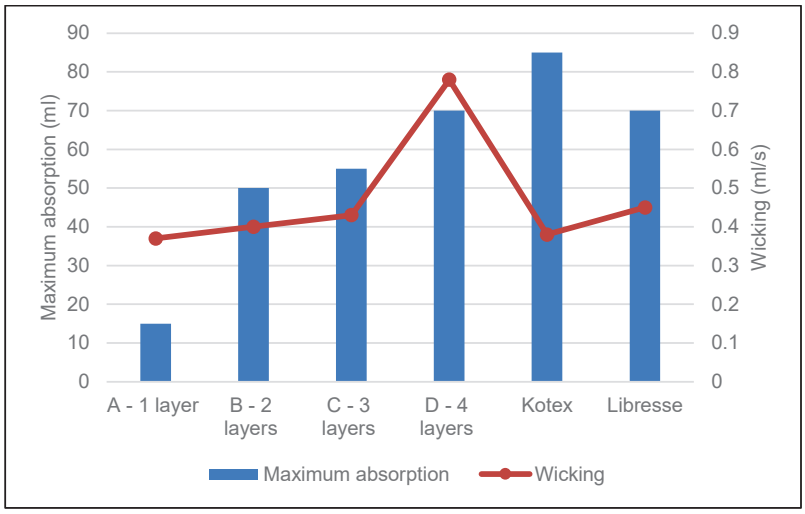

Figure 3. Maximum absorption and wicking of sanitary pads from banana fibres and commercial brands

However, a sample from a commercial brand, Kotex has the highest absorption capacity which is 85 ml, much higher than another commercial brand Libresse and all banana fibre pads. Nevertheless, four layers of banana sheets and Libresse seem to have a comparable amount of absorption at 70 ml, which is the second highest after Kotex. Hence, it can be considered as having an excellent absorbency as commercial pads and potentially be commercialised in the future.

4. CONCLUSIONS

Four types of pads with variations in the number of layers were produced. From the study, it was found that four layers of banana fibre sheets have the maximum absorption, comparable to the commercial pads tested. As for wicking, four layers of banana sheet pads absorb the quickest compared to others with a lower number of layers, and commercial brands. Despite the great potential of banana fibres as sanitary pads, there are still many parts that need to be further researched especially on the comfortability and hygienic issues of the materials.

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