DEVELOPMENT OF BIODEGRADABLE SANITARY PADS USING BANANA FIBER

HEALTH SAFETY

ENVIRONMENTAL PRESERVATION

FABRICADEMY
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A SUSTAINABLE APPROACH TO MENSTRUAL HEALTH

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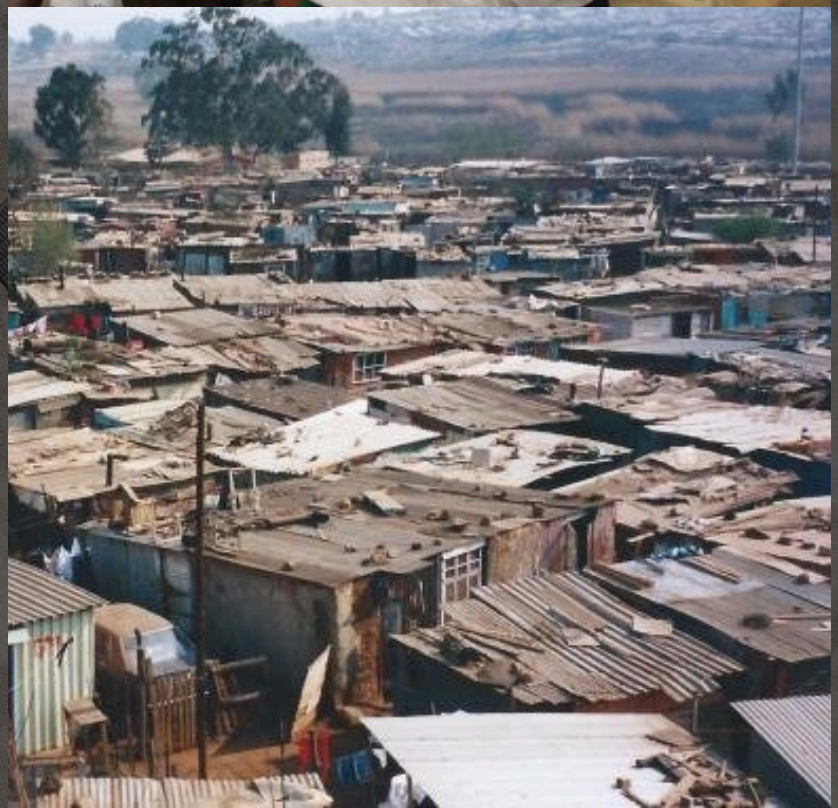


1. ABSTRACT

within This biodegradable pads project, was the exploration of the development of biodegradable sanitary pads using banana stem fibers as a sustainable alternative to synthetic menstrual products. The goal was to address menstrual hygiene challenges while promoting eco-conscious innovation in Rwanda and especially in rural areas. Using a hands-on fabrication process, fibers are extracted, softened, bleached, and molded into absorbent pads. The project not only demonstrates a sustainable menstrual solution but also emphasizes health safety, local resource use, and environmental preservation.

CHALLENGES

During my project, I faced some challenges, some were crucial and directly affected progress, while others were due to limited experience. These were later solved through continued research, help from the local instructor, and strong support from the lab.
Working on the biodegradable pads was easier thanks to the availability of banana pseudo-stems, but some chemicals and other materials were hard to find or access.

2.ACKNOWLEDGEMENT

Special thanks to my local instructors KAWAIDA Lars and Nuria Robles, mentors, and the global instructor for guiding me throughout my entire Fabricademy journey, right to the end.
I'm also deeply grateful to FABLAB RWANDA for providing all the materials and support I needed, and especially to KAWAIDA Lars, my local instructor, for standing by me with patience and understanding until the very end.

3. Introduction

In Rwanda, it is still hard for many girls and women to get clean, affordable, and eco-friendly menstrual products. Most pads sold in shops are made from materials that are not good for the environment and take a very long time to break down. This project uses banana fiber, a natural and widely available material in Rwanda to make sanitary pads that are safe to use, work well, and are better for the environment.
biodegradable solution that leverages banana fiber. A natural and abundant by-product to produce eco-friendly sanitary pads that are safe, effective, and sustainable.

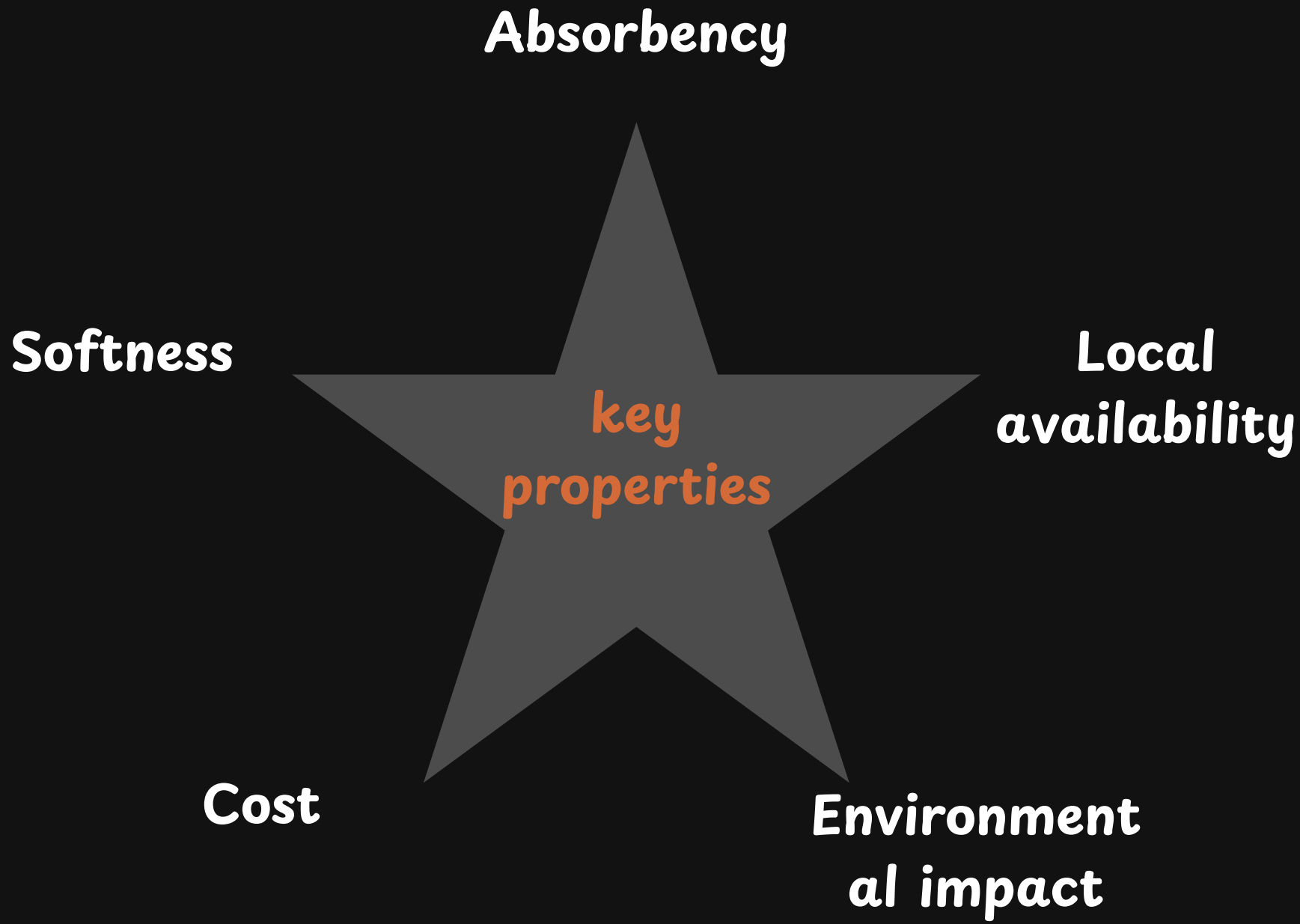
4.Background and Problem Statement

In Rwanda and many other places, most pads sold in shops create a lot of waste because they are made with plastic and other materials that don't break down easily. They are also expensive, which makes it hard for many girls and women to afford them. This causes two problems: pollution and period poverty. Using banana stem fibers—which are natural, renewable, and available in Rwanda—can help solve both issues.

5. MATERIAL RESEARH

In Rwanda, banana plants grow almost everywhere, and after picking the bananas, the stems are usually thrown away. But these stems have strong, natural fibers that we can use instead of wasting them. the research was very important because I wanted to really understand how these fibers work, how to remove them, make them soft, help them absorb liquid, and see how their natural features could change the final pad. My goal was to make pads that are safe to use, good for the environment, and made from local materials.

Banana pseudo stem (fibers) were found to be strong with their natural fibers found inside the soft part of the banana plant stem. They are normally thrown away after harvesting bananas, but they are rich in cellulose and have good potential for reuse. These fibers are long and durable, which makes them a good base material for making sanitary pads.



Based on previous research, I found that banana pseudostems stood out among other natural fibers, which made them my top choice for creating biodegradable sanitary pads.

COMPARISON BETWEEN BANANA FIBERS AND OTHER FIBERS

PROPERTY	Banana Pseudostem Fibers	Cotton (Organic)	Hemp Fibers	Bamboo Fibers	Jute Fibers
Absorbrncy	High (after treatment)	Moderate to high	Moderate	High	Moderate
Strength	Very High (strong and durable)	Moderate (weaker than banana)	High	Moderate	High
Local availabitiy	Abundant in Rwanda	Available but less common	Available but less common	Available, but less common	Available in some regions
Cost	Very low (locally sourced)	Higher (requires large scale farming)	Moderate	Higher	Moderate
Environment impact	Minimal (low-waste, renewable)	Low (organic farming)	Low (requires sustainable farming)	Low (biodegradable, sustainable)	Low (biodegradable, sustainable)

-Low Cost and Local Abundance

During the research, Ii was observed that the treated fibers were able to hold up to 10-12 times their own weight in liquid, proving they are excellent for sanitary pad cores.

-Natural Absorbency

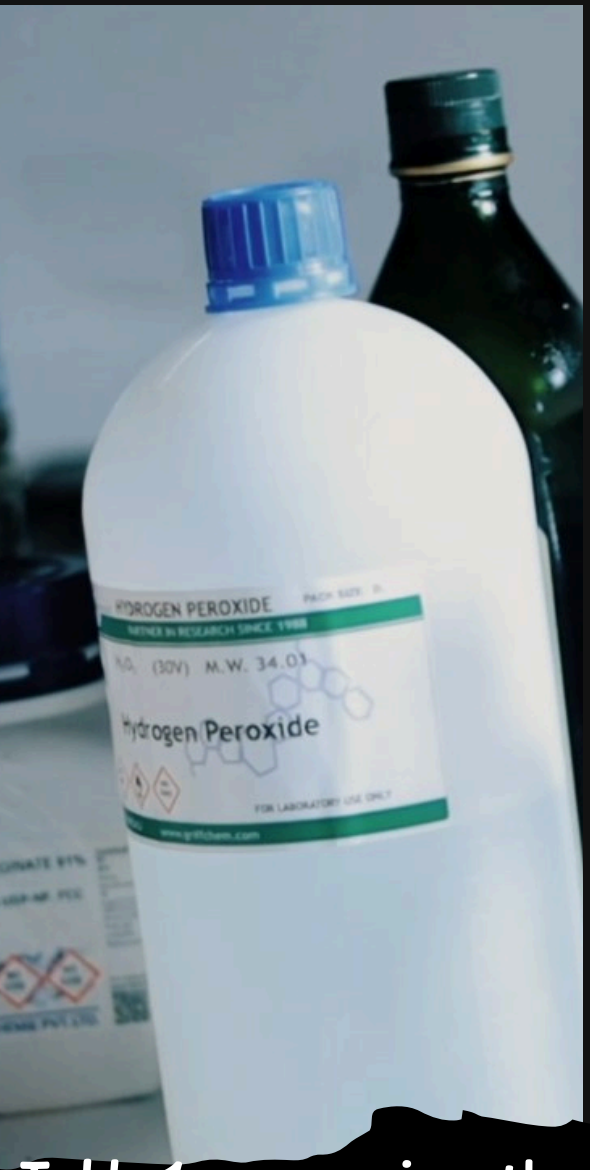
the fibers could absorb up to 8-12 grams of water per gram of fiber, depending on the treatment.

-Sustainable and Renewable

Since they're a waste product, they come at zero to very low cost. According to numbers done by MINAGRI (rwanda) , banana-producing regions can generate up to 60 tons of pseudostem waste per hectare, giving a strong supply for fiber extraction.

-Improved Softness After Treatment

Each plant provides 1.5-2 kg of usable fiber, and new stems regrow without needing replanting.



MATERIALS & CHEMICALS USED IN BIODEGRADABLE SANITARY PAD PRODUCTION

Category	Materials&Tools Needed
Raw Materials	Fresh banana pseudostems
Tools	**Sharp knife/scraper, bucket/soaking tank**
Liquids	**Water**

Table 1. summarizes the fundamental materials required for the initial stage of banana fiber extraction. The raw materials consist of fresh banana pseudo stems, while the extraction process requires basic tools (knife/scraper, soaking tank) and water for fiber retting. This selection emphasizes sustainable, locally available resources that align with the project's ecological objectives and demonstrate practical feasibility in resource-constrained settings."

MATERIALS & CHEMICALS USED IN BIODEGRADABLE SANITARY PAD PRODUCTION

2. Fiber Softening & Treatment

Category	Chemicals&Materials
Softening Agents	5% NaOH (Sodium Hydroxide) or baking soda solution
Neutralizing Agent	acetic acid (vinegar)
Tools	Heating system, stirring rod

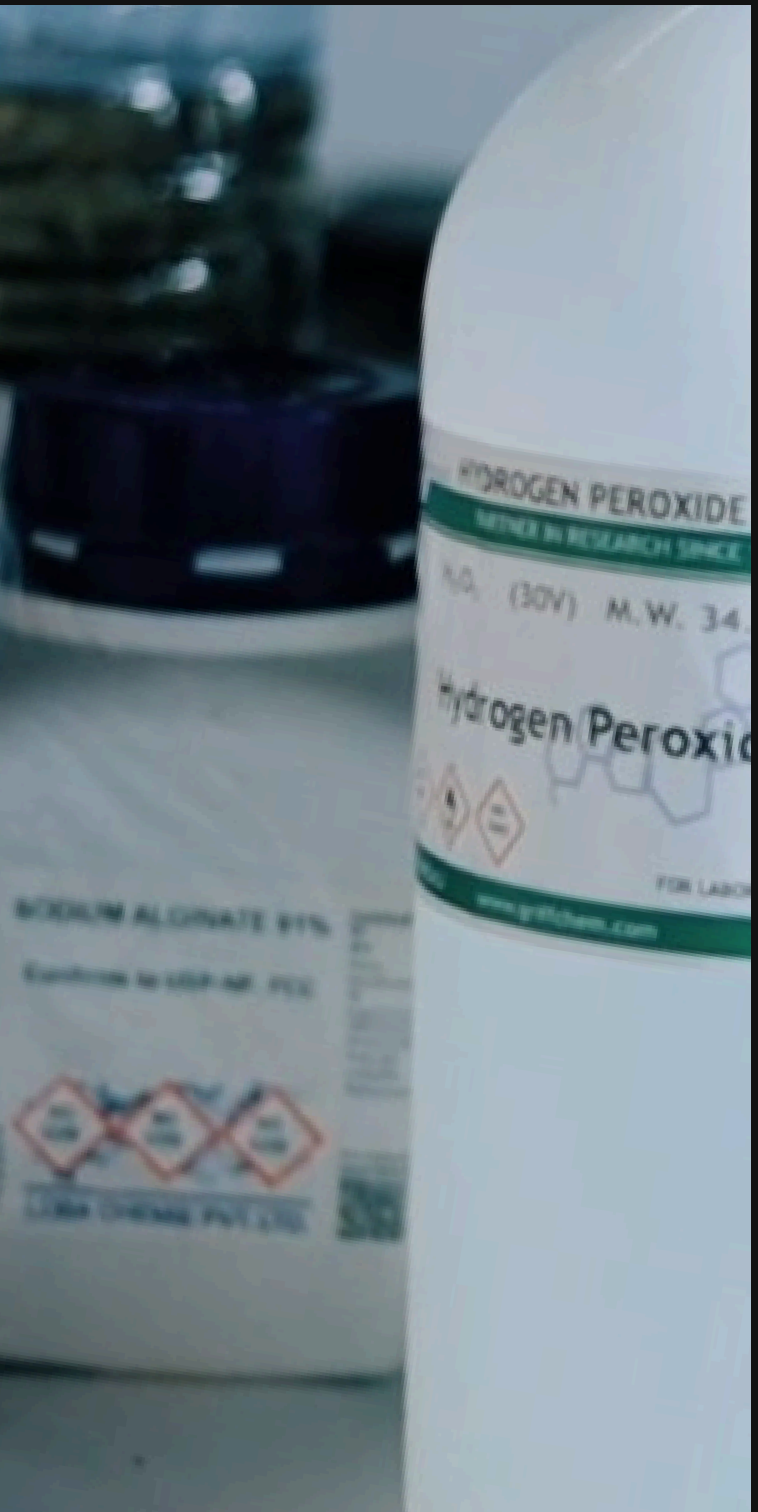
Table 2 lists the chemicals used to treat banana fibers. Sodium hydroxide (NaOH, 5%) softens the fibers, while baking soda is a safer alternative. Vinegar (acetic acid) neutralizes the NaOH, and hydrogen peroxide (3%) lightens the fibers if needed. These chemicals were chosen for effectiveness, cost, and eco-friendliness.

MATERIALS & CHEMICALS USED IN BIODEGRADABLE SANITARY PAD PRODUCTION

3. Bleaching

Category	Chemicals&Materials
Bleaching Agents	3% Hydrogen Peroxide (H_2O_2)
Tools	Bucket

Table 3 shows bleaching materials. A mild 3% hydrogen peroxide solution lightens fibers, while a simple bucket suffices for treatment. This low-concentration approach balances effectiveness with safety and cost-efficiency.



MATERIALS & CHEMICALS USED IN BIODEGRADABLE SANITARY PAD PRODUCTION

4. Absorbency Enhancement

Category	Chemicals&Materials
Absorbent Agents	sodium Carboxymethyl Cellulose (CMC), Agar Gel
Alternatives	Aloe vera gel, alginate, pectin
Liquids	Distilled water Tools

MATERIALS & CHEMICALS USED IN BIODEGRADABLE SANITARY PAD PRODUCTION

5. Testing & Quality Assurance

Category	Chemicals&Materials
Test Fluid Simulated	Simulated menstrual blood (saline + gelatin+Red liquid food color)
Tools	Dropper, Pad prototype

To test the absorbency of the pad prototype, a simulated menstrual fluid was prepared using a mix of saline, gelatin, and red food coloring to mimic the consistency and appearance of real menstrual blood. A dropper was used to apply the fluid onto the pad for controlled testing and observation.

Banana pseudo stem (fibers) were found to be strong with their natural fibers found inside the soft part of the banana plant stem. They are normally thrown away after harvesting bananas, but they are rich in cellulose and have good potential for reuse. These fibers are long and durable, which makes them a good base material for making sanitary pads.

6. DESIGN AND PROTOTYPING

The design and prototyping phase mainly involved two parts: first, molding and compressing the processed banana pulp to form the pad's absorbent core; and second, assembling the pad by combining all layers into the final product.

1.MOLDING

A 5-axis CNC machine was used to make the mold for the pad. The shape was first designed in SolidWorks to match the final look of the pad.

The mold was wooden molded and strong enough to resist against the compresion load aaplied to it while compressing.

1.COMPRESSION

After molding the pad shape, The gently compressed with the compressing machine in the UNIVERSITY OF RWANDA mechanical Lab, the banana fiber pulp to make it firm and keep everything in place. The core had to be soft but strong enough to stay together when used. The compression also helped remove extra moisture and gave the pad a cleaner, neater finish.

2.ASSEMBLY

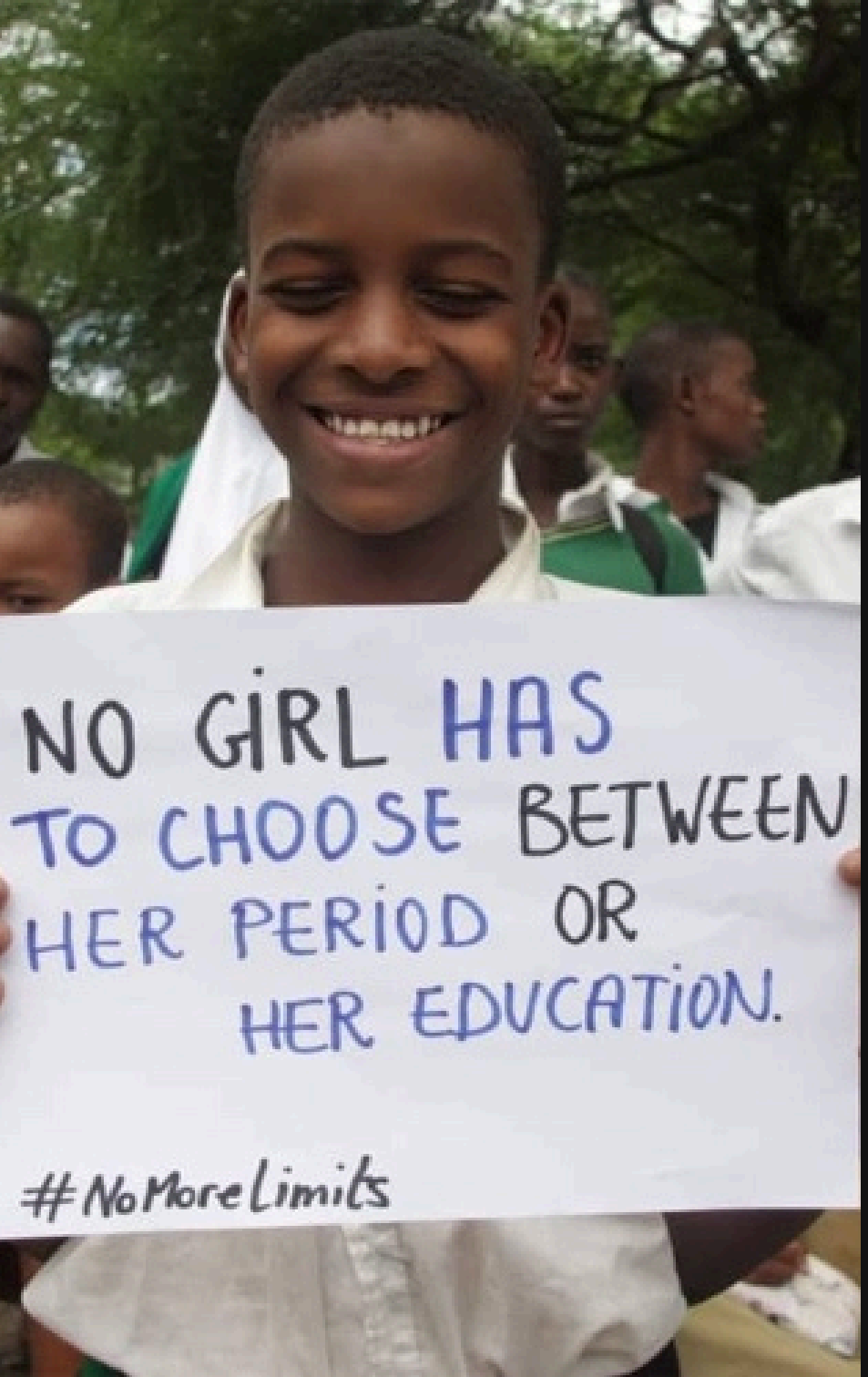
The core material of the pad got assembled with the outer layers of the pad.

The muslin material was used as It is Made from 100% cotton fibers, which are natural and break down easily in compost or soil.

It contains no synthetic fibers (like polyester or nylon), which makes it environmentally friendly.

7.CHALLENGES ENCOUNTERED

·Bleaching required experimentation to avoid weakening the fibers.
·The hand-processing of banana stems was labor-intensive.
·Ensuring hygiene without access to industrial-scale sterilization posed limitations.
·Moisture retention during drying stages required warm weather or controlled environments.



8.ENVIRONMENTAL AND SOCIAL IMPACT

The biodegradable sanitary pad project promotes environmental conservation byreducing plastic waste. The use of agricultural by-products like banana stems prevents them from going to waste. Socially, this innovation empowers women by providing affordable and dignified menstrual solutions.

9.BILL OF QUANTITIES

Qty	Description	UNIT PRICE	TOTAL PRICE
1kg	**Dried banana pseudostems**	4.00 $	4.00 $
1	**Sharp knife or scraper**	2.00 $	2.00 $
-	**Water**	-	-
2	**Bucket or soaking tank**	3.00 $	6.00 $
1 Bag	**Sodium Hydroxide (NaOH)**	8.00 $	8.00 $
500 ml	Vinegar	1.00 $	1.00 $
1 set	Gloves	5.00 $	5.00 $
1l	**Hydrogen peroxide**	13.00 $	13.00 $
10pcs	**Paper toel**	0.70$	13.00 $

Qty	Description	UNIT PRICE	TOTAL PRICE
100g	**Sodium CMC**	6.00 $	6.00 $
1	**Distilled water**	6.00 $	6.00 $
Local availabitiy 1m	**Organic cotton fabric**	6.00 $	6.00 $
2	**Cellulose fibers**	6.00 $	12.00 $
1 Bag	**Cornstarch bioplastic**	4.00 $	4.00 $
500 ml	PECTINASE	1.00 $	1.00 $
1 set	Olibe oil	12.00 $	12.00 $
1l	**aline**	8.00 $	8.00 $
1 Packet	**Dropper**	2.00 $	2.00 $

10.CONCLUSION

The goal during the development of this project was to understand sustainable menstrual hygiene, focusing on designing biodegradable sanitary pads derived from banana pseudostems.

This presented an opportunity to develop a fully compostable sanitary product.

The design would allow users to experience how natural materials can effectively meet hygiene needs while illustrating how conventional plastic-based pads harm ecosystems.

What's really special is how this connects people to nature in their daily lives. When women use these pads, they're part of a cycle - the same farms that grow bananas could one day supply materials for pads, and used pads could help those farms grow. It shows how we can take care of ourselves while taking care of the earth.

The final design isn't just a product - it's proof that simple solutions can make big changes. With just basic tools and ingredients, communities could make their own pads from local plants. This could mean cheaper, healthier products for women and less waste for the environment. It's a small idea that could grow into something much bigger.

11. References

- Chintan Madhu & Bharat Patel (2024)
- Mihitha Basnayake (2024)
- tudu2019.pdf
- EssentialChem, 1:1, 1-9.

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