Development of Sanitary Napkin Using *Ananas Comosus* Fiber for Eco-Friendly Product

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***Abstract*- This study examines the developing of a high-absorbent, environmentally friendly napkin using a special blend of pineapple (*ananas comosus)* fiber, cotton fiber, Tencel fabric, Thuthi (*abutilon indicum)* powder, and a super polymer sheet. The objective is to develop a skin-friendly, biodegradable, and sustainable substitute for traditional sanitary and hygiene products. Tencel fabric improves breathability and moisture wicking, while pineapple and cotton fibers add inherent softness and absorbency. Known for its antibacterial and therapeutic qualities, thuthi powder reduces infections and skin irritation by adding a natural healing element. To improve liquid retention and provide greater comfort and dryness, the super polymer sheet is added. This multilayered structure is a promising invention in the hygiene product industry because it is made to be highly efficient, economical, and biodegradable.**

***Index Terms*- Environmentally friendly, Biodegradable, Antibacterial, Moisture wicking**

INTRODUCTION

The building blocks of all fabrics and textile materials are called fibers in the textile industry. These structures are elongated and can be spun together to form yarn, which can then be knitted or woven into fabric. While synthetic fibers can add to the pollution caused by microplastics, natural fibers frequently biodegrade. The textile business is becoming more and more dependent on sustainable methods like recycling and organic farming. The tiniest visible element in any textile product is a fiber. The building blocks or basic unit of fabrics and textiles are textile fibers. Textile fibers can be woven or spun into yarn due to their pliability. Moreover, fibers play an important part in assessing the characteristics and functionality of produced textiles goods. Various factors, including the intended end-use, influence the choice of these fibers. necessary characteristics as well as environmental factors. Proper care and maintenance are essential to prolonging the life and quality of textile goods. whether they are textiles for clothing, home decor, or industrial materials. Both plant and animal fibers, including wool, silk, and feathers from chickens, can be found in natural sources. Examples of plant fibers include sisal, bamboo, coir, flax, hemp, kenaf, jute, ramie, oil palm, pineapple, banana, cotton, and so on. Because of its abundant supply, cheap cost, biodegradability, recyclable nature, and superior mechanical strength, natural fiber is gradually replacing synthetic fiber in various applications. Natural fibers also have the advantages of being widely available, inexpensive, non-toxic in the wild, and recyclable.

1.1. NATURAL FIBERS:

Materials used to make fabrics that come from plants, animals, or minerals are known as natural fibers in textiles. When considering the environmental impact of synthetic fibers, these fibers are less favorable due to their organic origin and biodegradability. Textiles made of natural fibers come from Plants, Animals, Minerals.

1.1.1. PLANT FIBERS: Plant materials such as seeds, leaves, stems, and fruits are used to make plant fibers for textiles. The comfort, ability to adapt, and sustainability of these fibers make them valuable. These textiles are also utilized in the manufacturing of apparel. Additionally, sheets, packing materials, and ropes are made from the plant fibers. For example, the coir that is extracted from the coconut is utilized to make industrial ropes. Many people are able to earn a living by using cotton as a fiber in the creation of textiles. Bags for carrying products are made from jute fiber, which is also environmentally beneficial and reusable. Fibres from Plants: Cotton, Linen, Jute, hemp, sisal, ramie, etc…

PROPERTIES: Biodegradability, Breathability, Thermal Insulation, Strength and Durability, Elasticity, Aesthetic Appeal, Chemical Resistance, Comfort, Color Retention, Flame Resistance.

USES: Apparel, Home Textiles, Industrial Textiles, Sustainable Fashion.

1.1.2. ANIMAL FIBER:

The natural fibers that come from animals are called animal fibers. These fibers are often composed of many protein types. Wool and silk are two of the most often used types of animal fibers. It's crucial to remember that animal fibers derived from various species typically have unique characteristics. Animal fibers like wool, cashmere, and alpaca are highly valued when used to make clothing because they have desirable qualities like warmth, softness, and drape. They are also very comfortable to wear, and when combined with contemporary synthetic dyes, they offer an unmatched range of color options with minimal shade restrictions. Fibres comes from Animals: Wool, Silk, cashmere, silk, etc…

PROPERTIES: Natural Insulation, Breathability, Durability, Aesthetic Appeal.

USES: Clothing, blankets, carpets, and insulation materials, High-end garments, ties, and luxury home textiles, Sweaters, shawls, and other luxury items.

1.2.3. MINERAL FIBERS:

The term "mineral fiber" refers to any non-metallic inorganic fiber. Inorganic natural sources are the source of mineral fibers. Mineral fibers are less significant in the textile industry. Asbestos and glass are the two most often utilized natural mineral fibers. However, among the mineral fibers, asbestos (AS) is the most significant and practical fiber material. Asbestos is found in nature as fiber. Melted rock or slag is blown with air or steam to create a synthetic mineral fabric called rock wool or slag wool. In addition to being soft and flexible, it is an excellent insulator of heat, electricity, and corrosion. Thermal insulation and fireproofing products contain mineral fibers as fillers. Fibers from Minerals: Asbestos, Basalt Fiber.

PROPERTIES: Fire Resistance, Thermal Insulation, Chemical Resistance, Strength and Durability, Low Moisture Absorption.

USES: Fireproof Textiles, Insulation Material, Reinforcement Materials, Protective Clothing.

1.2. *ANANAS COMOSUS* FIBER

The leaves of the pineapple plant, Ananas comosus, are used to make pina fiber, a natural textile fabric. This fiber is extensively utilized in many different textile applications because of its unique properties, luxurious feel, and eco-friendly production. Pineapple fiber comes from the pineapple plant's big, prickly leaves. The extraction process involves removing the fibers from the leaves, which are sometimes considered agricultural waste, after the fruit has been picked. Piña fiber has been used for decades in the Philippines and other tropical nations, where it is usually woven into fabric for handicrafts, clothing, and home textiles.

1.3.1. PROPERTIES OF *ANANAS COMOSUS* FIBER:

- Breathable and lightweight: *Ananas comosus* fiber is renowned for being lightweight, which makes it cozy to wear in warm weather. Good air circulation is made possible by its breathability, which improves comfort.
- Luster: Fabrics created from piña have an opulent appearance due to the fiber's inherent gloss. This luster is highly sought-after for luxury textiles since it is frequently likened to silk.
- Durability: The strength and resilience of *Ananas comosus* fiber, in spite of its light weight, add to the fabrics' extended lifespan.
- Biodegradability:*Ananas comosus* fiber is an eco-friendly option for textile production because it is a natural fabric that decomposes naturally.
- Hypoallergenic: *Ananas comosus* fiber is generally hypoallergenic, so people with sensitive skin can use it.

1.3.2. USES:

- Traditional Garments: In the Philippines, pina fabric is commonly used to make traditional garments such as barong Tagalog and formal wear, valued for its elegance and cultural significance.
- Home Textiles: *Ananas comosus* fiber can be woven into table linens, curtains, and decorative items, adding a touch of sophistication to home decor.
- Accessories: The fiber is also used in making bags, hats, and other fashion accessories, capitalizing on its lightweight and breathable qualities.
- Sustainable Fashion: With growing interest in eco-friendly materials, pineapple fiber is increasingly being incorporated into modern fashion collections, appealing to consumers looking for sustainable alternatives to synthetic fabrics.

1.3.3. ADVANTAGES OF *ANANAS COMOSUS* FIBRE:

- Sustainability: Since *Ananas comosus* leaves are derived from agricultural waste that would otherwise be thrown away, *Ananas comosus* fibers are an environmentally beneficial choice. As a result, less trash is produced and less new resources, such as water or land, are needed.
- Biodegradability: *Ananas comosus* fibers naturally disintegrate over time, minimizing their environmental impact, in contrast to synthetic fibers.
- Durability: The strength and durability of Pinatex are well-known. Because of the fibers, a strong, durable material is produced that can be used for upholstery, purses, and shoes.
- Lightweight: The fibers offer a nice compromise between performance and comfort because they are robust but lightweight.
- Breathability: The air circulation caused by *Ananas comosus* fibers makes garments and accessories comfortable to wear.
- Cruelty-free: Since Pinatex is a plant-based alternative, it offers a vegan option for consumers looking to avoid animal-derived products like leather.
- Low Maintenance: Products made from *Ananas comosus* fibers are generally easy to maintain and clean, with a resistance to stains and wear.

- *ABUTILON INDICUM*:

Abutilon indicum, a member of the Malvaceae family, is a multipurpose medicinal plant that is also known as Indian Mallow or Atibala. It is widely distributed throughout tropical and subtropical regions, including Africa, Australia, Southeast Asia, India, and Sri Lanka. This perennial shrub, which can grow up to three meters in height, has broad, heart-shaped leaves with serrated edges, vivid yellow to orange funnel-shaped blooms, and tiny capsule-like fruits that contain many kidney-shaped seeds. It thrives in warm climates and well-drained soils, and is often found along roadsides, riverbanks, agricultural fields, and wastelands. Due to its restorative and fortifying properties, the plant is highly valued in traditional medicine, especially in Ayurvedic, Siddha, and Unani systems, where it is known as "Atibala."which means "very strong." Abutilon indicum has been used medicinally for centuries in many different forms. The roots are often used in decoctions to treat fevers, diarrhea, and urinary tract infections due to their well-known digestive, diuretic, and anti-inflammatory properties; the leaves are applied as a paste to wounds and skin infections due to their antimicrobial and wound-healing properties; the blossoms, which are rich in flavonoids and antioxidants, are used to treat bronchitis, urinary tract issues, and respiratory illnesses; and the seeds are often used in formulations to improve immunity, reproductive health, and digestion due to their well-known aphrodisiac and laxative properties.

1.4.1. PROPERTIES OF *ABUTILON INDICUM:*

Anti-inflammatory: Decreases discomfort and swelling.

Antimicrobial: Combats fungal and bacterial illnesses.

Wound Healing: Encourages the renewal of tissue.

Antioxidant: Prevents oxidative stress.

Calm and Skin-Friendly: Prevents rashes and irritation.

Diuretic & Laxative: Promotes kidney and digestive health.

1.5. TENCEL FIBER:

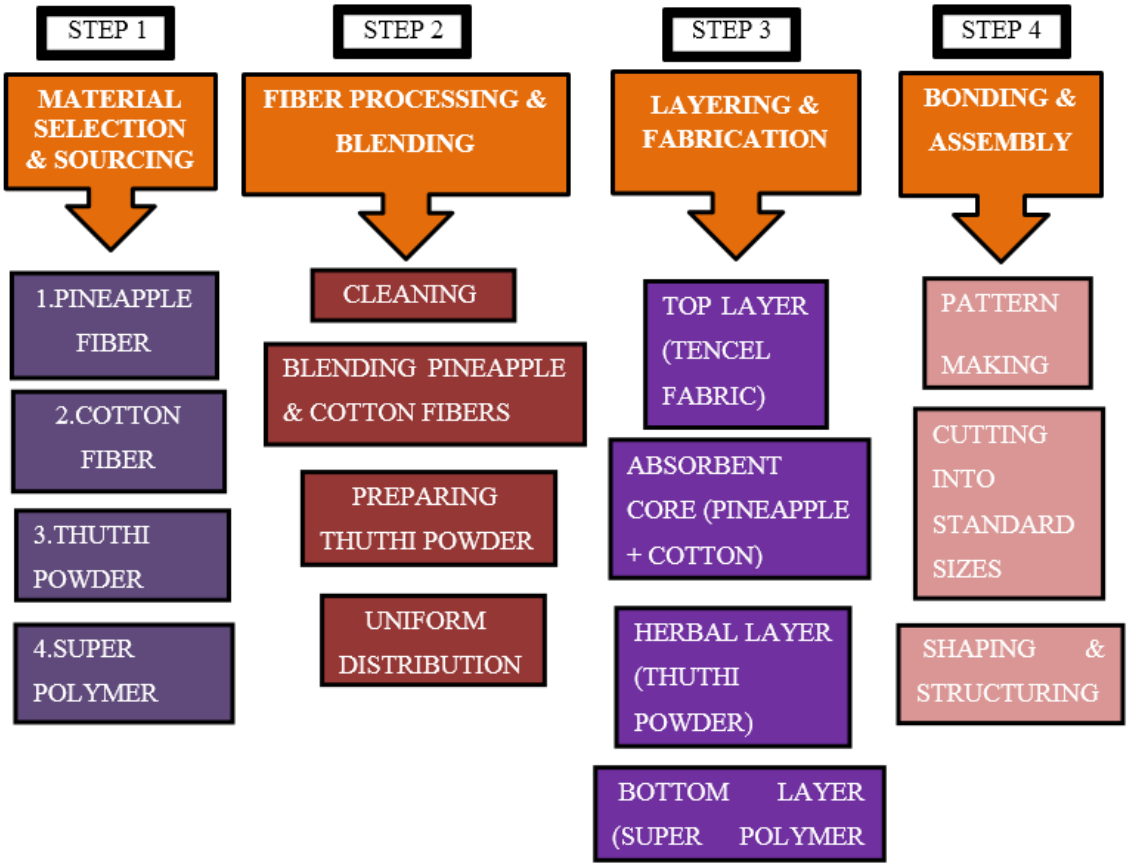
As the term "functional textile" has become more widely used, the situation has become more complex. For many years, the purpose of textiles was fairly simple: synthetic fibers stood for strength and ease of maintenance, while hydrophilic natural fibers, like cotton and wool, and man-made cellulosic fibers stood for absorbency and breathability. The synthetic fiber industry has been developing new products and marketing strategies for sportswear and other industries that claim improved "physiological function in textiles."Consumers have grown to trust these promises, and while hydrophilic fibers might be superior, synthetic fibers are widely regarded as the best choice for active sportswear. To solve the problem, Lenzing AG, a significant producer of cellulosic fibers, decided that a deeper comprehension of the "inherent physiological properties and functions" of hydrophilic fibers was necessary. A study program was started to look into the inherent properties of fibers using cutting-edge methods and approaches. The objective was to compile the evidence needed to persuade our clients of the superior "inherent functionality" of Lenzing's cellulosic fibers and the reality that, in many cases, the creation of a "functional textile" may be accomplished without the employment of highly intricate functional synthetic fibers and finishes. The "inherent physiological fiber properties" of Lenzing's

hydrophilic fibers are stated in this article, but no specific textile product development opportunities are examined.

2.1. OBJECTIVES

- To reduce environmental waste by creating a biodegradable napkin with natural fibers like cotton, pineapple, and Tencel fabric.
- High Absorbency & Comfort By blending cotton and pineapple fibers, this product ensures better moisture retention and softness for increased user comfort.
- Thuthi powder's antibacterial and skin-soothing qualities will help to avoid infections and irritation.
- Better protection is ensured by integrating a super polymer film for enhanced liquid retention and leak avoidance.
- Tencel fabric promotes better air circulation and moisture wicking, which keeps the napkin fresh and dry.

3.1. METHODOLOGY



3.1.2. PROCESS OF *ANANAS COMOSUS* FIBER:

Raw Materials

The pineapple (Ananas Comosus) leaf sample was gathered from Hawassa, which is a rural village on farmers' property. In this work, fibers were produced using this raw material as a substitute. Following leaf collection, fiber is made by hand utilizing decortication techniques, retting chemicals, and other processes. When producing fiber, use a clamshell to remove any leftover waste from the fiber's surface, running water to prevent knotting, and soap of any type to wash the fiber until it turns white. Lastly, use a drying machine or the sun to dry the fiber.

Within three to four days of harvest, the extraction procedure had to be completed. Longer storage causes the leaves to dry out and make it harder to remove the fibers. The leaves were weighed and measured, and different methods for removing the fibers embedded in them were tried. The leaves were covered in a thick layer of hydrophobic wax, which made it difficult to remove the fibers. Simple tools and techniques like scraping with a clamshell and a knife were used to do this.

3.1.2.1. *ANANAS COMOSUS* FIBER EXTRACTION

Pineapple fibers are manually removed from pineapple leaves using a mix of scraping and water

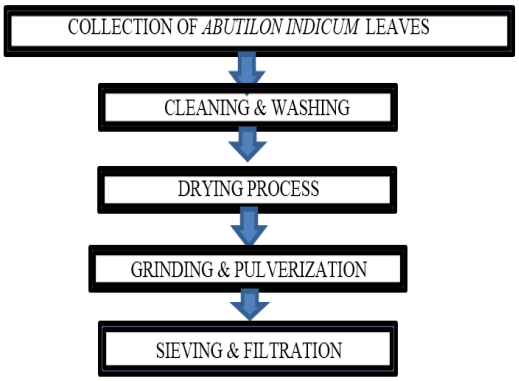
retting. After being fully cleaned and dried, the fiber output ranges from 2.5 to 3% of the weight of the green leaves. After 18 days in water, pineapple leaves produce high-quality spinnable fibers. The fiber's strength is severely reduced by microbes if it is soaked in water for longer than eighteen days.

In manual The leaf's hydrophobic waxy coating was scraped off using a dull knife or a broken plate. To prevent damage to the fibers and cutting of the leaves, it required a great deal of patience and care. The leftover wax layer on the removed fiber could be cleaned using a soft wire brush and clamshell. It took a lot of time and was laborious. Because the clamshell was used, some of the fibers were damaged, which could lead to some waste. The fibers might be easily removed by scraping the leaves. Fibers were successfully extracted using a mixture of extraction technologies.

Fibers are removed either manual (hand) or machine processing. The fibers were extracted as long, somewhat yellowish threads. After being cleaned and dried, the fibers are gently combed in a wet condition using tiny pins that move slowly to separate the coarser bundles and produce fine strands that are noticeably longer.

ANANAS COMOSUS FIBER EXTRACTION PROCESS

3.1.3. ABUTILON INDICUM POWDER EXTRACTION:

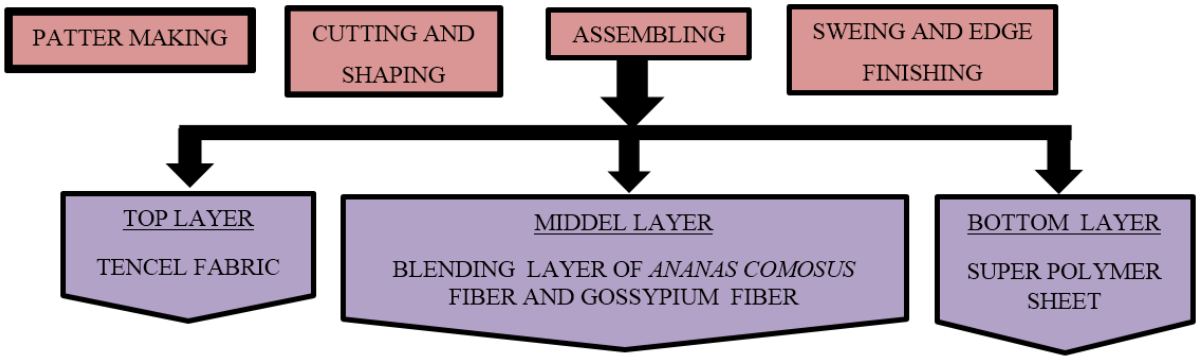


- Collection of Abutilon Indicum Leaves - Select fresh, mature leaves from healthy plants.
- Cleaning & Washing - Remove dirt, dust, and impurities - Wash thoroughly with clean water .
- Drying Process - Sun-dry or shade-dry leaves to remove moisture - Ensure proper air circulation to prevent mold growth.
- Grinding & Pulverization - Crush dried leaves into coarse powder - Use a grinder or pulverizer for fine powder consistency.
- Sieving & Filtration - Pass the powder through a fine mesh sieve - Remove coarse particles for uniform texture.
- Packaging & Storage - Store in airtight, moisture-free containers - Maintain in a cool, dry place for preservation.

3.1.4. SWEING STEPS FOR NAPKIN:

- Cut the flannel top and bottom layers (as well as the liquid-proof liner layer) to the same size as the completed pattern.
- Cut two holding pieces that are each ½" x 3".
- In order to fold the pad inserts, cut six 8" x 18" rectangles.
- Put the pad holder together
- Stack the top, liner, and bottom layers together, then sew around the pad holder's whole edge. (Topstitch and zigzag stitch are alt.)
- Make sure the vinyl liner is facing up for dependable fluid-proofing and pleasant wear.
- Stitch the holding strips into place on the top layer. Repeatedly topstitch the front holding strip ends, then topstitch the back holding strip ends in a straight line.
- Attach Velcro to the top and bottom of one wing, respectively, to create a closing. Sew in place.

3.1.4.1. FLOW PROCESS OF SUSTAINBLE SANITARY NAPKIN:



SUMMARY

In this project, pineapple fiber, cotton fiber, thuthi powder, Tencel fabric, and a super polymer sheet are used to create an environmentally friendly sanitary napkin. The napkin is an environmentally beneficial substitute for traditional synthetic goods because of its excellent absorption capacity, skin-friendliness, and biodegradability. Tencel fabric provides comfort and breathability, while cotton and pineapple fibers provide exceptional absorbency and durability. Long-term usage of the napkin is safe since thuthi powder (Abutilon Indicum) has antimicrobial and skin-soothing qualities. By improving leakage prevention, the super polymer sheet guarantees dependability. This napkin decreases non-biodegradable trash and its carbon footprint by substituting biodegradable materials, such as PLA sheets, for plastic-based ones. The initiative emphasizes comfort, health, and environmental conscience in order to demonstrate a sustainable approach to menstruation hygiene.

CONCLUSION

The creation of a sustainable, biodegradable, and skin-friendly sanitary napkin utilizing pineapple fiber, cotton fiber, thuthi powder, Tencel fabric, and a super polymer sheet provides an alternative to traditional synthetic-based goods. The infusion of Thuthi powder strengthens the antibacterial and calming qualities of this napkin, which also guarantees good absorbency, comfort, breathability, and leakage prevention.

By using natural and biodegradable materials, this invention lessens the amount of plastic waste produced by conventional napkins while also promoting environmental sustainability. Utilizing PLA sheets or other biodegradable backsheet materials guarantees that the final product will continue to be compostable and environmentally friendly.

This initiative prioritizes women's comfort, health, and sustainability, exhibiting a comprehensive approach to menstruation hygiene. With more investigation and improvement, these napkins may prove to be a profitable substitute for more conventional ones reduce environmental impact while providing superior performancer

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