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# DEVELOPMENT OF CALOTROPIS GIGANTEA–COTTON BLENDED FIBERS FOR HOME TEXTILE APPLICATIONS

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**Abstract**

The need for eco-friendly textile materials has spurred more study into using unusual natural fibers. Often referred to as milkweed or erukkam, Calotropis gigantea is an underutilized plant fiber with special qualities like hollow shape, lightweight structure, and biodegradability. This study investigates the creation of novel home textile uses by combining Calotropis fibers with cotton. The study looks into yarn development, fabric properties, fiber properties, and the viability of blending. According to the results, mixes of cotton and calotropis have improved softness, thermal insulation, and environmentally friendly qualities while retaining enough tensile strength for use in home furnishings. According to the results, Calotropis has the potential to be a sustainable substitute for creating useful and valuable textiles.

## 1. INTRODUCTION

The Asclepiadaceae family's wild shrub Calotropis gigantea produces silky floss fibers around its seeds and bast fibers from its stem. The fibers are lightweight, hollow, hydrophobic, and biodegradable [2], and their blending with cotton offers potential for eco-friendly, functional textiles, especially in home textile applications like cushion covers, curtains, upholstery, and thermal insulators. The global textile industry is increasingly focusing on sustainability and renewable resources to reduce environmental impact.

Global textile industry is increasingly focusing on sustainability and renewable resources to reduce environmental impact. Cotton, though widely used, requires high water consumption and pesticide usage, making blending with alternative fibers an attractive solution [1].

Calotropis gigantea, a wild shrub belonging to the Asclepiadaceae family, produces silky floss fibers around its seeds and bast fibers from its stem. Traditionally neglected due to processing challenges, Calotropis fibers are lightweight, hollow, hydrophobic, and biodegradable [2]. Their blending with cotton offers potential for eco-friendly, functional textiles, particularly in **home textile applications** such as cushion covers, curtains, upholstery, and thermal insulators.

This paper investigates the blending feasibility of Calotropis with cotton to develop innovative, sustainable textiles.

**REVIEW OF LITERATURE**

Since natural fibers have supported the textile industry for millennia, research has concentrated on sustainable substitutes for synthetic fibers in recent decades. Bananas, pineapple leaves, bamboo, hemp, coir, and other non-traditional fibers have all been effectively incorporated into textile constructions to enhance their ecological performance [3], [6].

**CALOTROPIS GIGANTEA FIBER CHARACTERISTICS**

Calotropis yields two kinds of fibers: stem bast fibers and seed floss. The seed floss is a great option for insulating applications since it is low density, lightweight, hollow, and silky [2, 4, 7]. Similar to jute, the coarser, lignocellulosic bast fibers have the ability to mix when spun [8]. Researchers have found that the mechanical characteristics of Calotropis fibers are influenced by their cellulose (~60–65%), hemicellulose (~18–20%), and lignin (~12–15%)

**Figure 1: Calotropis gigantea**

Prior research showed that Calotropis floss might be used in place of kapok in cushions, pillows, and materials for thermal and acoustic insulation [7]. Calotropis seed fiber nonwoven textiles were found to be water-repellent, lightweight, and appropriate for sanitary and medical uses[10].

**BLENDING STUDIES:**

Calotropis and cotton have demonstrated promise in enhancing comfort and thermal insulation while lowering material costs [5, 11]. According to reports, performance and sustainability can be balanced by including up to 20–30% of uncommon fibers (banana, pineapple, hemp, or milkweed) [6], [12]. According to mechanical research, air permeability and insulation greatly improve with increasing Calotropis percentages, whereas tensile strength declines [11].

**SUSTAINABILITY PERSPECTIVE:**

Calotropis shrubs grow abundantly in arid and semi-arid regions of South Asia, require no irrigation, pesticides, or fertilizers, and can be harvested with minimal environmental impact [13]. This makes them ideal for sustainable textile innovations aligned with eco-friendly production goals.

**MATERIALS AND METHODS**

**MATERIALS:**

- **Calotropis gigantea fibers** were extracted from seed floss and bast stem by retting and mechanical separation.
- **Cotton fibers** (40s count, medium staple length) were procured locally.

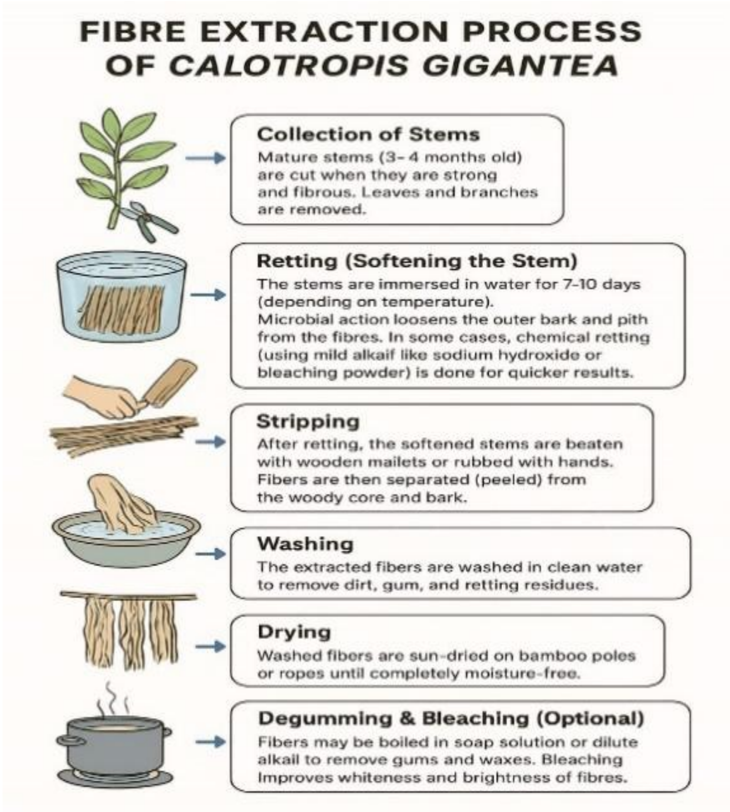


**Figure 2: Fibre Extraction method**

**BLEND RATIOS:**

Blends of Cotton:Calotropis were prepared in ratios of 100:0, 90:10, 80:20, and 70:30.

**Yarn and Fabric Development:**

- Fibers were carded and spun into yarn using ring spinning.
- Woven fabrics were prepared (plain weave, 30 × 30 density).

**Testing Methods:**

- **Tensile strength** (ASTM D2256)
- **Air permeability** (ASTM D737)
- **Thermal conductivity** (Lee’s disc method)
- **Moisture regain** (oven-dry method)

**Results and Discussion**

**Table 1. Properties of Cotton–Calotropis Blended Fabrics**

| Blend Ratio (Cotton:Calotropis) | Tensile Strength (MPa) | Air Permeability ($cm^3/s/cm^2$) | Thermal Conductivity (W/mK) | Moisture Regain (%) |
|---|---|---|---|---|
| 100:0 | 32.5 | 5.2 | 0.041 | 7.8 |
| 90:10 | 30.1 | 6.0 | 0.038 | 7.1 |
| 80:20 | 28.6 | 6.8 | 0.035 | 6.9 |
| 70:30 | 26.9 | 7.2 | 0.033 | 6.5 |

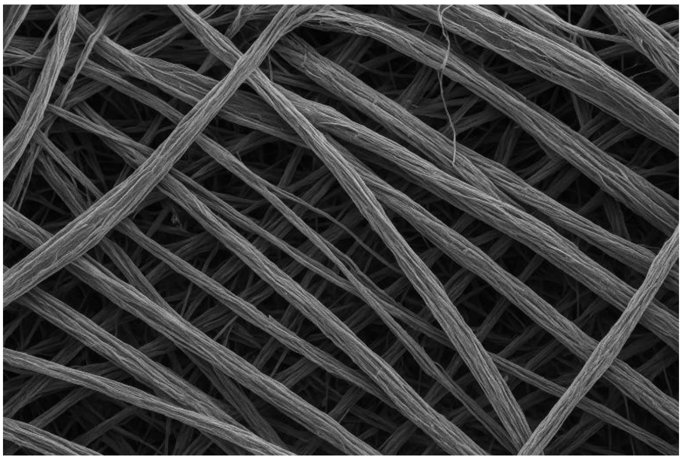

**Figure 2. SEM Micrograph of Calotropis Fiber (showing hollow structure)**

**Discussion:**

- Air permeability increased, making fabrics more breathable—suitable for home textiles;
- Blends' tensile strength marginally declined as their Calotropis content increased because of its weaker structure in comparison to cotton.
- Blends with lower thermal conductivity had superior insulating qualities; moisture regain was slightly decreased, which was advantageous for lightweight, fast-drying applications. All things considered, mixes containing up to 20% Calotropis provided household textile items with balanced performance.

**Conclusion**

For sustainable home textile applications, the study shows that it is possible to combine Calotropis gigantea fibers with cotton. Cotton guarantees comfort and durability, while caloriptis improves breathability, thermal insulation, and environmental friendliness. Performance is best with 80:20 cotton:calotropis blends.

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