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A Feasibility Study Of Use Of Corn Cotton Blended Fabric In Apparel Industry

Nidhi Thakur[1*], Dr. Kalpana Munjal[2]

[1*]Research Scholar, Faculty of Design, Vivekananda Global University, Rajasthan, India
[2]Associate Professor, Faculty of Design, Vivekananda Global University, Rajasthan, India

Abstract

The garment business has a huge environmental effect. Cotton, a popular garment fabric, is water- and pesticide-intensive to produce. Sustainable corn-cotton mixed cloth replaces cotton. Its corn-cotton combination lowers water and pesticide use. Corn-cotton hybrid cloth has less carbon impact than cotton. This research examines the viability of corn-cotton mixed clothing fabric. Corn-cotton mixed fabric's environmental effect, characteristics, and commercial possibilities are examined. The research also examines corn-cotton mixed fabric marketing difficulties and potential. The research suggests that corn-cotton hybrid fabric may replace cotton in garments. It offers equivalent fabric characteristics, lesser environmental impact, and high commercial potential. Production costs and customer ignorance prevent corn-cotton mixed fabric from being commercialized. The increased demand for sustainable materials and awareness of the garment industry's environmental effect provide business potential. Consumer preferences for corn-cotton mixed fabric were also tested. The sample indicated that corn-cotton mixed fabric is popular with customers, particularly those concerned about the environment. This research suggests that corn-cotton hybrid fabric might replace cotton in garments. However, further study is required to overcome commercialization obstacles and create cheaper manufacturing techniques.

Keywords: Feasibility study, Corn-Cotton Blended Fabric, Apparel industry, Sustainability, Eco-friendly, Fabric Properties, Rajasthan

1. INTRODUCTION

A relatively recent breakthrough in the textile sector is corn fiber. The Dow Chemicals and Cargill Inc. teamed together to create Cargill Dow Polymers LLC, which created maize fiber. Ingeo fiber is another name for corn fiber. A lot of corn's starch are separated by producers from the plant's filaments and changed over into sugars, which are then matured and isolated into polymers (Sachwani, 2021). The maize filaments are presently glue-like materials that are expelled into fine strands and afterward slashed, checked, brushed, and turned into yarn. The remainder of the process is identical to how wool is processed apart from the chemical steps.

Figure: Corn

Corn fiber is a synthetic fabric manufactured completely from materials that are regenerative every year. These fibers compliment the qualities of natural items like cotton and wool while still having the performance benefits often associated with synthetic materials (Dhir, 2021). Lactic acid, a component of maize fiber, is made by first becoming corn starch into sugar and afterward aging the subsequent item to make lactic corrosive. The advantages of lactic corrosive, which is a common molecule and is regarded to be a sleeping giant, include: Biomass may be used to create it; it contains a carboxylic acid group as well as a hydroxyl group; it has optical activity.
Corn fiber cloth is inexpensive, simple to maintain, also, exceptionally charming to wear. Also, it is UV and stain safe (Zhang, et. al. 2020). Various purposes for this texture incorporate prepared to-wear, diapers, beds, carpeting, and upholstery. Additionally, since less fuel is used in the creation of this cloth, it is also environmentally sustainable.

Figure: Corn Fiber

Industrial-scale production of the polymer needed to create corn fiber spins on the maturation, refining, and polymerization of maize dextrose, a basic plant sugar. There are less greenhouse gases emitted to the environment as a result of the production and usage of maize fiber (Jose, et. al. 2020). The main cause of climate change on a global scale is greenhouse gases. Composability and chemical recyclability imply that the whole life pattern of creation, utilization, removal, and once again use is conveniently shut under the proper circumstances and with the appropriate treatment.

1.1. Importance of Study: The fiber offers exceptional quality characteristics, is fully eco- friendly, and is produced only from maize. The characteristics of maize fiber include:
Corn fiber is available in a broad range of counts, from miniature denier for the lightest materials to high counts for additional sturdy purposes, in both spun and filament form. It comes from sugars found in plants that exist naturally. Dissimilar to petrol-based products, which must be discarded through warm reusing, actual reusing, or landfill, items may be recycled as they reach the end of their useful lives and then given back to the environment. In textiles, corn fiber strikes a balance between comfort, softness, and drape with strength and resilience (Devi, et. al. 2019). Incredibly, corn is inherently flame resistant and needs no chemical additives or surface treatments. It is said to offer exceptional moisture management capabilities and no odor retention, providing the user with the utmost comfort and assurance.
The filament made from corn fiber is reported to have a soft sheen, a flowing drape, and a natural hand, making it a novel material to inspire creativity. By using corn fibrefill in place of polyester and nylon blends in padded clothing, manufacturers of outerwear may provide a fuller narrative and a more ecologically sustainable option. It is said to function better than other synthetics in terms of UV light resistance, maintaining strength, colour, and characteristics over time. Independent, easy-care studies that included both washing and dry-cleaning have shown that the article of clothing made of corn fiber can be cleaned utilizing customary washing and drying gear. Independent tests have shown that corn fibers perform better or as well as polyester in significant dynamic wear applications.

1.2. Advantages of Corn Fibre

- In view of its high dissolving point, high crystallization degree, phenomenal lucidity, and high strength (which is equivalent to that of customary poly fiber), the fiber has a wide range of applications.
- The corn fiber resembles lustrous silk in appearance, hand feel, brightness, and other ways. According to reports, clothing made of maize fiber has outstanding after-wash look, rapid drying, and high dirt release.

1.3. Disadvantage of Corn

- The material made of corn fiber is excessively hard and weak.

1.4. Process of Making Corn Fiber

Wet milling is mostly used as the first stage in the process of extracting starch from biomass. By utilizing bacteria from the homolactic (Khan, et. al. 2022). Lactobacteriaceae family in a fermentation process, the starch is changed into dextrose, which is consequently changed into lactic corrosive. Condensation-collected monomer lactide that has been vacuum-distilled to remove impurities. We extract PLA resin from lactide utilizing a dissolvable free strategy like ultrafiltration, nanofiltration, and particle trade.
There are two optical isomers of lactic acid: L-isomer and D-L isomer. Solvent at high pressure and high vacuum is needed to create the polymer from the D-L isomer using direct build-up. Thus, L isomer is utilized. In the first place, lactic corrosive was consolidated to make short chain PLA (Wubneh, et. al. 2022). After that, vacuum distillation transforms it into lactic acid. Distillation doesn't need the use of a solvent. Ring-opening polymerization is the last phase.

1.5. Challenges

1. Endurance: Addressing concerns about the fabric's endurance and aesthetic appeal is one of the problems of corn-cotton blends. For the fabric to be widely used, it must be made sure that it keeps up its quality and appeal throughout time.

2. Specialized knowledge in manufacturing processes and procedures is necessary for the effective deployment of corn-cotton mixed fabrics (Ratna, et. al. 2022). Finding and training experienced workers who can efficiently use and maximize the manufacturing of corn-cotton mixed fabric may be difficult for the business.

1.6. Opportunities

1. **Green Manufacturing Practices:** Using fabric made of a corn-cotton mix supports sustainability and environmental responsibility. This gives clothing producers the chance to use more environmentally friendly manufacturing techniques and boost their image as ethical and sustainable companies.
2. **Growing Customer Preference for Sustainable Products:** Consumers are increasingly looking for apparel that is ecologically friendly (Liu, et. al. 2023). The usage of fabric made from a corn-cotton mix gives clothing producers a chance to fulfil this need and satisfy the rising consumer desire for environmentally friendly, sustainable materials.
3. **Improving Sustainability in the clothing sector:** The clothing sector may support overall sustainability efforts by introducing fabric made of a corn-cotton mix into their product lines. This entails lowering the industry's environmental effect and fostering a more sustainable future by decreasing water use, pesticide use, and carbon footprint.

1.7. Properties of Corn Fiber

- Strength and opposition are coordinated with solace, non-abrasiveness, and wrap in materials on account of the creative way that corn fiber mixes the characteristics of regular and manufactured strands.
- Corn fiber has outstanding moisture management properties and is inherently flame retardant.
- Corn fiber is an excellent carpet fiber for the house and transportation because of its excellent stain resistance capabilities (Bolat, et. al. 2021). It additionally requires no compound options or surface medicines and is innately fire resistant.
- 170 degrees Celsius is the melting point.
- The heat setting is carried out for 30 seconds at 125–130 degrees Celsius.
- The polymer will degrade by hydrolysis, especially in aqueous high-temperature and alkaline environment.

2. LITERATURE REVIEW

Ozougwu, & Ogbonnaya, (2021) -The research evaluated the organoleptic properties of textiles made using starch that was taken from three particular dietary sources. The research specifically examined the organoleptic qualities of three samples of textiles made using starch taken from local foods such russet potatoes, maize, and rice. experiment design was employed. Following accepted practices, starches were extracted from the samples. Size solution was created using the technique described by Lata and Mehta (2012). A cotton mix (cotton/polyester 60/40%), 100% coloured cotton, and three separate 20 × 20 cotton fabric samples were created. The fabric samples were sized, given time to dry, and then pressed in accordance with normal procedure for organoleptic analysis. Utilizing rating scales, data were gathered in three steps and then analysed using descriptive statistics.

Jhanji, (2023)- Despite being one of the main sectors for creating income and providing jobs, the textile and apparel industry is nonetheless tarnished and given a poor reputation because of its negative effects on the environment throughout its whole supply chain. Cotton and synthetic fibers are the main raw materials used in the textile and accessory industries to make a variety of clothing applications. In addition to polluting the groundwater and air, the extensive use of pesticides to improve yield also reduces soil fertility. Environmental issues are also raised by synthetic fibres' inability to break down and the emission of methane by wool during landfill decomposition. In addition to the purchase phase, the production line also includes the energy and chemical-intensive processes of dyeing, printing, and bleaching.

Bao, et. al. (2023)- The issue of pollution in the textile and garment industries has become much worse due to the acceptance of fast fashion and consumer addiction. Researchers have created a variety of biodegradable polymers for textiles and clothing to address this issue. However, the present study ignores the practical use and growth trend of biodegradable materials in the textile and clothing sector and instead concentrates only on the characteristics of a single material. To better understand the state of biodegradable material research and use in the textile and apparel industry, a thorough review of the subject has been done in this work.

Eren, et. al. (2020)- the most often used textile components when using terry-woven textiles for water-related purposes. This kind of fabric is produced with loop pile, usually spanning the full surface, on one or both sides. Ground warp, pile warp, and weft yarns are the three yarn systems used to create these textiles. Because of their cosy, breathable, and soft construction, consumers choose ready-made bathrobes and towels. These goods transmit the moisture and dry fast. Terry towel textiles may be made from a variety of absorbent fiber mixes, such as cotton, flax, bamboo, Lyocell, etc. The purpose of this study is to examine overall towel fabric absorbency characteristics in relation to fiber type. Towel fabrics with varying yarn counts of ground warp and weft yarn were assessed for comfort features such as wicking, drop test, immersion test, and air permeability properties. The materials used were 100% cotton, 70% cotton, 30% bamboo, and

100% micro cotton. According to test findings, terry towel fabrics created from various fiber blends exhibit varied water absorption behaviour and air permeability in relation to their fiber type.

Yang, et. al. (2021)-The fiber made of poly (lactic acid) (PLA) was created more than ten years ago. It is believed to be the most suitable practical and biodegradable fiber to replace ordinary polyester made of polyethylene terephthalate (PET) in material products. This study looks at current headways in the polymerization of PLA, turning of PLA fiber and fiber, turning of staple yarn, production of textures, colouring and completing procedures, and aftercare processes. Albeit the properties of PLA fiber and PET fiber are by and large comparable, the distinctions between the two, for example, warm corruption and low hydrolytic protection from solid soluble, fundamentally affect the technique decision and boundary setting for the creation and handling of PLA filaments and textures. Albeit two- step liquefy turning is the essential strategy used to make PLA fibers, disintegration at high temperatures is as yet a test.

2.1. Research Objectives

- To determine the viability of employing corn-cotton mixed fabric in the Rajasthan garment business.
- To assess fabric qualities, environmental effect, and customer acceptability.

3. RESEARCH METHODOLOGY

3.1.Research Approach

To get insight and comprehend 140 consumers' perspectives, preferences, and feasibility concerns about corn-cotton mixed fabric in the garment business in Rajasthan, the qualitative research technique will be used. This method may be used to record verbally stated attitudes, ideas, and beliefs.

3.2. Sample Selection

In Rajasthan, 140 clients from the garment business would be chosen via convenience sampling. Customers from various locations and demographic groups will be included in the sample, guaranteeing a broad representation.

3.3. Research Strategy

As part of the research plan, case studies will be done, with the 140 clients serving as the primary analytical unit. A thorough grasp of consumer opinions on the viability of corn- cotton blended fabric in Rajasthan's garment sector will be provided by this in-depth investigation.

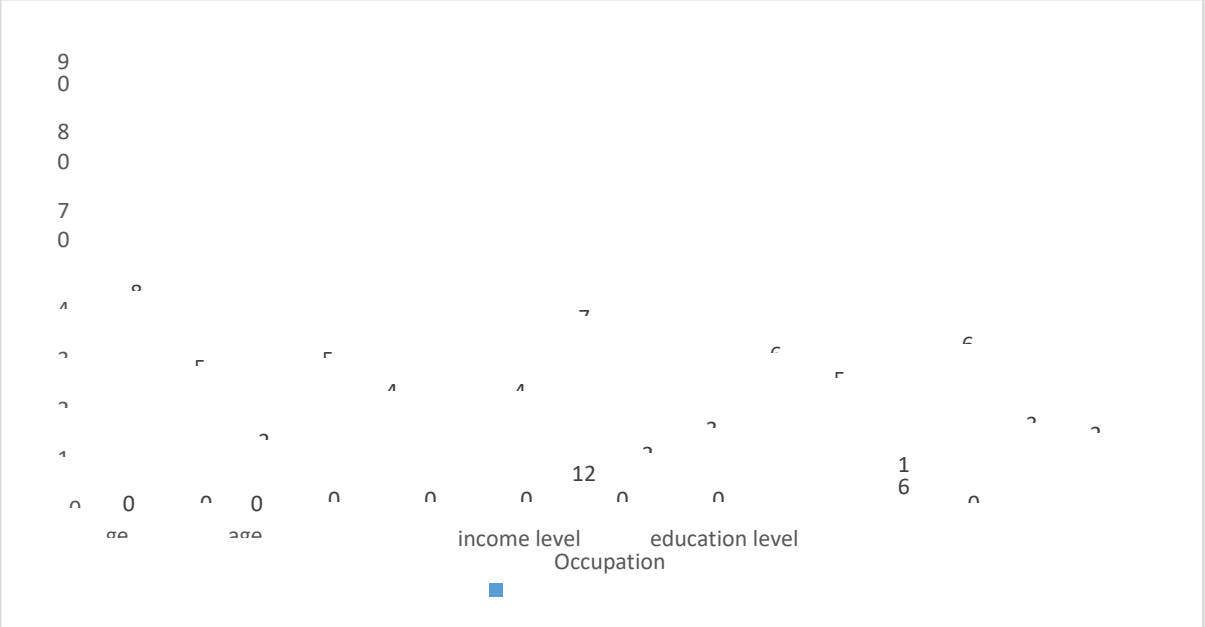
4. DATA ANALYSIS

We'll summarize and discuss the results of the document survey and theme analysis. From the 140 consumers' viewpoints in Rajasthan, the pros and cons of employing corn-cotton mixed fabric in the garment sector will be examined.

Table 1: Demographic Profile

Demographic Characteristic	Number of Customers	Percentage (%)
Gender		
- Male	85	60.7%
- Female	55	39.3%
Age Group		
- 18-25 years	25	17.8%
- 26-35 years	58	41.2%
- 36-45 years	45	32.1%
- 46 and above	12	8.9%
Income Level		
- Low (below Rs 20,000)	45	32.1%
- Medium (Rs 20,000-50,000)	75	53.6%
- High (above Rs 50,000)	20	14.3%
Education Level		
- High School	30	21.4%
- Bachelor's Degree	60	42.8%
- Master's Degree	50	35.8%
Occupation		
- Student	16	11.4%
- Office Worker	64	45.7%
- Business Owner	32	22.8%
- Other	28	20.1%

Figure 1: Demographic Profile



Customers that buy corn-cotton blends are often young, educated, and of average income, according to the demographic profile of these consumers. Additionally, they are more likely to be men than women and office employees than students or company owners. Customers that purchase corn-cotton blends are, specifically, 60.7% male and 39.3% female. Customers between the ages of 26 and 35 make up the majority (41.2%), followed by those between the ages of 18 and 25 (17.8%), 36 and 45 (32.1%), and 46 and over (8.9%). A middle income makes up 53.6% of clients, followed by low income customers (32.1%) and high-income customers (14.3%). Customers with a bachelor's degree make up 42.8% of the market, while those with a high school diploma (21.4%) and a master's degree (35.8%) are next. Office employees make up 45.7% of clients, followed by students (11.4%), company owners (22.8%), and other customers (20.1%).
For companies who offer items made of a corn-cotton combination, this information may be useful. Businesses may use this information, for instance, to focus their marketing efforts on the particular demographic groups most likely to be interested in their goods. Additionally, companies may utilize this data to create goods that are especially suited to the requirements of their target clients.

Table 2: Fabric Properties

Fabric Property	Corn-Cotton Blend
Tensile Strength	**150 N**
Breathability	**High**
Softness	**4.5/5**
Colour fastness	**Excellent**

A high-quality fabric with many appealing qualities is a corn-cotton mix. It offers good colour fastness and is durable, soft, and breathable. Due of these qualities, it works well for a range of clothing types, including formal, sporty, and casual attire. The corn-cotton mix has a tensile strength of 150 N, which indicates that it can endure 150 newtons of force before breaking. This indicates that the corn-cotton mix is a sturdy fabric since it has a high tensile strength for a textile. Additionally, a corn-cotton combination is quite breathable. This indicates that air may readily move through it, keeping the user cool and at ease. This is a useful quality for clothing that will be worn outside in the heat. The suppleness rating for the corn-cotton blend is 4.5 out of 5. This indicates that the cloth is soft. A feature like this is ideal for clothing that will be worn close to the body. Finally, the colour fastness of the corn-cotton mix is superb. This indicates that even when exposed to sunshine or other environmental variables, the fabric's colour won't fade quickly. For clothing that will be often cleaned or exposed to sunshine, this is a desirable quality. Overall, a fabric made of a combination of maize and cotton is adaptable, excellent, and has many desired qualities. It is a sensible solution for many different types of clothing and a sustainable one that helps lessen the negative effects of the fashion industry on the environment.

Table 3: Environmental Impact Assessment

Environmental Indicator	Corn-Cotton Blend
Water Usage	**500 litres**
Pesticide Usage	**Low**
Carbon Footprint	**5 kg CO2eq**
Biodegradability	**Yes**

A textile with a minimal environmental effect is a corn-cotton mix. It has a carbon footprint of 5 kg CO2eq per kilogram, uses little insecticide, and takes 500 litres of water to manufacture. Additionally, biodegradable, a corn-cotton combination degrades organically over time in the environment. However, depending on the precise manufacturing techniques used, the environmental effect of corn-cotton blends might vary. For instance, the kind of maize and cotton grown might influence how much water and pesticides are needed. The industrial techniques utilized may also have an influence on the environment. For instance, environmentally friendly agricultural methods like crop rotation and integrated pest control may assist to lessen the effect of corn-cotton blends. Corn-cotton mix may be recycled or composted at the end of its useful life, so lowering its environmental effect even further. In general, a sustainable textile that may lessen the negative environmental effects of the fashion industry is a corn-cotton mix.

5. CONCLUSION

In conclusion, cotton cloth may be replaced by corn-cotton blends in the garment business. It has a less detrimental effect on the environment, similar fabric qualities, and strong commercial potential. The high cost of manufacture and the general lack of customer knowledge are obstacles to the marketing of fabrics made of maize and cotton. However, the potential for commercialization include the rising need for eco-friendly textiles and the growing understanding of how the garment business affects the environment. The results of this research point to the possibility of corn-cotton mix fabric as a viable replacement for cotton fabric in the garment sector. To overcome the barriers to commercialization and provide more affordable manufacturing techniques, further study is required. Since corn- cotton mix fabric is a relatively new material, there is significant doubt about its long-term performance and durability. But based on early results, it seems to be a fabric with a lot of promise and potential. The cost of manufacturing, the accessibility of raw resources, and the amount of customer demand are only a few of the variables that will affect whether or not corn-cotton blended fabric is commercialized. However, there is a high market potential for corn-cotton blended fabric, as shown by the rising demand for sustainable materials and the growing awareness of the effect the garment sector has on the environment.

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