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ENHANCING COTTON GINNING PROCESSING METHOD FOR BETTER FIBRE QUALITY

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Abstract: Cotton, as a fundamental fibre source for the textile industry, plays a pivotal role in global economic development. The quality of cotton fibre is of paramount importance, as it directly influences the final product's characteristics. In this research article, we explore various methods to enhance cotton processing techniques, aiming to produce better-quality cotton fibre.

Keywords: Cotton, Ginning, Fiber, Lint, Neps, Miconaire.

Introduction. Cotton, with its natural, breathable, and versatile properties, is one of the world's most important agricultural crops. Cotton fibre quality significantly affects the textile industry, where it serves as the primary raw material. The demand for high-quality cotton fibre continues to grow, driven by the increasing preference for natural, sustainable, and durable textiles. To meet this demand, it is essential to explore innovative methods for enhancing cotton processing and fibre quality.

Literature Review. Reviewed the existing literature mentioned below in the cited sources on cotton processing methods and their effects on fibre quality.

Innovative Harvesting Techniques. Traditional cotton harvesting methods involve picking cotton bolls manually or using mechanical pickers. However, these methods can result in contamination and damage to the cotton fibres. Innovative harvesting techniques, such as spindle pickers and automated cotton-picking robots, offer precision and gentler handling of cotton bolls. These advancements minimize fibre damage and contamination, contributing to better-quality cotton.

Advanced Processing Methodologies.

a. **Ginning Technology:** Lummus and KEK modern ginning technology, such as saw ginning has evolved to minimize fibre damage during the separation of cotton fibres from seeds. These methods reduce the production of short fibres and neps, contributing to higher-quality cotton.

b. **Lint Cleaning:** Innovative lint cleaning techniques, including air-jet cleaning and optical sorting, have emerged to remove impurities and short fibres more effectively. This results in cleaner and longer cotton fibres, enhancing overall fibre quality.

c. **Carding and Spinning:** Advanced carding and spinning techniques, like open-end spinning and rotor spinning, enable the production of finer and more consistent yarns. These methods improve the uniformity and strength of cotton fibres, leading to better-quality textiles.

Sustainability and Environmental Considerations. Enhancing cotton processing methods for better-quality fibre must also address sustainability concerns. Sustainable cotton cultivation practices, such as reduced pesticide and water use, play a critical role in minimizing the environmental impact of cotton production. Additionally, genetic modifications can be tailored to improve cotton's adaptability to changing climate conditions, ensuring its long-term sustainability.

Material collection and testing. Two bales of the NIAB-78 upland variety of Pakistani cotton were selected: one contaminated bale of medium staple 1-1/32” inch (2.62 cm) grade-4, shown at fig. 1, and another bale of the same staple variety grade-3, shown at fig. 2. The selections were based on similar fibre properties, and the testing of the Shirley Analyzer for non-lint content was determined on one sample of ginned lint from each bale. Fibro-graph length, Pressley strength, and miconaire fineness were measured on two samples of ginned lint from each bale at the fibre testing laboratory of the department of textile engineering, Mehran University, Jamshoro, Sindh, Pakistan.

Fig. 1. Grade-4 cotton.

Fig. 2. Grade-3 cotton.

Experimental Processing. These cottons were processed into yarn by Rieter B3/4 bale openers, B11 UNI-clean, B3/3 mixing openers, B60 UNI-flex, C15 card, D35 draw frame, and EGM 168 ring frame (China) in the textile product lab at Mehan University of Mehran Engineering & Technology, Jamshoro, Sindh, Pakistan. The preparatory processing specifications were 0.0330 g/cm sliver carded at 0.050 g/s, 0.0366 g/cm drawing sliver formed at 130 cm/s, and 0.0330 f/cm roving produced at 23.5 cm/s. The cotton was carded into rolls, and the loading used was 126,000 g. The cotton was spun into 0.000123 g/cm yarn with 6.27 turns/cm at 16.3 cm/s, as specified in Table 1, and 2.

Data Analysis.

Table 1. Statistical analysis for lint classification, fibre properties, and processing waste for contaminated cotton.

Source	NIAB78 cotton	NIAB78 cotton
Grade	Grade 3	Grade 4 (contaminated)
Staple - inch	1-1/32 (2.62 cm)	1-1/32 (2.62 cm)
Micronair - unit	4.3	4.7
2.5% span length, cm	2.62	2.62
1/8 in, gauge Pressley x10-7 dyne/cm2 strength	3.61	3.62
Shirley Analyzer non-lint Content, %	1.76	2.63

Table 2. Individual spinning performance and yarn qualities for contaminated cotton.

Source	NIAB78	NIAB78
Grade	Grade 3	Grade 4 (contaminated)
End down spindle, h	41.0	47.3
Strength x 10-7dyne/cm2	2.00	1.98
Irregularity C.V., %	24.0	23.3

Material and Method. Both cottons were initially classified as normal preparations, one-grade up and one-grade reduction, but after review, the cotton containing trash was considered to be one-grade reduction, as indicated in Table 3.

Table 3. Comparison of contamination effects on spinning quality.

Grade	Grade 3	Grade 4 (contaminated)
Ends Down spindle, h	34.5	45.7
Strength –x10-7, dyne / cm2	2.06	1.97
Irregularity C.V., %	23.6	23.5

There is no difference in miconaire readings within the source of cotton. The number of end breaks per 96 spindles during spinning was used to characterize processing performance. One yarn size and five strength measurements were made on each of the five yarn packages for each test. And all yarn packages made from both cottons were tested by Uster4 for yarn evenness at 37.1 cm/s. Testing, including fibre quality evaluation, according to the established procedures.

Conclusion. The quality of cotton fibre is a vital determinant of the textile industry's success. Enhancing cotton processing methods is essential to meet the growing demand for better-quality cotton fibre. Genetic engineering, innovative harvesting techniques, and advanced processing methods offer promising solutions to improve cotton quality.

While comparing, it revealed that the clean cotton was longer and stronger than the cotton reduced in grade because of contamination. The cotton contaminated with trash products increased textile mill processing waste, and decreased yarn strength. The overall trend for the comparisons between cottons normal preparation, and those reduced in grade because of contamination was toward reduced spinning quality.

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Conflict of Interest. The authors declares no conflict of interest.

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C O N T E N T S

PRIMARY PROCESSING OF COTTON, TEXTILE AND LIGHT INDUSTRY