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International Journal of Engineering Technology Research & Management

DESIGN AND DEVELOPMENT OF HIGH TWIST WOVEN FABRIC AND ANALYSIS

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ABSTRACT
The positioning of the individual yarn strands and the level of comfort of the fabric are significantly influenced by yarn structure. all comfort-related characteristics that are greatly influenced by the arrangement in the yarn. The degree of twist is important for the final product because it affects the fabric's look, usability, and durability. The goal of this initiative is to design and development of high twist woven fabric and analyze how it affects fabric comfort and behavior, finding its suitable application in apparels. In this research, yarn samples of VSF compact spun yarn are used, which come in a variety of counts and twists. With the appropriate warp and weft yarns, plain weave fabric is created and the parameters are studied by putting the fabric sample under several tests in the fabric stage, these experiments enable us to examine the mechanical properties of fabric, as well as the impact of yarn density and TPI on fabric properties

Keywords:
yarn, fabric, comfort.

INTRODUCTION

high twist yarn has a big impact on how well yarn is produced and of high quality. When the yarn is impacted by outside forces, it creates cohesion between the fibres and strengthens the yarn. As a result, researchers studying textiles and clothing are becoming highly engaged in twisting mechanisms, including twist allocation, and spreading. It is clear from the literature survey that different researchers have concentrated on the properties of high twist yarn. A variety of rotation levels have been examined in this study. By using various counts (30, 40 COUNT) to determine the ideal amount of twist for creating a yarn with desirable properties and its crucial parameters can only result in an increase in the behaviour and characteristics of the fabric. project's primary goal is to investigate the mechanical properties of fabric, as well as the effects of yarn density and TPI on fabric characteristics. We do this by conducting a few tests at various stages of the fabric production process, and we also look for the most appropriate applications (apparels). In addition, optimization tools are employed because they aid in identifying sample variance and clarifying how yarn parameters affect fabric strength.

FIELD OF INVENTION

In the textile business, highly twisted yarn is frequently used to develop fabric for furnishings and clothing. In the weaving industry, it is constantly stressed to increase output while maintaining the quality of woven fabric so the factory can satisfy the demands of both domestic and foreign markets and customers who are accustomed to high-quality products. Besides that The main characteristic of the textile business in the future is its competence. In order to satisfy demand and enhance to reach national and international standards, alternative yarn and fabric solutions are therefore needed. The applications will find a worldwide market by twisting the yarn.

OBJECTIVE OF THE INVENTION

- To source yarn of VSF compact spun yarn in various counts and twists.
- In order to create plain weave fabrics with the intended warp and weft yarns, samples must undergo a variety of fabric testing procedures, including tensile strength tests, abrasion test, air permeability test, crease recovery test, drape coefficient test and thickness test.
- To examine how yarn density and TPI affect the characteristics of a cloth.

LITERATURE REVIEW

1) **Literature Reference: FABRIC PROPERTIES AND THEIR CHARACTERISTICS Praburaj Venkatraman.** - e-space.mmu.ac.uk.

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Review: he fabric structure is created by the interlacing of two or more groups of yarns.
- Right-angle yarn interlacing.
- Might be distorted or bow. any cut border may be ravelled.
- Usually lighter in weight due to the use of less fabric.

possess a minimal range of motion and flexibility
- Weave construction affects bulkiness and wrinkle recovery
- Less air permeable, less stable to stress, particularly with dense fabric.

optimal concealment and protection

2) **Literature Reference: YARN TWIST-textilecoach.net, Aug 2 2021.**
Review: High twist yarns yield fabrics with high abrasion and pilling resistance. As the twist rises, the strands tightly bond and become difficult to remove from the yarn. which likewise aids in preventing pilling. The degree of twist in a yarn affects its look by modifying its thickness and ability to reflect light. A shadow stripe can be created in weaving by using alternate S&Z twisted yarns. Different patterns can be created in a fabric by using similar yarns with varying twist levels. A cloth with an S-twist created by weaving S-twist yarns will have an enhanced S-twist effect. Level of twist can also be used to subdue or enhance a twill effect. The same is true for Z-twill.

3) **Literature Reference: Simultaneous optimization of woven fabric properties using principal component analysis-researchgate- authors-Mohsin Iqbal Qazi, Rehman Akhtar, Muhammad Abas, Qazi Salman Khalid, Abdur Rehman Babar and Catalin Iulian Pruncu 17 Feb 2017.**
Review: Fabric interlacing and yarn structure serve as deciding factors for fabric characteristics. The current research focuses on the multi-response optimization of specific fabric properties using principal component analysis, including shrinkage, areal density, thickness, flexural rigidity, and bending modulus. The study's variables included yarn twist (four levels), fabric weave pattern (plain and twill), and yarn type (carded and combed). The experiments were designed using the Taguchi orthogonal array method, and eight distinct samples were generated. These properties of the fabric were discovered to be significantly influenced by the yarn twist and fabric weave design. Furthermore, using analysis of the variance method, contribution% of parameters to these properties was determined.

4) **Literature Reference: Effect of twist on yarn strength and fabric properties/twist directions- September 29, 2021 by Mazharul Islam Kiron.**

Review: The durability, flexibility, resilience, and strength of a yarn are all influenced by the quantity of twist added to it. A skein with a high twist may produce a hard, comparatively stiff yarn, whereas a yarn with a low twist may produce a weak, more flexible yarn. Warp yarns have more twists than weave yarns do, and finer yarns have more twists than coarser yarns do. Soft-twist fabrics, like peach effect fabrics, have a loose twist that enables fiber ends to rise to the surface. While fabrics with textured surfaces, like crêpe, are given a maximum twist, fabrics with smooth surfaces receive a greater amount of twist, which provides additional strength and some crease resistance.

5) **Literature Reference**: **Effect of yarn twist on tensile strength, abrasion and pilling resistance of plain-woven cotton fabric-** Million Ayele, Yohannes Merga, Amarech Yilma & Derseh Yilie.**Researchgate September 2021.**

Review: The warp yarn's twist can be increased, which enhances the fabric's tensile strength, abrasion resistance, and pilling resistance. The abrasion resistance rate goes from 2.1 to 4.7, the pilling resistance rate goes from 2.7 to 4.5, and the tensile strength goes from 174.5N to 199.8N when the twist level is increased from 900TPM to 915TPM. The outcomes show that a significant rise in yarn twist enhances fabric performance. Future research will focus on optimizing the twist for optimal improvement in these fabric properties, as it is known that twist above a certain point degrades yarn strength.

6) **Literature Reference: Viscose staple fiber, manufacturing process and properties- Aryan Rathore , Feb 8, 2022-textile school.com**

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Features of VSF	Traits description
outstanding performance	The efficacy of VSF is comparable to that of natural cotton fibre, and it has better moisture absorption, air permeability, dyeability, antistatic properties, and a softer texture than synthetic fibre.
excellent functional qualities	VSF also had the feature of synthetic staple fibres. VSF fabric has much superior gloss, chromatography, heat, and corrosion than synthetic fabric, resulting in beautiful colours and dynamic hanging.
Clear environmental benefits	Since GlVSF is a biomass fibre that can naturally degrade and wouldn't produce secondary pollution, its benefits for the ecosystem are clear.
Strong material renewable	The primary raw materials for VSF are cotton linter, wood, bamboo, and hemp. These resources come from sustainable agricultural and forestry sources, making VSF more environmentally friendly than synthetic fibre, which uses non-renewable fuel as its primary raw material.

Table 2.1

DESIGN

YARN

1.	**30's Ne VSF Compact spun yarn (High twist) Z twist**
2.	**30's Ne VSF Compact spun yarn (High twist) S twist**
3.	**40's Ne VSF Compact spun yarn (Normal Twist) Z twist**
4.	**40's Ne VSF Compact spun yarn (High twist) S twist**

FABRIC

S,NO	WARP	WEFT	STRUCTURE
1	**30's Ne VSF Compact spun yarn (High twist) Z twist**	**40's Ne VSF Compact spun yarn (Normal Twist) Z twist**	**Plain**
2	**30's Ne VSF Compact spun yarn (High twist) Z twist**	**30's Ne VSF Compact spun yarn (High twist) Z twist (40TPI)**	**Plain**
3	**30's Ne VSF Compact spun yarn (High twist) Z twist**	**30's Ne VSF Compact spun yarn (High twist) S twist (40TPI)**	**Plain**
4	**30's Ne VSF Compact spun yarn (High twist) S twist**	**40's Ne VSF Compact spun yarn (High Twist) S twist (40 TPI)**	**Plain**

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FABRIC TESTING

Mechanical properties
EPI
PPI
GSM
Thickness
Crease recovery
Abrasion resistance
Tensile strength
Air permeability
Drape coefficient

MECHANICAL PROPERTIES

SNo	Sample	EPI	PPI	GSM	Thickness (mm)	Crease recovery angle	Abrasion resistance	Air permeability	Drape coefficient
1	30's VSF * 40's VSF {high twist Z twist}	66	48	230	0.3	124	42.22	2460(1.4)	54.21
2	30's VSF* 30's VSF {High twist Z twist}	66	48	356	0.23	143	45.58	2960(2.1)	62.8
3	30's VSF* 30 VSF {High twist S+ Z twist}	64	60	268	0.28	125	34.12	2360(1.4)	43.32
4	30's VSF * 40's VSF {high twist S twist}	66	48	236	0.31	122	40	2660(1.4)	57.21

TENSILE STRENGTH TEST

Sample	Breaking force (kgf)	Elongation (mm)	Time(s)
30's VSF * 40's VSF {high twist Z twist}	21.3	19.2	3.84
30's VSF* 30's VSF {High twist Z twist}	23.5	13	2.6
30's VSF* 30 VSF {High twist S+ Z twist}	31.5	12.7	2.540
30's VSF * 40's VSF {high twist S twist}	31.9	14.30	2.860

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METHODOLOGY

- VSF compact spun yarn in various counts and twists.
- To create plain weave fabrics with the intended warp and weft yarns.
- To do series of tests in fabric Stage.
- Tests are done to study the parameters (Mechanical properties).
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CONCLUSION

With the desired warp and weft yarns, plain weaved fabrics are created. The parameters are then examined by putting samples of the fabric through a series of tests at the fabric stage. These experiments enabled us to examine the mechanical properties of fabric, as well as the impact of yarn density and TPI on fabric properties.

ACKNOWLEDGEMENT

This research was supported/partially supported by [The Bannari Amman group]. We thank our colleagues from [BANNARI AMMAN INSTITUTE OF TECHNOLOGY] who provided insight and expertise that greatly assisted the research, although they may not agree with all the interpretations/conclusions of this paper. We thank [MS. PAVITHRA SHEN G T, ASSISTANT PROFFESSOR, DEPARTMENT OF FASHION TECHNOLOGY, BANNARI AMMAN INSTITUTE OF TECHNOLOGY] for assistance with [particular technique, methodology], and for comments that greatly improved the manuscript.

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