Materials Sciences and Applications, 2025, 16(8), 441-452
https://www.scirp.org/journal/msa
ISSN Online: 2153-1188
ISSN Print: 2153-117X

Effect of Wash Cycles and Polyester Fiber Blend Ratios on Wicking Behavior of Blended Knit Fabrics

Kazi Md. Elias[1*], Mohammad Obaidur Rahman[1], Engr H.M. Zakir Hossain[2]

[1]Department of Physics, Jahangirnagar University, Savar, Bangladesh
[2]Jute Textile Wing of Bangladesh Jute Research Institute, Dhaka, Bangladesh
Email: *kazi-elias@ttsl-bd.com

How to cite this paper: Elias, K.M., Rahman, M.O. and Hossain, E.H.M.Z. (2025) Effect of Wash Cycles and Polyester Fiber Blend Ratios on Wicking Behavior of Blended Knit Fabrics. *Materials Sciences and Applications*, **16**, 441-452.
https://doi.org/10.4236/msa.2025.168025

Received: July 21, 2025
Accepted: August 23, 2025
Published: August 26, 2025

Abstract

Wicking is a crucial property for comfort in human beings. The body continuously produces energy through metabolic processes and maintains comfort by dissipating this energy into the environment. Two important aspects of maintaining comfort are the evaporation of sweat and the avoidance of overheating, particularly in warm and uncomfortable environments. This research investigates the wicking properties of blended knit fabrics made of different proportions of cotton, polyester, and elastane fibers. It focuses on how a higher percentage of polyester influences wicking performance. Additionally, the impact of multiple washing cycles on wicking properties was analyzed. The original state of the fabrics was assessed after several wash cycles, including after one wash, three washes, and ten washes. Ten weft-knitted blended fabrics were prepared for the study. The findings revealed differences in wicking performance between the fabrics in their original state after one wash and after ten washes. Notably, the wicking performance after ten wash cycles was nearly identical to that after three wash cycles. It helps determine whether multiple wash cycles are necessary in different scenarios.

Keywords

Wicking, Wicking Rate, Polyester, Wash Cycles, Comfort

1. Introduction

The primary focus of this study is to evaluate the impact of the number of washing cycles and the polyester fiber blend ratios on weft-knitted blended fabrics. So, many researchers conducted multidirectional studies on the wicking behavior of textiles, including yarns and fabrics. The study focused on experimentally blended fabrics made from cotton, polyester, and elastane to see the effect of the number of washing cycles as well as the influence of polyester fiber blend ratios on wicking behavior. Dunila *et al.* conducted a study on the wicking behavior of textiles using the Lattice-Boltzmann method, along with Voronoi diagrams and multiphase flow algorithms commonly employed in computational fluid dynamics. Time-resolved X-ray tomographic microscopy and neutron radiography method synchronized with image processing and analysis procedures to comprehend wicking dynamics in yarns and yarn structure [1]. He, J., *et al.*, a helical capillary model was developed to examine the impact of yarn twist and fiber diameters on the wicking properties of polyester yarns. Simulations and experiments validated the model's accuracy in predicting liquid movement, highlighting the influence of twist on fiber arrangement and liquid pathways [2]. Hossain MA, *et al.* conducted research with Vortex yarn. They found good performance in terms of wicking behavior from vortex-spun nappy yarn [3]. Wenhua Shi, *et al.*, a hydrophilic silicone agent can enhance stain removal but diminishes significantly after washing. Incorporating this agent into detergent can improve stain removal in home laundry. A hydrophilic silicone agent can be supplemented in detergent formulation to improve the stain removal performance of moisture-wicking cloths during home laundry [4]. K. Parveen Banu, *et al.* used viscose staple yarns were produced with different linear densities, and the characteristics and wicking performance of the yarn were analyzed. Yarns with coarser counts exhibited better wicking performance compared to those with finer counts [5]. Robert Fischer *et al.* conducted research on the relationship between yarn pore size and wicking behavior. Yarn's pore structure allows rapid liquid absorption, with some pores saturating in seconds. Wicking behavior is influenced by a few key filling events, which require an understanding of liquid movement between pores and the configuration of the pore network [6].

Wicking is important for comfort because it helps fabrics pull moisture away from the skin. This process manages sweat efficiently, making exercise garments more comfortable. Good wicking fabrics that come into contact with the skin should absorb minimal moisture and effectively spread and transport liquid away. Suitable materials include polyester for low moisture absorption, polypropylene for its excellent moisture-wicking abilities, and polyamide for both wicking and durability. The way a fabric is made also affects its ability to wick moisture. According to the AATCC, wicking is the movement of liquid through a material by capillary action. Moisture-wicking fabrics are key components of modern sportswear and outdoor clothing. Water absorption rate, wicking height, drip diffusion time, and drying rate.

Cotton is very effective at absorbing moisture. Polyester is less effective at absorbing moisture but exhibits better wickability. Elastane generally has minimal impact on moisture absorption. Increasing the twist in the yarn can reduce the speed of moisture absorption. The structure of the yarn plays an important role in moisture absorption [7]. The materials used in the yarn can significantly influence how well it absorbs moisture. Yarn that contains more wax tends to absorb moisture more slowly. Knitting elements can affect wicking activities on fabrics [8]. A higher content of viscose fibers improves the vertical wicking rate, but better rising height can be achieved in samples made from 100% coarser polyester fibers. Fabrics that are knitted tightly are less effective at absorbing moisture [9]. Fabrics with a higher grams per square meter (GSM) generally absorb moisture less efficiently. Synthetic fabrics are typically less absorbent than natural fibers. The use of specific dyes and treatments can enhance or reduce moisture absorption; hydrophobic (water-repelling) treatments help fabrics absorb less moisture.

Fabrics with more porous structures are effective in promoting moisture absorption. The wicking tendency also depends on the direction of wicking, and wicking tends to be in the weft direction compared to the warp direction [10]. Twist significantly affects wickability in that a higher twist leads to lower wickability [11]. The measurements of water contact angles on both the front and back surfaces of the fabrics show apparent variations in moisture-wicking characteristics between the pique, honeycomb, and ottoman knitted fabrics. This bicomponent material is set to transform functional sportswear in the future [12]. The capacity to draw moisture away is mainly affected by the material's structure. During knitting, the drying efficiency is predominantly dictated by the kind of raw material utilized, with the features of the knitted structure playing a lesser role [13].

2. Materials and Methods

2.1. Material

The fabric consists of a blend of cotton, polyester, and elastane. The proportion of polyester varies, including levels of 5%, 6%, 7%, 8%, 9%, 15%, 16%, 17%, 18%, and 19%. Elastane is included in amounts ranging from 1% to 5%. Blended materials are highly favored in the textile industry for their ability to deliver both quality and affordability. These fabric combinations are frequently used in clothing for sports, functional wear, and apparel suited for active lifestyles. With a growing global interest in blended fabrics, they contribute significantly to sustainable development. The combination of three different fiber types in a single blend often leads to reduced costs for manufacturers. The specifics of the sampling plan are presented in **Table 1**.

Table 1. Sampling plan.

SN.	Fabric Type	Fabric Composition
1	CVC, Single Jersey Elastane Fabric	Cotton 90%, Polyester 5%, Elastane, 5%
2	CVC, Single Jersey Elastane Fabric	Cotton 90%, Polyester 6%, Elastane, 4%
3	CVC, Single Jersey Elastane Fabric	Cotton 90%, Polyester 7%, Elastane, 3%
4	CVC, Single Jersey Elastane Fabric	Cotton 90%, Polyester 8%, Elastane, 2%
5	CVC, Single Jersey Elastane Fabric	Cotton 90%, Polyester 9%, Elastane, 1%
6	CVC, Single Jersey Elastane Fabric	Cotton 80%, Polyester 15%, Elastane, 5%
7	CVC, Single Jersey Elastane Fabric	Cotton 80%, Polyester 16%, Elastane, 4%
8	CVC, Single Jersey Elastane Fabric	Cotton 80%, Polyester 17%, Elastane, 3%
9	CVC, Single Jersey Elastane Fabric	Cotton 80%, Polyester 18%, Elastane, 2%
10	CVC, Single Jersey Elastane Fabric	Cotton 80%, Polyester 19%, Elastane, 1%

2.2. Preparatory Process

The BCI (Better Cotton Initiative) upland cotton is sourced from the United States, along with staple polyester and Lycra. This upland cotton was graded 42-1. Table 2 lists the essential raw cotton test parameters, while Table 3 and Table 4 list the critical test parameters for polyester and elastane, respectively.

Table 2. Quality parameters of cotton.

Fiber Type	Tenacity	Elongation	UHML	MIC	SF	SCI	Rd	+b
	[gm/tex]	[%]	[mm]		[%]			
Cotton	31.8	7.0	29.29	4.24	10.1	138	71.0	9.8

Note. UHML stands for Upper Half Mean Length, MIC stands for Micronaire, SCI stands for Spinning consistency index, Rd describes Reflectance, and +b describes the yellowness of cotton

Table 3. Quality parameters of polyester.

Fiber Type	Tenacity	Elongation	Length
	[gm/tex]	[%]	[mm]
Polyester	56.7	22.0	38.0

Table 4. Quality parameters of elastane fiber.

Fiber Type	Tenacity	Elongation	Length
	[gm/tex]	[%]	[mm]
Elastane	11.25	465	Continuous

Table 5. Quality parameters of knitting.

SN	Fabric Type	M/C Dia.	M/C Gauge	M/C RPM	Stitch Length (mm)	Needle Pitch (mm)	Lycra Denier	Reqd GSM
1	90% C 5% P 5% E	32	24	22	29.0	1.058	20 D	180
2	90% C 6% P 4% E	32	24	22	29.5	1.058	20 D	180
3	90% C 7% P 3% E	32	24	22	29.0	1.058	20 D	180
4	90% C 8% P 2% E	32	24	22	29.0	1.058	20 D	180
5	90% C 9% P 1% E	32	24	22	29.0	1.058	20 D	180
6	80% C 15% P 5% E	32	24	22	29.0	1.058	20 D	180
7	80% C 16% P 4% E	32	24	22	29.5	1.058	20 D	180
8	80% C 17% P 3% E	32	24	22	29.0	1.058	20 D	180
9	80% C 18% P 2% E	32	24	22	29.0	1.058	20 D	180
10	80% C 19% P 1% E	32	24	22	29.0	1.058	20 D	180

Note. C for Cotton, P for Polyester, and E for Elastane.

The high-quality yarn was produced on advanced spinning machines with a count of 34/1 Ne ring-spun. Grey fabrics were knitted using Terrot machines from Germany. The essential parameters of the knitting process are detailed in Table 5.

High-quality dispersed dyes from BEZEMA, Germany, were used, along with reactive and dispersion dyes for the blended fabrics. Final samples were processed using Stenter (Germany) and Compactor (Italy) equipment.

2.3. Test Plan

The wicking test was conducted for the original state, after one wash, three washes, and 10 washes to see the effect of the wash cycle on the wicking behavior of weft-blended knit fabrics.

2.3.1. Test Standard

The widely used test standard, AATCC 197 [14], was employed. For conditioning purposes, ISO 139 [15] was followed. The AATCC detergent 1993 of 66 ± 1 gm was used, the temperature was 41 ± 3, the agitation speed was 660 ± 15.

2.3.2. Test Procedure

The fabric's hydrophobic or hydrophilic characteristics were evaluated. Specimens were cut to dimensions of (100 ± 5) mm from the selvage, with at least three samples measuring (165 ± 3 mm × 25 ± 3 mm), ensuring the longer side aligned with the fabric's direction. ASTM D1776 conducted testing. The specimen was marked at distances of 5 ± 1 mm, 20 ± 1 mm, and 150 ± 1 mm. A clean flask containing fresh water was prepared, filled to the 5 ± 1 mm mark. The timer commenced when the water reached this point, and the Time for water migration was recorded. The soluble ink at the 20 ± 1 mm mark was observed, and the increase in water level was noted until it reached the 150 ± 1 mm mark. The test was stopped if the water did not wick to these markers within 5.01 or 30.01 minutes. The distance wicking occurred, and the corresponding Time was measured, after which the specimen was removed. The vertical wicking rates in mm/s were calculated by dividing the wicking distance by the wicking Time using the specified formula.

$$\mathbf{W = d/t}$$

where, W = Wicking Rate, mm/s, D = Wicking distance, mm, t = Wicking time in seconds.

Figure 1 shows the different stages of wicking test in progress.

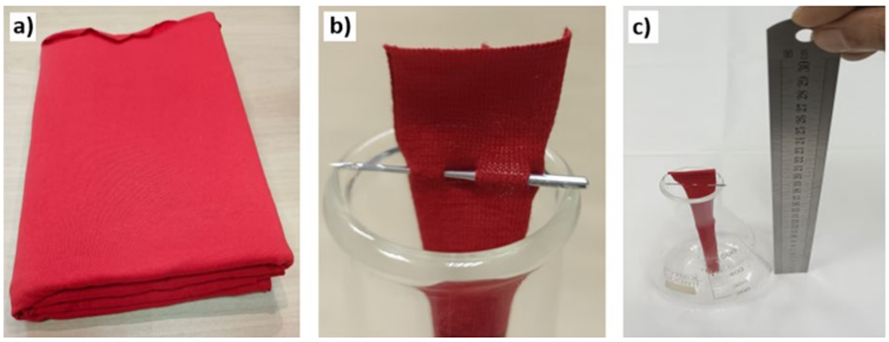

Figure 1. Wicking test: a) Sample, b) Specimen in hanging, c) Test started.

3. Results and Discussion

The fabrics made from the 90% cotton group and the 80% cotton group showed almost similar wicking behavior. In the 90% & 80% cotton group, the wicking time started to increase, and simultaneously, the wicking rate (mm/sec) decreased. The same trend was shown, that this increase occurred in direct proportion to the polyester fiber blend ratios. A very negligible effect was observed with different percentages of elastane fiber. Secondly, it was also observed that the wicking rate decreased with the increase in the number of washing cycles compared to the original state of the sample. The same trend of wicking behavior is noticed in both length and width directions. A similar phenomenon was observed in the 80% cotton group. Table 6 and Table 7 present the wicking test results in their original state, after one wash, three washes, and ten washes for both lengthwise and width-wise directions, with the data sets pertain to a wicking distance of 20 mm. Table 8 and Table 9 illustrate the outcomes of the wicking tests in their initial form and

Table 6. Wicking test results for 20 mm wicking distance (Lengthwise).

Sl. No.	Type of Fabric	Original	After 1 Wash	After 3 Wash	After 10 Wash
1	90% Cotton 5% Polyester 5% Elastane	3.58	2.95	2.71	2.65
2	90% Cotton 6% Polyester 4% Elastane	3.39	2.91	2.68	2.62
3	90% Cotton 7% Polyester 3% Elastane	3.28	2.83	2.60	2.49
4	90% Cotton 8% Polyester 2% Elastane	3.22	2.78	2.59	2.50
5	90% Cotton 9% Polyester 1% Elastane	2.95	2.71	2.49	2.44
6	80% Cotton 15% Polyester 5% Elastane	1.75	1.75	1.61	1.52
7	80% Cotton 16% Polyester 4% Elastane	1.69	1.69	1.62	1.52
8	80% Cotton 17% Polyester 3% Elastane	1.62	1.62	1.49	1.44
9	80% Cotton 18% Polyester 2% Elastane	1.58	1.58	1.45	1.42
10	80% Cotton 19% Polyester 1% Elastane	1.53	1.53	1.41	1.32

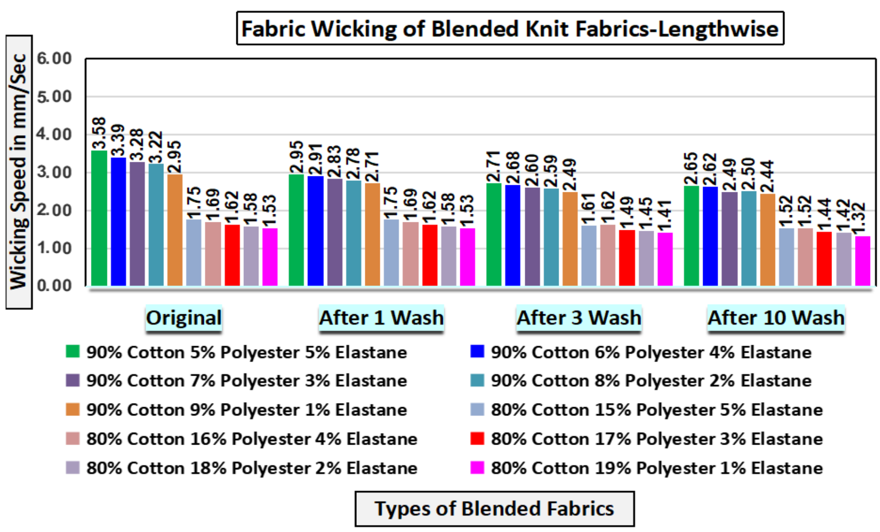

Figure 2. Wicking test result for 20 mm wicking distance lengthwise.

after one, three, and ten washes. These results are available for both the lengthwise and widthwise orientations, along with the data sets relevant to a 150 mm wicking distance. Table 6 shows the wicking test results for 20 mm wicking distance in the length direction as well as Figure 2 shows the graphical display of the wicking test results for 20 mm wicking distance in the length direction.

Table 7 shows the wicking test results for 20 mm wicking distance in the width direction as well as Figure 3 shows the graphical display of the wicking test results for 20 mm wicking distance in the width direction.

Table 7. Wicking test results for 20 mm wicking distance (Widthwise).

Sl. No.	Type of Fabric	Original	After 1 Wash	After 3 Wash	After 10 Wash
1	90% Cotton 5% Polyester 5% Elastane	2.91	2.57	2.42	2.34
2	90% Cotton 6% Polyester 4% Elastane	3.26	2.53	2.40	2.30
3	90% Cotton 7% Polyester 3% Elastane	3.05	2.47	2.32	2.24
4	90% Cotton 8% Polyester 2% Elastane	2.89	2.25	2.12	2.01
5	90% Cotton 9% Polyester 1% Elastane	2.79	2.20	2.11	1.91
6	80% Cotton 15% Polyester 5% Elastane	1.67	1.67	1.60	1.55
7	80% Cotton 16% Polyester 4% Elastane	1.62	1.62	1.52	1.48
8	80% Cotton 17% Polyester 3% Elastane	1.53	1.53	1.48	1.42
9	80% Cotton 18% Polyester 2% Elastane	1.44	1.44	1.41	1.32
10	80% Cotton 19% Polyester 1% Elastane	1.43	1.43	1.35	1.36

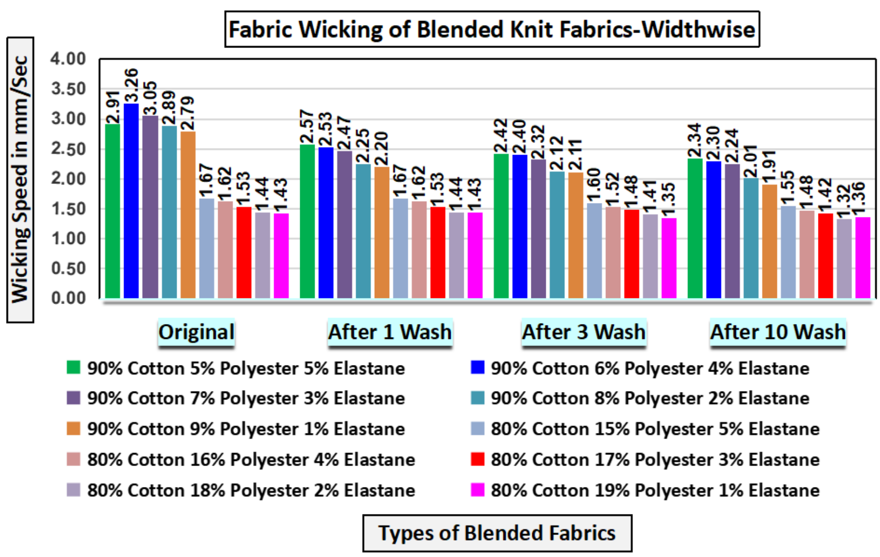

Figure 3. Wicking test result for 20 mm wicking distance widthwise.

Table 8 shows the wicking test results for 150 mm wicking distance in the length direction as well as Figure 4 shows the graphical display of the wicking test results for 150 mm wicking distance in the length direction.

Table 8. Wicking test results for 150 mm wicking distance (Lengthwise).

Sl. No.	Type of Fabric	Original	After 1 Wash	After 3 Wash	After 10 Wash
1	90% Cotton 5% Polyester 5% Elastane	0.26	0.26	0.22	0.21
2	90% Cotton 6% Polyester 4% Elastane	0.26	0.25	0.22	0.20
3	90% Cotton 7% Polyester 3% Elastane	0.25	0.24	0.22	0.20
4	90% Cotton 8% Polyester 2% Elastane	0.24	0.24	0.21	0.19
5	90% Cotton 9% Polyester 1% Elastane	0.22	0.21	0.19	0.17
6	80% Cotton 15% Polyester 5% Elastane	0.17	0.16	0.14	0.13
7	80% Cotton 16% Polyester 4% Elastane	0.16	0.15	0.13	0.12
8	80% Cotton 17% Polyester 3% Elastane	0.15	0.15	0.13	0.12
9	80% Cotton 18% Polyester 2% Elastane	0.14	0.14	0.12	0.11
10	80% Cotton 19% Polyester 1% Elastane	0.13	0.12	0.11	0.10

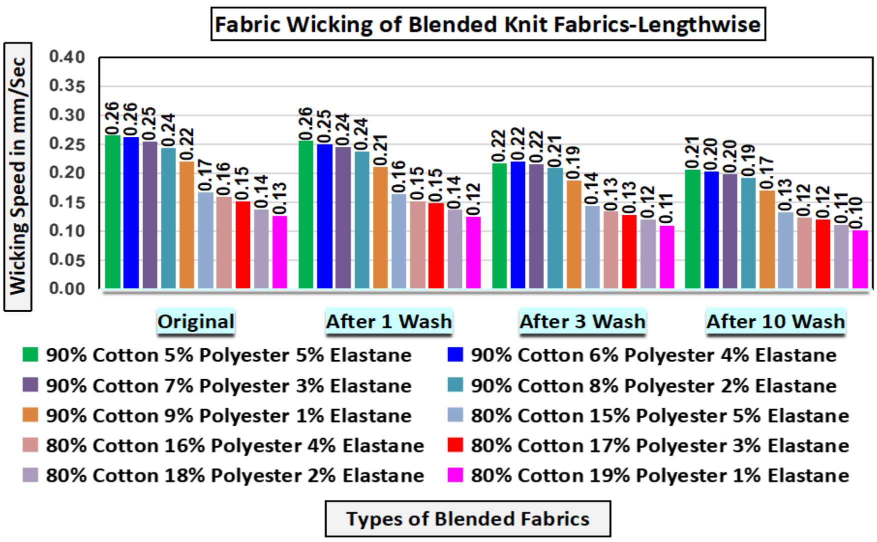

Figure 4. Wicking test result for 150 mm wicking distance lengthwise.

Table 9. Wicking test results for 150 mm wicking distance (Widthwise).

Sl. No.	Type of Fabric	Original	After 1 Wash	After 3 Wash	After 10 Wash
1	90% Cotton 5% Polyester 5% Elastane	0.26	0.26	0.24	0.23
2	90% Cotton 6% Polyester 4% Elastane	0.26	0.25	0.23	0.22
3	90% Cotton 7% Polyester 3% Elastane	0.25	0.24	0.22	0.21
4	90% Cotton 8% Polyester 2% Elastane	0.24	0.24	0.22	0.21
5	90% Cotton 9% Polyester 1% Elastane	0.22	0.21	0.20	0.18
6	80% Cotton 15% Polyester 5% Elastane	0.17	0.16	0.15	0.14
7	80% Cotton 16% Polyester 4% Elastane	0.16	0.15	0.14	0.13
8	80% Cotton 17% Polyester 3% Elastane	0.15	0.15	0.14	0.13
9	80% Cotton 18% Polyester 2% Elastane	0.14	0.14	0.13	0.12
10	80% Cotton 19% Polyester 1% Elastane	0.13	0.12	0.11	0.11

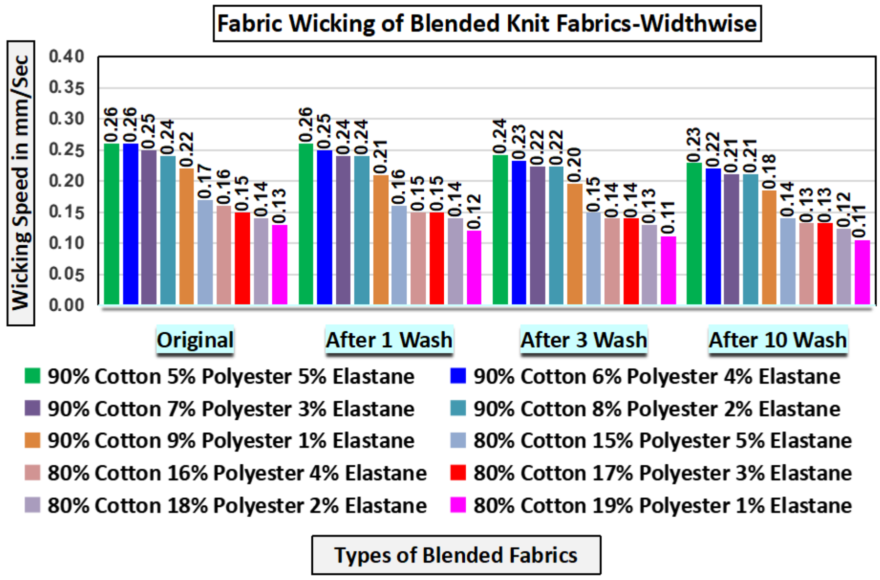

Figure 5. Wicking test result for 150 mm wicking distance widthwise.

Table 9 shows the wicking test results for 150 mm wicking distance in the width direction as well as Figure 5 shows the graphical display of the wicking test results for 150 mm wicking distance in the width direction.

In the graphical representation, it was observed that the vertical wicking rate was negatively correlated with the polyester fiber blend ratios; specifically, the higher the polyester fiber blend ratio, the lower the wicking rate. Side by side, it was noticed that the decreased wicking rate occurred with the increase in the number of washing cycles.

3.1. Statistical Analysis by Two-Way ANOVA in Length Direction

The two-way analysis of variance (ANOVA) was conducted using the statistical significance test. Table 10 shows the ANOVA data set for Wicking Rate.

Hypothesis Statement for Wicking Test (Length Direction)

The hypothesis statement was made before conducting the two-way ANOVA. The H0 and Ha represent the null hypothesis and alternative hypothesis, respectively.

Factor A: Testing Condition (Before wash, After 1 Wash, After 3 Wash, After 10 Wash)

H0: Mean Wicking Rate for all testing conditions of all groups Fabrics (Group 1, Group 2), are equal.

Ha: Mean Wicking Rate for all testing conditions of all groups Fabrics (Group 1, Group 2) are unequal.

Factor B: Fabric Types (Group 1, and Group 2)

H0: Mean Wicking Rate for all Fabric Types of all groups (Group 1, Group 2 are equal.

Ha: Mean Wicking Rate for all Fabric Types of all groups (Group 1, Group 2 Are unequal.

Table 10. Two-way ANOVA table for wicking (Length direction).

Source	Df	SS	MS	F (df1, df2)	F Critical	P-value
Factor A (Group) Rows (A)	1	15.9138	15.9138	579.9936 (1, 35)	4.1213	0
Factor B (Group) Column (B)	3	1.2919	0.4306	15.6954 (3, 35)	2.8741	0.000001237
Error	35	0.9603	0.02744			
Total	39	18.1661	0.4658			

Decision for Factor A:

Here, the statistical significance level, alpha (0.05) > p-value (0).

F statistics (579.9936) > F Critical (4.1213), The null hypothesis was rejected. The sample difference between the averages of some groups is big enough to be statistically significant.

Decision for Factor B:

Here, the statistical significance level, alpha (0.05) > p-value (0.000001237).

F statistics (15.6954) > F Critical (2.8741).

The null hypothesis was rejected. The sample difference between the averages of some groups is big enough to be statistically significant.

3.2. Statistical Analysis by Two-Way ANOVA in Width Direction

The two-way analysis of variance (ANOVA) was conducted using the statistical significance test. Table 11 shows the analysis of variance dataset.

Hypothesis Statement for Wicking Test (Width Direction)

The hypothesis statement was made before conducting the two-way ANOVA. The H0 and Ha represent the null hypothesis and alternative hypothesis, respectively.

Factor A: Testing Condition (Before wash, After 1 Wash, After 3 Wash, After 10 Wash)

H0: Mean Wicking Rate for all testing conditions of all groups Fabrics (Group 1, Group 2) are equal.

Ha: Mean Wicking Rate for all testing conditions of all groups Fabrics (Group 1, Group 2 are unequal.

Factor B: Fabric Types (Group 1, Group 2)

H0: Mean Wicking Rate for all Fabric Types of all groups (Group 1, Group 2) are equal.

Ha: Mean Wicking Rate for all Fabric Types of all groups (Group 1, Group 2) are unequal.

Table 11. Two-way ANOVA table for wicking (width direction).

Source	Df	SS	MS	F (df1, df2)	F Critical	P-value
Factor A (Group) Rows (A)	1	9.2352	9.2352	225.3762 (1, 35)	4.1213	0

Continued

Factor B (Group) Column (B)	3	1.242	0.414	10.1029 (3, 35) 12.6755	2.8741	0.00006146
Error	35	1.4342	0.04098			
Total	39	11.9114	0.3054			

Decision for Factor A:

Here, the statistical significance level, alpha (0.05) > p-value (0).

F statistics (225.3762) > F Critical (4.1213).

The null hypothesis was rejected. The sample difference between the averages of some groups is big enough to be statistically significant.

Decision for Factor B:

Here, the statistical significance level, alpha (0.05) > p-value (0.00006146).

F statistics (10.10290.6606) > F Critical (2.8741).

The null hypothesis was rejected. The sample difference between the averages of some groups is big enough to be statistically significant.

4. Conclusion

The ideal characteristics of good moisture-wicking fabric designed for slim-fit garments include low moisture regain and the ability to transfer liquid moisture from the skin to the fabric. The study examined how wash cycles affected wicking performance. Incorporating polyester fiber caused to decrease the moisture wicking property. The statistical analysis with Two-Way ANOVA found that there are significant differences among the wicking performance after one wash, after three wash, and after ten wash cycles. Additionally, it was observed that polyester fibers made slow down the wicking rate. It is essential to note that this study focused exclusively on weft-blended knit fabrics, specifically those composed of cotton, polyester, and elastane fibers. There remains considerable scope for further research on woven fabrics using different fibers and blend ratios.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Hettiarachchi, D., Michielsen, S., Wen, C. and Wang, L. (2024) Liquid Moisture Wicking in Textile and Inter-Fibre Pore Filling Behaviour in Yarns: A Review. *The Journal of The Textile Institute*, 1-20. https://doi.org/10.1080/00405000.2024.2440062

[2] He, J., Li, J., Yang, Q., Xie, Z., Jin, X., Sun, X., *et al.* (2024) Three-dimensional Spiral Model of the Wicking Effect for Continuous Polyester Filaments. *Textile Research Journal*, **94**, 1680-1691. https://doi.org/10.1177/00405175241227933.

[3] Hossain, M.A. and Islam, M.R. (2024) Investigation of Comfort Characteristics of Knitted Fabric Produced from Neppy Yarn. *Journal of Engineered Fibers and Fabrics*,

19, 1–10. https://doi.org/10.1177/15589250231224056

[4] Shi, W., Pei, L., Gu, X. and Wang, J. (2023) Investigation on Decontamination Mechanism of Moisture-wicking Fabrics during Home Laundry. *Journal of Surfactants and Detergents*, **26**, 693-702. https://doi.org/10.1002/jsde.12676

[5] Parveen Banu, K., Tharani, P.M. and Subramaniam, V. (2013) Wicking Behavior of Viscose Staple Yarns Differing in Linear Densities. *Journal of Environmental Nanotechnology*, **2**, 1-5. https://doi.org/10.13074/jent.2013.09.132018

[6] Fischer, R., Schlepütz, C.M., Zhao, J., Boillat, P., Hegemann, D., Rossi, R.M., *et al.* (2022) Wicking Dynamics in Yarns. *Journal of Colloid and Interface Science*, **625**, 1-11. https://doi.org/10.1016/j.jcis.2022.04.060

[7] Sun, S., Peng, M., Liu, J., Liu, Y., Zhou, W., Dai, H., *et al.* (2024) A Novel Moisture-Wicking and Fast-Drying Functional Bicomponent Fabric. *Fibers and Polymers*, **26**, 447-462. https://doi.org/10.1007/s12221-024-00810-2

[8] Priyalatha, D.S. (2024) Effect of State of Fabric on Wicking Characteristics of Knitted Fabrics Suitable for Sports Applications. *Archives for Technical Sciences*, **10**, 1-8. https://doi.org/10.70102/afts.2024.1631.001

[9] Mallick, P. and De, S.S. (2021) Study the Wicking Phenomena of Cotton Woven Fabrics and Its Constituent Yarns: Relation between Fabric Wicking and Yarn Wicking. *Journal of Natural Fibers*, **19**, 5297-5309. https://doi.org/10.1080/15440478.2021.1875371

[10] Chu, C., Hu, C., Sun, Y., Yan, H., Zhang, Y. and Ning, F. (2021) Structural Design and Vertical Wicking Behavior of Cotton Roving-Based Materials for Nutrient Transport of Indoor Plant. *Journal of Engineered Fibers and Fabrics*, **16**, 1-8. https://doi.org/10.1177/15589250211066797

[11] Singh, M.K. and Behera, B.K. (2020) Effect of Filament Configuration on Handle and Transmission Properties of Polyester Multifilament Fabrics. *Journal of The Institution of Engineers* (*India*): *Series E*, **102**, 33-44. https://doi.org/10.1007/s40034-020-00184-z

[12] Kayalvizhi, C., Krishnakumar, V., Suganth, G. and Prakash, C. (2014) Wicking Behavior of Bamboo/Polyester Blended Yarns. *Indian Journal of Fibre & Textile Research*, **49**, 105-108. https://or.niscpr.res.in/index.php/IJFTR/article/view/9548

[13] Hasan, M.K., Kayumov, J., Zhu, G., Khatun, M., Nur, A. and Ding, X. (2019) An Experimental Investigation to Examine the Wicking Properties of Silk Fabrics. *Journal of Textile Science and Technology*, **5**, 108-124. https://doi.org/10.4236/jtst.2019.54010

[14] (2022) TM197 Test Method for Vertical Wicking Rate of Textiles to Specified Distances. https://members.aatcc.org/store/tm197/617/

[15] International Organization for Standardization. ISO 139: 2005. Textiles—Standard Atmosphere for Conditioning and Testing. https://www.iso.org/standard/35179.html