AN INVESTIGATION OF THE EFFECT OF UTILIZING PLA WEFT YARN ON SOME FABRIC PROPERTIES

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Abstract: *Using Polylactic acid (PLA) fibers in textiles may be accepted as a sustainable manner in terms of their being biodegradable under specific conditions, unlike traditional synthetic fibers like polyester or nylon, which take a long time to break down and contribute to environmental pollution. Additionally, PLA fibers break down into simpler compounds, reducing environmental impact. This study investigates the effect of some weft yarn properties such as weft yarn types including PLA yarn, recycled PET-Trevira yarn, Polyester yarn, and the weft density factors on tear strength, air permeability, and some fastness properties of plain, twill, and satin fabrics. 9 different types of plain, twill, and satin fabric groups were produced by using 3 different weft yarn types (Polyester, recycled Polyester-Trevira, PLA) at the 3 different weft densities (24,26,28 threads/cm for plain, 32, 34,36 threads/cm for twill, 36,38,40 threads/cm for satin groups) were produced where a total of 27 different drapery samples were obtained. SPSS Statistical analyses and bar graphs were used for the evaluation of the results. Randomized two-way ANOVA was used at the significance level of 0.05 among the plain, twill, and satin groups separately. Additionally, SNK tests were also performed to observe the means of each parameter. General evaluations of washing, dry cleaning, and rubbing fastness of dyed fabrics were also inserted.*

Keywords: PLA, drapery fabrics, weft yarn type, tear strength, air permeability.

ISTRAŽIVANJE EFEKTA KORIŠĆENJA PLA PREĐA POTKE NA NEKA SVOJSTVA TKANINE

Apstrakt: *Upotreba vlakana polimlečne kiseline (PLA) u tekstilu može se prihvatiti kao održiv način u smislu da su biorazgradiva pod određenim uslovima, za razliku od tradicionalnih sintetičkih vlakana poput poliestera ili najlona, kojima je potrebno mnogo vremena da se razbiju i doprinesu zagađenju životne sredine. Pored toga, PLA vlakna se raspadaju u jednostavnija jedinjenja, smanjujući uticaj na životnu sredinu. Ova studija istražuje uticaj nekih svojstava pređe potke, kao što su vrste prediva, uključujući PLA predivo, reciklirano PET-Trevira predivo, poliestersko predivo i faktore gustine potke na snagu kidanja, propustljivost vazduha i neka svojstva postojanosti običnog, kepera i satenske tkanine. Devet različitih tipova običnih, keperovih i satenskih grupa tkanina proizvedeno je korišćenjem 3 različite vrste prediva (poliester, reciklirani poliester-Trevira, PLA) pri 3 različite gustine potke (24,26,28 niti/cm za obične, 32, 34,36 niti/cm za keper, 36,38,40 niti/cm za satenske grupe) pri čemu je dobijeno ukupno 27 različitih uzoraka draperije. Za ocenu rezultata korišćene su SPSS statističke analize i trakasti grafikoni. Randomizovana dvosmerna ANOVA je korišćena na nivou značajnosti od 0,05 među grupama obične, keperove i satenske odvojeno. Pored toga, SNK testovi su takođe sprovedeni da bi se posmatrala sredina svakog parametra. Takođe su ubačene opšte ocene o pranju, hemijskom čišćenju i trljanju obojenih tkanina.*

Ključne reči: PLA, tkanine za draperije, tip prediva potke, čvrstoća na kidanje, propustljivost vazduha.

1. INTRODUCTION

The advancement of biopolymers has gained momentum due to the implementation of environmental regulations governing waste management. Forecasts indicate that biodegradable polymers will play pivotal roles in upcoming industries. These polymers fall into three primary categories: (1) natural biopolymers like cellulose, starch, chitin, and polysaccharides; (2) synthetic polymers generated through polymerization, such as polylactic acid (PLA) and poly(€-caprolactone) (PCL); and (3) composite polymers like PCL/starch. PLA stands out among these categories as one of the most extensively researched. It is a linear, aliphatic, thermoplastic polyester derived from lactic acid, sourced entirely from renewable origins like corn. The distinct properties of PLA products, including low raw material costs, access to renewable agricultural resources, and high biodegradability, make them exceedingly marketable. Notably, microorganisms in the environment can fully break down PLA into CO_2 and H_2O due to its high biodegradability. Owing to their multitude of advantages, PLA-based products find wide-ranging applications across diverse industries.

Specifically, efforts in research to broaden the use of PLA fibers in the textile sector have resulted in the creation of diverse PLA fiber types, including nonwoven, woven, and knit fabrics. These fibers have gained significant traction within the textile industry as a biomass material due to their comparable properties to polyethylene terephthalate (PET). Indeed, there's a recognized potential for PLA fibers to replace conventional petrochemical-based polymers commonly used in textiles. To incorporate PLA fibers into clothing materials within the textile sector, it's crucial to comprehend their degradation characteristics and understand effective degradation methods. However, despite their potential, many wastes from industries like textiles, films, plastics, or nonwovens often remain uncollected and unrecycled due to the high costs involved in processing. PLA, a highly versatile polymer with vast potential, finds extensive applications across diverse industries, including textiles and medicine. Numerous studies have extensively explored its thermal and crystallization characteristics [1-9].

There are some early works related to utilizing of PLA in textile. Poly lactic acid (PLA) and ramie fibre (RF) core spun yarns were produced in order to a provide a novel fabrication technology with the combination of two-dimensional (2D) braiding and three-dimensional (3D) weaving [9]. RF/PLA core-spun yarns were employed as weft yarns, and RF/PLA combined yarns as the warp and Z-directional yarns to weave 3D orthogonal woven fabrics on a 3D weaving loom. The tensile strength of RF ply yarn composites shows an initial rise followed by a decline as the twist ratio increases. It peaks at the maximum tensile strength of 60.4 MPa when the twist ratio reaches 0.3. Optimal curing conditions of 190, 5 MPa, and 30 minutes result in the 3D RF/PLA composites exhibiting their highest flexural and shearing properties, specifically observed at a 50% RF content level [9].

The biodegradability of polylactic acid (PLA) nonwovens was evaluated using enzymatic degradation. The findings proposed the mechanism of enzymatic degradation of PLA nonwovens, which might be useful for waste management in the textile industry [10]. PLA samples were produced through 3D printing, exhibiting various cross-sectional shapes and configurations, some integrating post-tensioning ducts while others lacking them. Prior to insertion, experimental assessments were conducted on continuous jute and flax reinforcing fiber strands to ascertain their mechanical characteristics. These strands were subsequently subjected to post-tensioning at predetermined stress levels and affixed in position using 3D-printed anchors. The research investigated the influence of factors such as fiber type, matrix cross-sectional shape, number of reinforcing strands, and the degree of post-tensioning on specific mechanical properties of PLA (such as strength, stiffness, and rigidity-to-weight) through both tensile and flexural mechanical assessments [11]. Although these examples of the early literature may be increased, it has been understood that there is a gap in the literature related to investigation of fabric properties having Poly lactic acide fibres as a raw material. This work has aimed to make a comparative evaluation for tear strength, air permeability and some fastness results of plain, twill and satin drapery woven samples produced from different weft yarns such as polyester, recycled Trevira, Polylactic acide (PLA) at different weft densities (24,26,28 threads/cm for plain, 32,34,36 threads/cm for twill, 36,38,40 threads/cm for satin groups) by using the same warp yarn of 22 dtex polyester at the constant warp density of 40 threads/cm.

2. EXPERIMENTAL

2.1. Material Preparation

This study has been conducted to perform a comparative study for the evaluation of tearing strength, washing, dry-cleaning and rubbing fastness of plain, twill and satin woven samples produced from polyester, polylactic acid and recycled polyester-Trevira weft yarn at different weft densities. The plain samples were woven at the weft densities of 24,26 and 28 threads/cm, twill samples were woven at the weft densities of 32,34 and 36 threads/cm while satin samples were woven at the weft densities of 36,38 and 40 threads/cm. The draw texturized polyester and recycled Polyester-Trevira yarn (%50 / %50) and biopolymer based polylactic acid yarns were provided as the weft yarn. 22 dtex polyester warp yarn was used at the warp density of 40 threads/cm for all drapery samples. The utilized weft yarn properties are indicated below in table 1, while the experimental plan for the fabric production is displayed in table 2. The woven drapery fabrics with Polyester, recycled Polyeseter-Trevira weft yarn and PLA weft yarn were exposed to dyeing process with the relevant recipe. The dyeing process for the fabric samples with PLA weft yarn are indicated below in Figure 1.

Table 1: Weft yarn properties

	dtex/fil	elongation (%)	Breaking tenacity (cN/dtex)	Number of intermingling	Hot air shrinkage (%)
Polyester	167/108	19.9	6.6	108	6
Recycled Polyester- Trevira (50%-50%)	167/64	32.0	6.1	79	4
Polylactic Acide (PLA)	167/48	27.3	2	19	10

Table 2. Fabric Production Parameters

Fabric code	Weft yarn type	Weaving type	Weft density (threads/cm)	Warp density (threads/cm)	Warp yarn type
P24	167/108 dtex/fil Intermingled Polyester	Plain	24	40	22 dtex Polyester
P26			26		
P28			28		
T24	167/64 dtex/fil Intermingled Recycled Polyester-Trevira (%50/50)		24		
T26			26		
T28			28		
PL24	167/48 dtex/fil Intermingled PLA		24		
PL26			26		
PL28			28		
P32	167/108 dtex/fil Intermingled Polyester	Twill	32		
P34			34		
P36			36		
T32	167/64 dtex/fil Intermingled Recycled Polyester-Trevira (%50/50)		32		
T34			34		
T36			36		
PL32	167/48 dtex/fil Intermingled PLA		32		
PL34			34		
PL36			36		
P36	167/108 dtex/fil Intermingled Polyester	Satin	36		
P38			38		
P40			40		
T36	167/64 dtex/fil Intermingled Recycled Polyester-Trevira (%50/50)		36		
T38			38		
T40			40		
PL36	167/48 dtex/fil Intermingled PLA		36		
PL38			38		
PL40			40		

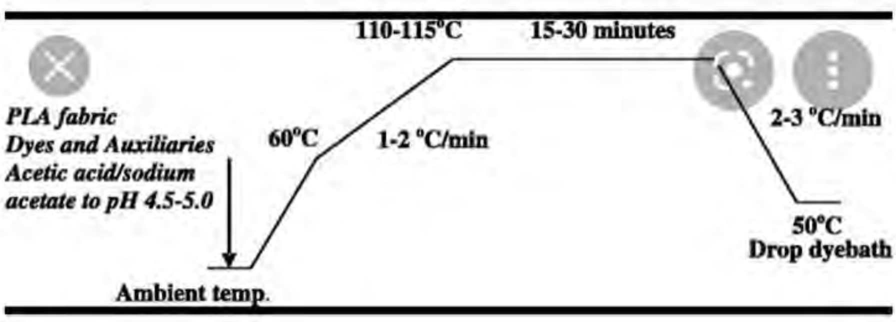

Figure 1: Dyeing recipes for the samples with PLA weft yarn

2.2. Method

The samples were conditioned for 24 h in standard atmospheric conditions (at the temperature of 20 ± 2 °C and relative humidity of 65 ± 2%) before the performed tests. The ability to resist tearing in textiles stands as a crucial attribute, especially concerning drapery fabrics. In pre-cracked samples subjected to a static load, a specific area known as the "del zone" emerges due to the stretching and consecutive breakage of yarn groups within the fabric. As tearing progresses, the del zone advances in the tearing direction through continued sliding of longitudinal yarns and stretching of transverse yarns [12,13]. To assess the tearing strength of shirting fabrics, measurements of dynamic tear strength (N) values were recorded. The weft-wise dynamic tear strength tests were conducted using the Titan test device (AYGENTEKS) placed in Vanelli Textile laboratory (Bursa, Turkey) according to ISO 13937-3:2000 test standard [14]. Air permeability of samples were also measured via SDL Atlas Digital Air Permeability Tester Model M021 A according to EN ISO 9237 standard [15]. Additionally, washing fastness, dry cleaning fastness and rubbing fastness values were evaluated according to to EN ISO 105-C06, ISO 105 - D01 and DIN ISO 105 X12 2016 test standards respectively [16-18]. James Heal's Color Fastness Tester "GyroWash 415" was utilized for washing and dry cleaning fastness measurement while Crockmeter rubbing fastness-tester was utilized for the rubbing fastness measurement. The grey scale was benefited from for determining the fastness grades. According to Grey Scale, 1-2-3-4-5 are rating classes also half rating values can be used like 4-5 (1- very poor, 2- poor, 3-fair, 4-good and 5-excellent).

2.3. Statistical Analysis

A completely randomized two-factor analysis of variance (ANOVA) was conducted to assess the influence of weft yarn type and weft density on tear strength and air permeability properties within plain, twill, and satin drapery fabric samples. SNK tests were employed to compare the means, and treatment levels distinguished by different letters (a, b, c) indicate significant differences at a significance level of 0.05. Statistical analyses were carried out using the SPSS 23 Statistical software package.

3. RESULTS AND DISCUSSION

3.1. Tear Strength

Tear is characterized by the consecutive breakage of yarn groups within the fabric and serves as a crucial mechanical parameter directly assessing serviceability. Fabrics with low tear strength are deemed inferior products. This particular property is affected by variations in yarn and fabric geometry, fiber relaxation, and frictional characteristics. Existing literature underscores that tightly woven fabric constructions limit yarn movement, whereas loose and open fabric constructions enable yarns to slide more freely [19-21]. According to Figure 2; regarding to weaving construction, plain woven samples provided lower tear strength results compared to their counterparts with those twill and satin woven samples. This may be attributed to the different of yarn float lengths between the different weaving constructions. The weaving construction of twill and satin fabrics incorporates longer yarn floats, leading to increased yarn sliding when subjected to tear force. Literature highlights that the quantity of yarn intersections per unit repeat significantly impacts the tear force of fabric in both warp and weft directions. Longer yarn floats allow greater freedom for yarns to slide and involve more threads contributing to tear resistance. Consequently, weaving patterns with fewer intersections, like twill and satin, are anticipated to offer higher tear strength due to increased yarn freedom to slide, compared to patterns with more intersections, such as plain weaving [19-21]. Considering the weft yarn type, generally samples with PLA weft yarn reveal lower tear strength results compared to those with polyester and recycled Polyester-Trevira weft yarns prominently for the plain, twill and satin groups. This

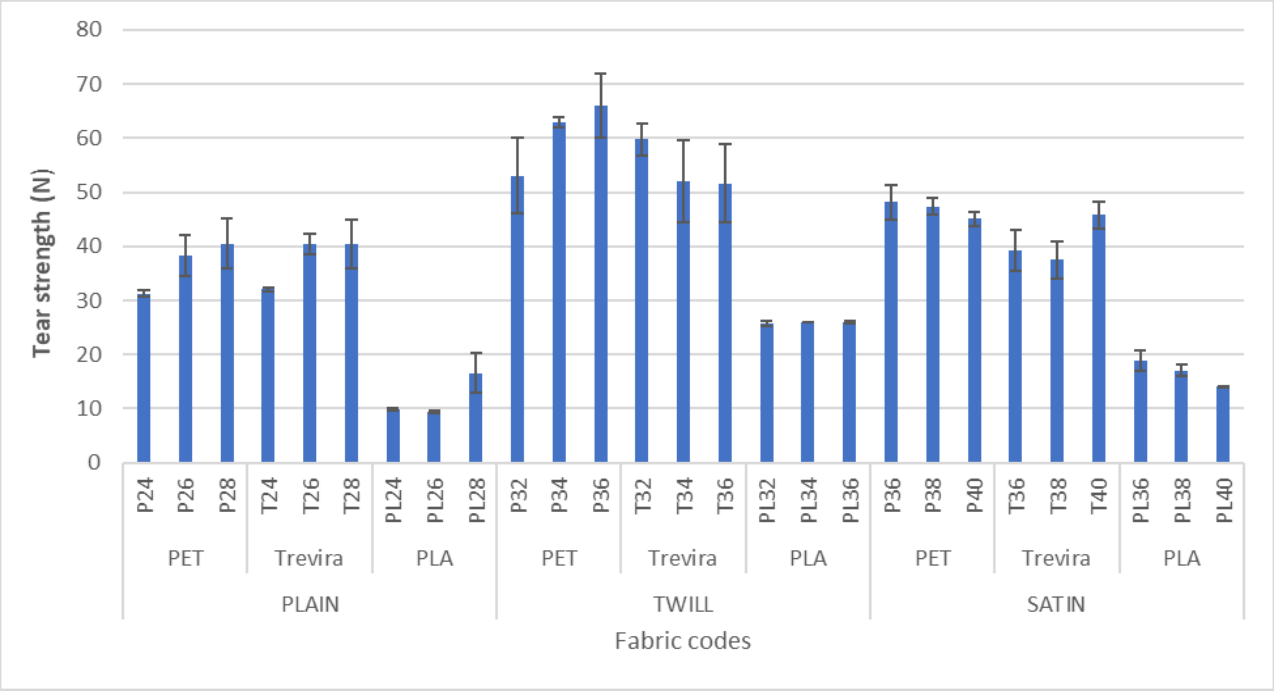

Figure 2: Tear strength of drapery fabrics

is probably because of the lower yarn tensile strength of PLA as indicated in Table 1. When it comes to weft density, there is a slight increase for the tear strength as the weft density increases from 26 threads /cm to 28 threads/cm for the woven samples with PET, PLA and Trevira weft yarn among the plain sample groups. However, the tearing strength decreased as the weft density increased among the woven fabrics with recycled Polyester- Trevira weft yarn among the twill sample groups. The same trend was also observed among satin group with polyester weft yarn.

Apart from employing bar graphs, a two-way ANOVA (as shown in table 3) was utilized to analyze the impact of weft yarn type and weft density on the tear strength of plain, twill, and satin fabric groups individually. The means were compared by means of SNK tests (table 4). According to ANOVA table, weft yarn type and weft density were significant factors on tear strength values of plain samples while interaction of weft yarn type and weft density were non-significant on air permeability of plain samples. Among twill samples, weft density and the interaction of weft yarn type and weft density factors were non-significant factors on tear strength of twill samples while weft yarn type was a significant factor at significant level of 0.05. When it comes to satin groups, weft yarn type, was a significant factor while weft density and the interaction of weft yarn type and weft density were non-significant factors on tear strength of satin groups at significant level of 0.05. SNK results also indicated that plain,twill and satin samples produced from Polyester, recycled Polyester-Trevira and PLA weft yarns possessed different tear strength results at significant level of 0.05 (table 4). Considering weft yarn type; samples from PLA weft yarn revealed the minimum tear strength among plain, twill and satin groups while samples from polyester weft yarn provided the highest tear strength among plain, twill and satin groups. Considering the weft density; samples with the weft density of 24 threads/cm indicated the minimum tearing strength while samples with the weft density of 26 and 28 threads/cm provided higher tearing strength which were observed under the same subset among the plain groups. Additionally tearing strength of samples with the weft density of 32,34 and 36 threads/cm were observed under the same subset at significance level of 0.05 among twill groups and the tearing strength of samples with the weft density of 36,38 and 40 threads/cm were observed under the same subset among the satin groups

Table 3: ANOVA results for tear strength of Plain, Twill and Satin Samples

Main source	Plain	Twill	Satin
weft yarn type	0.00*	0.00*	0.00*
weft density	0.00*	0.90	0.74*
weft yarn type* weft density	0.55	0.26*	0.10*

* significantly important

Table 4: SNK results for tear strength

Parameter: Weft yarn type	**Plain**		**Twill**		**Satin**	
Polyester	36.67 b		60.64 b		46.87 c	
Recycled Poylester-Trevira	37.65 b		54.47 b		40.84 b	
PLA	11.93 a		25.90 a		16.66 a	
Parameter : Weft density	**Plain**		**Twill**		**Satin**	
	24	24.38 a	32	46.15 a	36	35.40 a
	26	29.37 b	34	46.99 a	38	33.95 a
	28	32.50 b	36	47.88 a	40	35.03 a

The different letters next to the counts indicate that they are significantly different from each other at a significance level of 0.05

3.2. Air Permeability

Air permeabiity of drapery fabrics should be considered for wind penetration and this property may be influenced from the raw material and fabric structural property [22-25]. Figure 3 reveals the air permeability results of woven samples. Regarding to weaving type, plain samples generally indicated higher air permeability results compared to twill and satin groups. Highest value was obtained from T24 coded plain fabrics produced from recycled Polyester- Trevira weft yarn at 24 weft density while minimum value was found among P36 coded twill fabrics produced from polyester weft yarn at the 36 weft density. Another remarkable result was the decrement of the air permeability as the weft density increased among each plain, twill and satin groups with different weft yarn. The result is attributed to higher number of intersections of warp and weft yarns as the weft density increased.

To assess the impact of weft density and weft yarn type on the air permeability of samples, a two-factor analysis of variance (ANOVA) test was carried out within the plain, twill, and satin groups. The significance values (p-values) linked to F-tests for the two-way completely randomized ANOVA tests were presented in Table 5 [22]. SNK results for air permeability was also displayed in table 5. ANOVA results in-

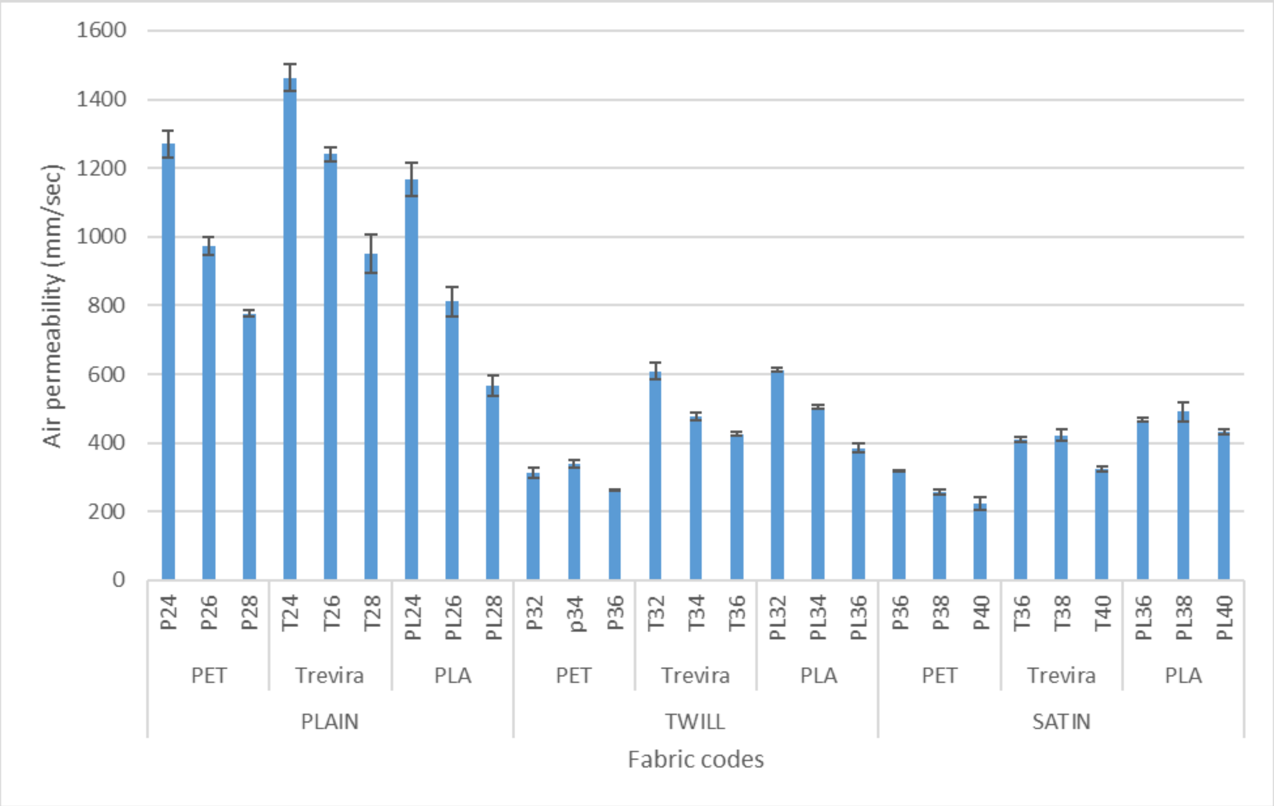

Figure 3: Air permeability of samples

dicated that weft yarn and weft density factors were significantly influential factors on air permeability of plain, twill and satin fabric groups at significant level of 0.05. Interaction of these two factors were only significant on the twill fabric groups at significant level of 0.05. SNK results also revealed that plain ,twill and satin samples produced from different weft density and from different weft yarn type possessed different air permeability results at significant ratio of 0.05 (table 6). Among the plain groups, samples produced from PLA weft yarn indicated the minimum air permeability result while samples with recycled Polyester-Trevira weft yarn revealed the highest air permeability value. On the other hand, among the twill groups,air permeability of samples with PLA and recycled Polyester-Trevira weft yarn were under the same subset at significance level of 0.05. and higher than air permeability of samples with Polyester weft yarn. Finally among the satin groups, samples with Polyester weft yarn indicated the minmimum value while samples with PLA weft yarn revealed the highest air permeability value. Considering the weft density, SNK results showed that the air permeability values decreased as the weft density increased among plain,twill and satin groups.

Table 5: ANOVA results for air permeability

Main source	**Plain**	**Twill**	**Satin**
weft yarn type	0.00*	0.00*	0.00*
weft density	0.00*	0.00*	0.00*
weft yarn type* weft density	0.48	0.00*	0.07

* significantly important

Table 6: SNK results for air permeability

Parameter: Weft yarn type	**Plain**		**Twill**		**Satin**	
Polyester	1006.22 b		305.22 a		267.11 a	
Recycled Polyester-Trevira	1218.22 c		504.00 b		385.66 b	
PLA	848.22 a		501.00 b		461.11 c	
	Plain		**Twill**		**Satin**	
Parameter: Weft density (threads/cm)	24	1300 c	32	511.22c	36	399.33 b
	26	1007 b	34	440.67 b	38	390.00 b
	28	764.89 a	36	358.33 a	40	326.55 a

The different letters next to the counts indicate that they are significantly different from each other at a significance level of 0.05

3.3. Washing fastness, dry cleaning fastness and rubbing fastness

Greige and dyed drapery fabrics' washing fastness and dry cleaning fastness and rubbing fastness were evaluated according to EN ISO 105-C06, ISO 105 - D01 and DIN ISO 105 X12 2016 test standards respectively. Table 7 demonstrates the evaluation of changes in the original fabric and grey scale staining for washing fastness, dry cleaning, and rubbing fastness. The washing fastness outcomes generally indicated satisfactory results concerning staining and color change evaluations across the plain, twill, and satin fabric groups utilizing different weft yarn types. The washing fastness properties of samples were grade of 5 for staining on different fabrics and 4/5 for sample change assessment. When it comes to dry cleaning fastness results, the plain, twill and satin samples from polyester and recycled polyester - Trevira weft yarns revealed satisfying grade of 5 for staining and grade of 4/5 for color change. However the results varied between the grade of 2 and 3 for staining and grade of 4/5 for color change assessment for plain, twill and satin samples produced from PLA weft yarns. Considering rubbing property, dry rubbing fastness results of samples and wet rubbing fastness results were close to each other among all samples. Additionally, there was a very slight decrement for the wet rubbing fastness results compared to dry rubbing fastness results among some of the sample groups.

Table 7: Washing , dry cleaning, rubbing fastness of plain, twill and satin fabrics TS EN ISO 105-C06, ISO 105 - D01, DIN ISO 105 X12 2016

	Washing fastness							Dry cleaning fastness		Rubbing fastness	
Fabric code	Staining on acetate	Staining on cotton	Staining on polyamide	Staining on polyester	Staining on acrylic	Staining on wool	Change assestment	staining	Change assestment	dry	wet
P24	5	5	5	5	5	5	4/5	5	4/5	5	5
P26	5	5	5	5	5	5	4/5	5	4/5	5	5
P28	5	5	5	5	5	5	4/5	5	4/5	5	4/5
T24	5	5	5	5	5	5	4/5	5	4/5	5	5
T26	5	5	5	5	5	5	4/5	5	4/5	5	5
T28	5	5	5	5	5	5	4/5	5	4/5	5	5
PL24	5	5	5	5	5	5	4/5	3	4/5	5	4/5
PL26	5	5	5	5	5	5	4/5	2/3	4/5	5	5
PL28	5	5	5	5	5	5	4/5	2/3	4/5	5	4/5
P32	5	5	5	5	5	5	4/5	5	4/5	5	4/5
P34	5	5	5	5	5	5	4/5	5	4/5	5	4/5
P36	5	5	5	5	5	5	4/5	5	4/5	5	4/5
T32	5	5	5	5	5	5	4/5	5	4/5	5	5
T34	5	5	5	5	5	5	4/5	5	4/5	5	5
T36	5	5	5	5	5	5	4/5	5	4/5	5	5
PL32	5	5	5	5	5	5	4/5	3	4/5	5	5
PL34	5	5	5	5	5	5	4/5	2	4/5	5	5
PL36	5	5	5	5	5	5	4/5	2/3	4/5	5	5
P36	5	5	5	5	5	5	4/5	5	4/5	5	4/5
P38	5	5	5	5	5	5	4/5	5	4/5	5	4/5
P40	5	5	5	5	5	5	4/5	5	4/5	5	4/5
T36	5	5	5	5	5	5	4/5	5	4/5	5	4/5
T38	5	5	5	5	5	5	4/5	5	4/5	5	4/5
T40	5	5	5	5	5	5	4/5	5	4/5	5	4/5
PL36	5	5	5	5	5	5	4/5	2/3	4/5	5	5
PL38	5	5	5	5	5	5	4/5	2/3	4/5	5	5
PL40	5	5	5	5	5	5	4/5	2	4/5	5	5

4. CONCLUSION

PLA (polylactic acid) fiber is a biodegradable and renewable resource derived from natural materials like corn starch or sugarcane. Its usage in textiles aligns with sustainability for its high biodegradability, being as a renewable resource, its requiring less energy compared to production of some other synthetic fibres and its being biocompatible to most of environmental processes [1-9]. This study has been performed to reveal the effect of different weft yarn types including Polyl lactic acide (PLA) yarn, recycled PET-Trevira yarn, Polyester yarn and the effect of different weft densities *(24,26,28 threads/cm for plain, 32,34,36 threads/cm for twill, 36,38,40 threads/cm for satin groups)* on tear strength, air permeability and on some fastness results of plain, twill and satin drapery fabrics. As per both the bar graphs and ANOVA analyses, the type of weft yarn significantly influenced tear strength and air permeability in the plain, twill, and satin sample groups. Among these samples, those with PLA weft yarn displayed lower tear strength values compared to counterparts using Polyester and recycled Polyester-Trevira weft yarn. The impact of weft density on tear strength exhibited variations based on the woven structure, as indicated by the SNK results for tear strength.

Considering air permeability, plain fabrics generally revealed more satisfactory results compared to twill and satin samples. ANOVA results indicated that weft yarn and weft density factors were significantly influential factors on air permeability of plain ,twill and satin fabric groups at significant level of 0.05. SNK results showed that samples with PLA weft yarn provided better air permeability results compared to samples with polyester weft yarn among twill and satin groups however they indicated lower air permeability compared to those with polyester and recycled Polyester-Trevira weft yarn among plain groups . Considering the weft density, SNK results also showed that the air permeability values deterioriated as the weft density increased among all woven structure groups. The washing fastness results were generally satisfying for all plain, twill and satin fabric groups with different weft yarn type. However the dry cleaning fastness results varied between the grade of 2 and 3 for staining and grade of 4/5 for color change assessment for plain,twill and satin samples produced from PLA weft yarns.

As a general evaluation using PLA yarns in the drapery fabric production may be a good alternative which can attract conscious consumers for eco-friendly products. Despite many advantages, the challenges with PLA fibres including higher production costs, potential limitations in terms of durability and some other mechanical restricting features in the fabrics should be considered. However, since PLA fibers offer a sustainable way for reducing the environmental impact of textile production, there should be more ongoing research and technological advancement aiming to address these limitations.

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