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Influence of the Kind of Fabric Finishing on Selected Aesthetic and Utility Properties

Abstract
Clothing designed by means of engineering methods should be characterised by pleasant handle, good drape, and appropriate hygienic properties. All these properties depend not only on the kind of raw material applied and the structure of fabrics, but also on the kind of finishing. Therefore, a suitable selection of the kind of finishing which would conscious creation of the fabric properties plays an important part in clothing design by means of engineering methods. The aim of this investigation was to determine the influence of the kind of finishing on selected aesthetic and hygienic properties of cotton and cotton/polyester woven fabrics destined for clothing. Twenty variants of raw woven fabrics differentiated by raw material (woven fabrics of 100% cotton, 67% cotton/33% polyester, 50% cotton/50% polyester, 33% cotton/67% polyester) were finished by means of two methods: the standard starch method and the elastomeric method. The woven fabric parameters, such as the dimension changes after washing, crease resistance, drape, and air permeability were analysed. All these parameters were tested in accordance with Polish standards. The test results are discussed in this article.

Key words: *finishing, fabric, aesthetic properties, utility properties, drape, shrinkage, air permeability.*

Introduction

Before carrying out tests to determine the behaviour of woven fabrics during use, it is very important to state where these fabrics would be applied. Woven fabrics for clothing manufacture, which are exposed to the action of mechanical forces, require tests concerning the influence of these forces not only on their strength, but also on the stability of their dimensions [1-3]. Knowledge of this latter feature is required for the selection of suitable utility criteria. There are numerous examples of a lack of shape stability in textiles after washing, especially in the case of woven fabrics made of cellulose yarns and their blends. The dimension changes show an incorrect structure of fabrics, which is the result of incorrect technological processes having been applied. Positive results in dimension stability can be achieved by proper selection of the chemical means used in the finishing process.

The bending rigidity of the fabric, together with the pressure acting on it, are the reasons for material creasing, which is the most frequently occurring mechanical effect appearing on the woven fabric's surface. Creasing also leads to a general aesthetic distortion of the material's surface view. The measure of crease resistance, which depends on the elastic fabric properties, is determined by the wrinkle angle [4]. The measurements of this property may be useful for a comparison of woven fabrics.

The drape of woven fabrics is one of the most important properties concerning both clothing textiles and technical textiles [7]. The first investigations concerned with mechanisms occurring in woven fabrics which determine their shape were limited to deformation tests of the fabric in two directions. Hitherto, the drape ability of woven fabrics has been estimated subjectively, but at present measuring devices exist which can objectively determine this fabric feature. Chu [5] and Cusic [6] have contributed significantly to the problem of practically determining the utility properties of woven fabrics by measurements of the fabric's three-dimensional form. The drape ability measuring device which at present is available on the market was designed by these researchers. Thanks to this device, Chu and Cusic have determined the drape coefficient (i.e., a ratio of the surface of the sample projection and the total surface of the tested sample). The numerical value of the drape coefficient allows us to objectivise the drape estimation of flat textile products. According to these researchers, a low value of the drape coefficient is identified with a woven fabric which can be easily deformed.

Drape ability is closely connected with stiffness [8]. Very stiff woven fabrics are characterised by a drape coefficient near 100%, whereas soft fabrics by one of 0%. This coefficient for woven fabrics with loose weaves is included within the range of up to over 30%, and up to 90% for stiff fabrics.

Air permeability is one of the biophysical features of clothing. This property determines the clothing's ability to carry out gaseous substances and sweat, significantly influences the thermal protection of the human body, ensures the maintenance of an appropriate body temperature, and determines its protection against atmospheric factors.

Aim of the Investigation

The main aim of the investigations we initiated was to determine the influence of the kind of finishing on the

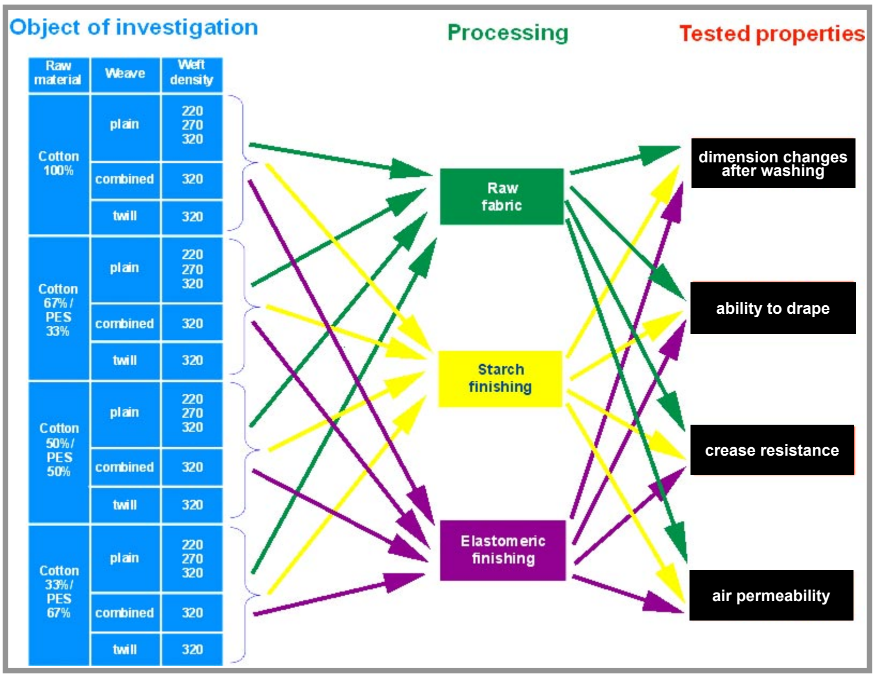

Figure 1. *Specification of the woven fabric variants and the plan of experiment.*

basic aesthetic and hygienic properties of the woven fabrics, such as the change of dimensions after washing, crease resistance, drape ability and air permeability. The research work we undertook allows a conscious creation of the fabric properties, and plays an important part in clothing design by means of engineering methods. The fabrics designed were finished by means of two methods: the standard starch method used for bed linen, and the improving elastomeric method. The fabrics were also differentiated by weaves and weft density in order to ascertain in what way these two factors influence the final values of the tested parameters after finishing.

Materials

Twenty variants of raw woven fabrics (R), also used for another investigation [9], were manufactured. These raw fabrics were then finished by two kinds of finishing methods: the starch method (S) and the elastomeric method (E). Therefore, the measurement material numbered sixty fabrics in total. The fabrics differed by various kinds of raw materials: five of them were made of 100% cotton yarn, and fifteen fabrics were manufactured from classical cotton/polyester yarn blends with various percentages of polyester content (33%, 50%, and 67%). All the yarns (weft and warp) applied have nominal linear density of 20 tex. The fabrics were additionally differentiated by weave (plain - P, twill -T, and combined - C) and weft density (22, 27, 32 threads/cm in the case of plain weave). The nominal warp density for all the fabrics was the same, and equalled 32 threads/cm. The specification of the fabric variants manufactured is presented in Figure 1.

Properties of the yarns used

The physico-mechanical properties of the yarns used are presented in Table 1.

Properties of raw fabrics

The properties of raw fabrics such as width, number of threads per cm, crimp of threads and mass per square meter are presented in [9], whereas shrinkage, breaking force and elongation at break are presented in Table 2.

Finishing methods

The following composition of the finish bath was used for starch finishing (S):

- Dexyne white - 40 g/l,
- VNO 500 Perustol (Rudolf Chemie) -10 g/l,
- M Volturin (Rudolf Chemie) - 5 g/l,
- PBD Heliofor (BASF) - 4 g/l.

Drying was carried out at a temperature of 140°C.

The following composition of the finish bath was used for the improving elastomeric finishing method (E):

- GFA Stabilex (HENKEL) - 50 g/l,
- magnesium chloride - 5 g/l,
- GES Rucofin (Rudolf CHEMIE) - 20 g/l,
- PBD Heliofor (BASF) - 4 g/l.

Drying was carried out at a temperature within the range of 150-160°C.

Properties of the finished fabrics

Properties of the finished fabrics are presented in Tables 3 and 4.

Experimental

All the properties of raw and finished woven fabrics were measured in accordance with the following standards:

a) Aesthetic properties:

- shrinkage: ISO 6330:1984, PN-EN ISO 3759:1988, PN-EN 25077:1998,
- crease resistance: PN-73/P-04737,
- drape ability: PN-73/P-04736;

b) Hygienic property:

- air permeability: PN-EN ISO 9237: 1998.

The changes in the aesthetic and utility

Table 1. *Specification of yarn parameters used for woven fabric manufacture.*

Parameter	Unit	Co 100%	Co 67%/ PES 33%	Co 50%/ PES 50%	Co 33%/ PES 67%
Linear density	tex	20.1	20.20	20.70	20.3
Variation coefficient of linear density	%	1.31	1.03	1.04	1.16
Breaking force	cN	349.3	342.0	377.40	394.3
Variation coefficient of breaking force	%	5.7	6.93	8.52	10.30
Tenacity	cN/tex	17.4	16.90	18.20	19.40
Elongation at break	%	6.9	7.43	8.99	9.89
Variation coefficient of strain	%	6.3	7.38	7.35	7.80
Twist	min^{-1}	916.0	933.0	948.0	892.0
Twist variation coefficient	%	5.03	4.01	5.13	4.60
Twist coefficient metric	-	129.9	132.4	136.4	127.10
CV%	%	14.7	14.42	14.12	15.36
Thin places/1000 m	-	3.2	6.40	0.0	26.40
Thick places/1000 m	-	46.4	66.40	36.0	128.0
Neps/1000 m	-	64.0	50.40	47.2	48.80

Table 2. *The mechanical properties of raw fabrics.*

Parameter	Unit	Thread system	CO 100%					CO 33%/PES 67%				
			P-22	P-27	P-32	C-32	T-32	P-22	P-27	P-32	C-32	T-32
Shrinkage	%	warp	-12.6	-11.6	-10.1	-15.1	-9.8	-5.1	-3.7	-4.1	-8.0	-5.0
		weft	-7.5	-8.8	-9.7	-14.3	-10.9	-4.4	-6.1	-5.9	-9.9	-5.9
Breaking force	daN	warp	64.1	60.3	46.1	66.7	62.3	64.9	64.3	56.3	66.4	61.8
		weft	42.3	54.6	51.8	66.5	56.6	45.3	62.0	48.2	64.2	54.6
Elongation at break	%	warp	12.9	14.6	15.0	10.6	7.6	15.3	15.8	14.3	12.0	8.9
		weft	11.1	12.6	11.5	12.8	11.9	14.2	14.3	12.4	16.6	14.3
Parameter	**Unit**	**Thread system**	**CO 50%/PES 50%**					**CO 67%/PES 33%**				
			P-22	P-27	P-32	C-32	T-32	P-22	P-27	P-32	C-32	T-32
Shrinkage	%	warp	-6.2	-5.6	-6.5	-7.5	-4.7	-9.6	-8.9	-9.1	-12.0	-7.2
		weft	-5.0	-8.9	-9.3	-10.9	-5.1	-6.5	-7.3	-9.2	-10.7	-6.3
Breaking force	daN	warp	64.3	61.6	62.8	68.7	64.7	75.2	67.3	63.4	74.6	68.2
		weft	50.2	61.2	64.3	73.6	65.4	58.7	54.2	61.8	73.0	64.6
Elongation at break	%	warp	19.8	19.4	19.8	14.5	10.7	20.1	20.9	23.2	17.0	10.5
		weft	13.6	14.5	15.1	15.8	15.2	19.7	18.7	19.1	20.8	20.0

Table 3. *The mechanical properties of fabrics after starch finishing.*

Parameter	Unit	Thread system	CO 100%					CO 33%/PES 67%				
			P-22	P-27	P-32	C-32	T-32	P-22	P-27	P-32	C-32	T-32
Width	cm	-	140.0	140.1	140.1	140.8	140.5	141.4	139.8	139.3	140.6	141.8
Number of threads per 1 dm	-	warp	344.0	345.0	345.0	343.0	345.0	341.0	343.0	347.0	344.0	341.0
		weft	223.0	272.0	312.0	316.0	320.0	229.0	281.0	316.0	304.0	308.0
Crimp of threads	%	warp	2.7	3.5	3.8	2.4	1.5	4.2	4.9	5.0	2.9	1.8
		weft	7.6	8.4	9.4	8.2	8.6	7.4	8.1	9.6	9.3	8.8
Mass per square metre	g/m²	-	116.1	128.5	137.1	135.8	136.4	123.9	139.4	144.9	142.7	139.9
Shrinkage	%	warp	-4.9	-4.3	-4.1	-3.7	-2.9	-2.0	-2.0	-2.0	-1.7	-1.2
		weft	-1.7	-2.6	-3.6	-4.3	-3.5	-0.6	-1.2	-1.8	-1.8	-1.4
Breaking force	daN	warp	60.8	57.1	45.8	57.9	60.7	60.2	64.3	65.1	68.9	58.7
		weft	44.1	39.4	43.4	49.1	43.7	38.2	46.6	49.4	56.9	49.2
Elongation at break	%	warp	9.0	9.4	8.9	7.0	6.1	14.4	15.7	16.1	12.8	11.9
		weft	13.9	13.9	16.0	15.2	15.9	17.0	19.8	20.1	20.8	21.3
Parameter	**Unit**	**Thread system**	**CO 50%/PES 50%**					**CO 67%/PES 33%**				
			P-22	P-27	P-32	C-32	T-32	P-22	P-27	P-32	C-32	T-32
Width	cm	-	140.6	139.4	138.9	140.5	140.5	140.5	138.2	138.5	146.1	141.9
Number of threads per 1 dm	-	warp	342.0	344.0	346.0	344.0	345.0	345.0	349.0	349.0	344.0	344.0
		weft	225.0	285.0	333.0	333.0	335.0	232.0	299.0	326.0	322.0	331.0
Crimp of threads	%	warp	3.9	4.9	5.0	3.0	1.5	3.8	4.8	5.6	2.6	1.7
		weft	8.2	9.3	9.6	8.9	9.2	9.5	10.2	10.5	8.7	9.4
Mass per square metre	g/m²	-	127.3	142.1	153.0	148.2	150.2	124.8	142.2	151.0	145.2	145.2
Shrinkage	%	warp	-1.4	-1.4	-1.4	-1.0	-0.7	-2.3	-2.6	-2.6	-2.6	-1.5
		weft	-0.2	-0.6	-0.6	-1.1	-0.7	-1.5	-0.9	-1.8	-2.3	-1.1
Breaking force	daN	warp	69.1	63.66	57.7	66.2	60.3	62.3	55.5	50.9	58.4	55.2
		weft	43.5	50.7	52.5	62.1	58.7	36.4	45.5	45.5	52.9	54.5
Elongation at break	%	warp	13.5	14.1	12.8	11.9	9.5	10.6	14.0	11.4	9.1	8.4
		weft	16.1	19.6	17.7	19.2	18.5	14.8	21.6	13.9	13.2	18.8

properties which appeared as a result of the two kinds of finishing applied are presented in Figures 2-7.

Shrinkage - measurement method and test results

Method

The dimension changes in the weft and warp directions of the raw and finished fabrics were assessed. Three measurement repetitions in the warp and weft directions for each sample were carried out. The dimension change after washing was calculated from the following equation (1):

$$Z_i = [(L_{pi} - L_{oi})/L_{oi}] \cdot 100\% \qquad (1)$$

where:

L_{pi} - length of a marked segment after washing, in mm; and

L_{oi} - length of a marked segment before washing, in mm.

Test results

Shrinkage of all raw fabrics is highest in both directions compared to the finished fabrics, for which shrinkage significantly decreases in the warp and the weft directions (Figures 2 and 3). The drop in shrinkage of the finished woven fabrics (in both directions) oscillates within the range of 5-10%. The shrinkage of fabrics with starch finish (S) in the warp direction is lowest. The highest difference between shrinkage of fabrics with starch

Table 4. *The mechanical properties of fabrics after elastomeric finishing.*

Parameter	Unit	Thread system	CO 100%					CO 33%/PES 67%				
			P-22	P-27	P-32	C-32	T-32	P-22	P-27	P-32	C-32	T-32
Width	cm	-	141.1	140.1	139.8	139.9	139.0	140.8	140.2	139.5	139.9	141.3
Number of threads per 1 dm	-	warp	342.0	347.0	346.0	352.0	348.0	344.0	344.0	346.0	346.0	342.0
		weft	227.0	278.0	308.0	318.0	318.0	229.0	281.0	316.0	320.0	329.0
Crimp of threads	%	warp	4.2	4.5	5.1	3.3	2.1	3.8	4.5	5.7	3.2	1.8
		weft	9.5	10.2	11.3	10.7	11.5	8.4	8.8	9.5	9.4	8.9
Mass per square metre	g/m2	-	116.3	130.1	137.8	139.5	139.3	120.9	134.6	148.5	145.7	144.5
Shrinkage	%	warp	-5.6	-4.9	-4.7	5.3	-4.0	-2.2	-2.2	-1.8	-1.5	-1.1
		weft	-1.4	-2.6	-3.4	-4.2	-4.3	-0.5	-1.1	-1.4	-1.4	-1.5
Breaking force	daN	warp	52.8	53.7	47.8	50.0	58.9	63.3	63.5	60.1	60.4	51.0
		weft	33.1	38.7	35.3	37.4	39.0	35.7	44.8	54.2	50.2	43.8
Elongation at break	%	warp	8.5	9.8	8.6	6.2	12.5	14.4	16.2	16.5	13.3	11.7
		weft	12.2	15.3	15.8	15.9	17.4	18.5	19.7	20.1	20.1	16.2
Parameter	**Unit**	**Thread system**	**CO 50%/PES 50%**					**CO 67%/PES 33%**				
			P-22	**P-27**	**P-32**	**C-32**	**T-32**	**P-22**	**P-27**	**P-32**	**C-32**	**T-32**
Width	cm	-	139.6	139.6	139.5	140.5	140.5	140.7	140.0	138.6	139.6	140.1
Number of threads per 1 dm	-	warp	345.0	344.0	346.0	344.0	343.0	344.0	343.0	346.0	345.0	345.0
		weft	242.0	286.0	333.0	337.0	328.0	240.0	287.0	333.0	326.0	328.0
Crimp of threads	%	warp	4.7	5.1	6.3	3.5	1.7	4.4	4.9	5.2	3.1	2.0
		weft	9.7	9.2	9.6	9.8	10.0	8.3	9.2	10.7	9.7	10.0
Mass per square metre	g/m2	-	129.9	145.0	154.7	151.6	147.7	125.4	134.1	145.9	142.9	141.0
Shrinkage	%	warp	-1.3	-1.5	-1.4	-1.4	-1.6	-2.7	-2.3	-3.0	-2.9	-2.9
		weft	-0.3	-0.2	-0.5	-1.2	-0.8	-0.8	-1.6	-2.1	-2.6	-2.0
Breaking force	daN	warp	60.1	53.5	51.9	55.6	45.2	58.9	53.8	52.9	53.5	45.6
		weft	39.1	44.8	51.9	53.7	41.3	39.0	48.1	44.2	49.5	39.7
Elongation at break	%	warp	12.0	13.0	13.4	11.8	8.7	12.5	12.8	12.8	9.9	8.3
		weft	15.3	14.0	17.6	18.2	13.8	17.4	18.7	17.3	18.0	15.5

and elastomeric finish is noticeable for fabrics made of 100% CO yarn and for fabrics made of CO 67%/PES 33%. In the case of fabrics made of yarn with a larger PES content, the differences are hardly noticeable.

The values of shrinkage after both finishings significantly decrease in the weft direction. The drop in shrinkage is connected with a content of PES fibres in fabrics. The larger the content of PES fibres, the larger the drop in the shrinkage value. Starch and elastomeric finishings influence the value of shrinkage in the same way, improving the ability to remain stable.

Crease resistance - measurement method and test results

Method

The aesthetic fabric property of crease resistance was also considered in our investigations. For each fabric sample, ten measurements of the wrinkle angle were carried out. The mean value of standard deviation for the results obtained for fabrics after starch finishing was 6.23 in the warp direction and 6.93 in the weft direction; for fabrics after elastomeric finishing, standard deviation was 3.76 in the warp direction and 4.55 in the weft direction. On the basis of the measurements carried out in this way, the crease resistance was calculated according to the formula:

$$M_{OW} = (\alpha_{OW}/180) \cdot 100\% \qquad (2)$$

where α_{OW} - the mean wrinkle angle expressed in degrees, successively in the warp, and in the weft direction.

Test results

The crease resistance of fabrics in both the weft and the warp directions can be

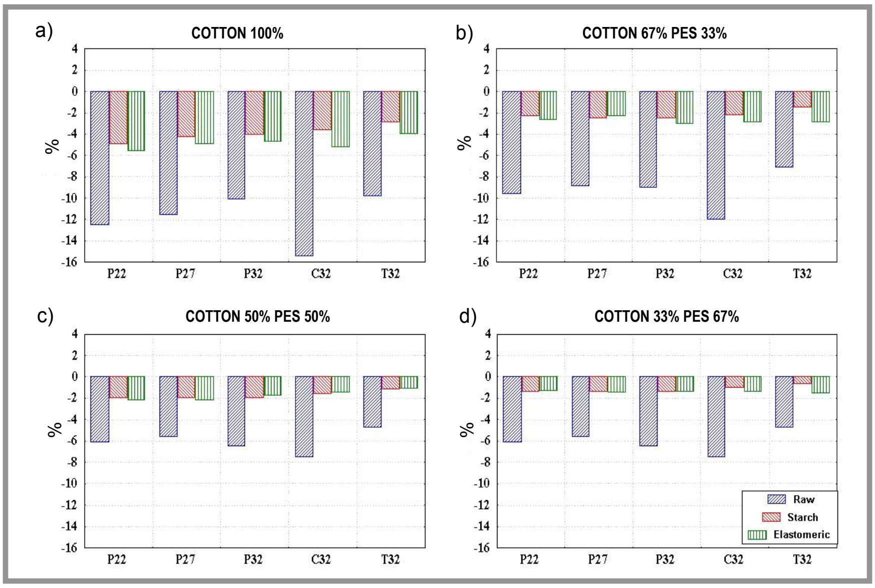

Figure 2. *Shrinkage in the warp direction. P22, P27, P32 - plain fabrics, successively of the weft density of 22, 27, 32 threads per cm; C32 - fabrics of combined weave of the weft density of 32 threads per cm; T32 - twill fabrics of the weft density of 32 threads per cm.*

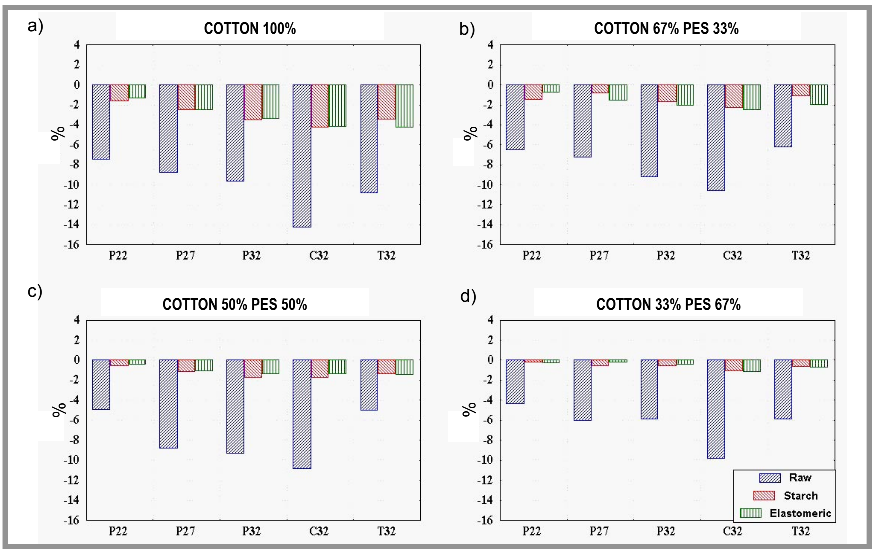

Figure 3. *Shrinkage in the weft direction. P22, P27, P32 - plain fabrics, successively of the weft density of 22, 27, 32 threads per cm; C32 - fabrics of combined weave of the weft density of 32 threads per cm; T32 - twill fabrics of the weft density of 32 threads per cm.*

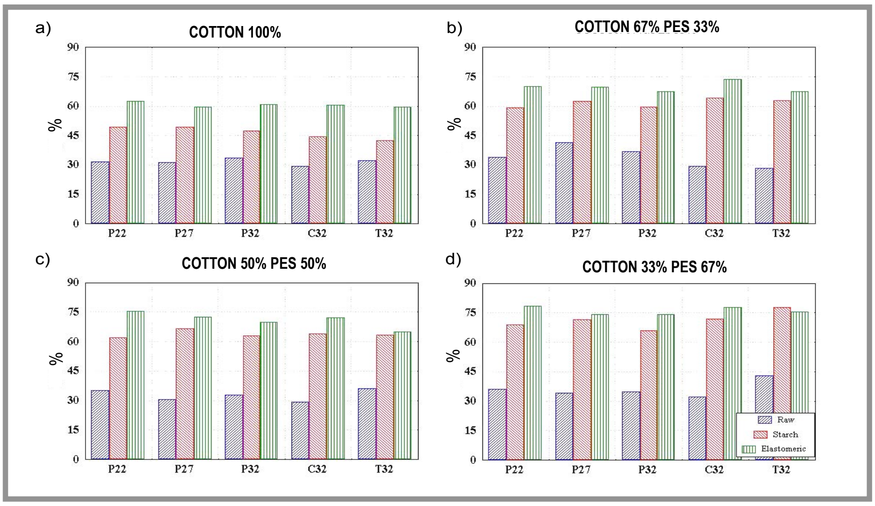

Figure 4. *Crease resistance in the weft direction. P22, P27, P32 - plain fabrics, successively of the weft density of 22, 27, 32 threads per cm; C32 - fabrics of combined weave of the weft density of 32 threads per cm; T32 - twill fabrics of the weft density of 32 threads per cm.*

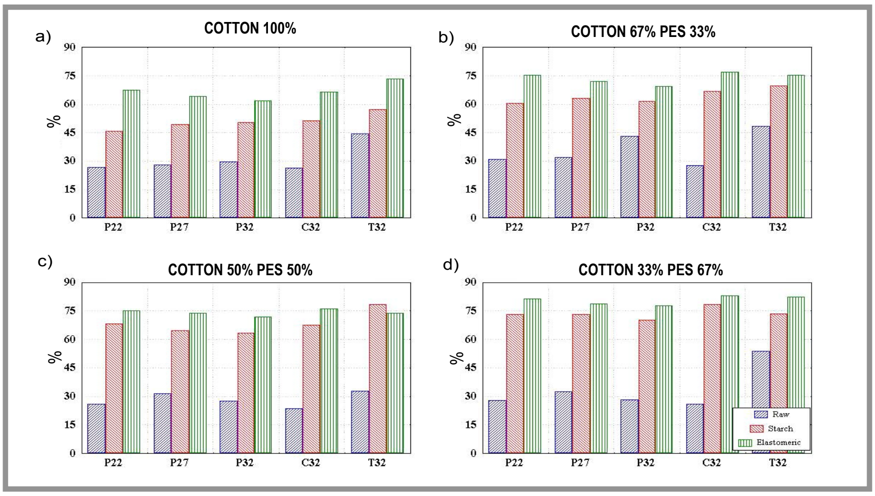

Figure 5. *Crease resistance in the warp direction. P22, P27, P32 - plain fabrics, successively of the weft density of 22, 27, 32 threads per cm; C32 - fabrics of combined weave of the weft density of 32 threads per cm; T32 - twill fabrics of the weft density of 32 threads per cm.*

improved by finishing. Better effects can be achieved by elastomeric finishing (E); this statement is in accordance with our expectations, as the elastomeric finish is applied to improve exactly this fabric feature. The crease resistance values of the fabrics manufactured from blended yarns increase more, independently of the polyester fibre content, than the values of those made from pure cotton fibres. The difference between the crease resistance of fabrics finished by various means is very readily visible for cotton fabrics.

Drape ability - measurement method and test results

Methods

The fabric's drape ability is one of the most important properties, which influences the appearance of clothing and determines the adjustment of clothing to the human silhouette [7]. The coefficient is confined within the range of 0% to 100%, and its small values determine bad drape, whereas the high values indicate good drape ability. The drape coefficient was assessed in accordance with Polish Standard PN-73/P-04736. Five measurements were carried out for each sample. The mean value of standard deviation for the fabrics after starch finishing was 32.73, whereas for fabrics after elastomeric finishing it was 28.59.

On the basis of the tests carried out, the drape coefficient was calculated from the following relationship:

$$K_v = [(\pi r^2 - S)/(\pi(r^2 - r_1^2))] \cdot 100\% \quad (3)$$

where:

- S - mean area of the sample projection, m^2;
- r_1 - radius of the disk supporting the sample, r_1=0.035 m; and
- r - sample radius, r=0.1 m.

Test results

Starch (S) and elastomeric (E) finishings influence the value of the drape coefficient (Figure 6). In most cases of finished fabrics, compared to raw fabrics, an increase in the value of the fabric drape coefficient was visible. Elastomeric finishing (E) causes a higher increase in the drape coefficient in relation to fabrics with starch finish. Considering the 100% cotton fabrics, we noted that the highest values of the drape coefficient have fabrics after elastomeric

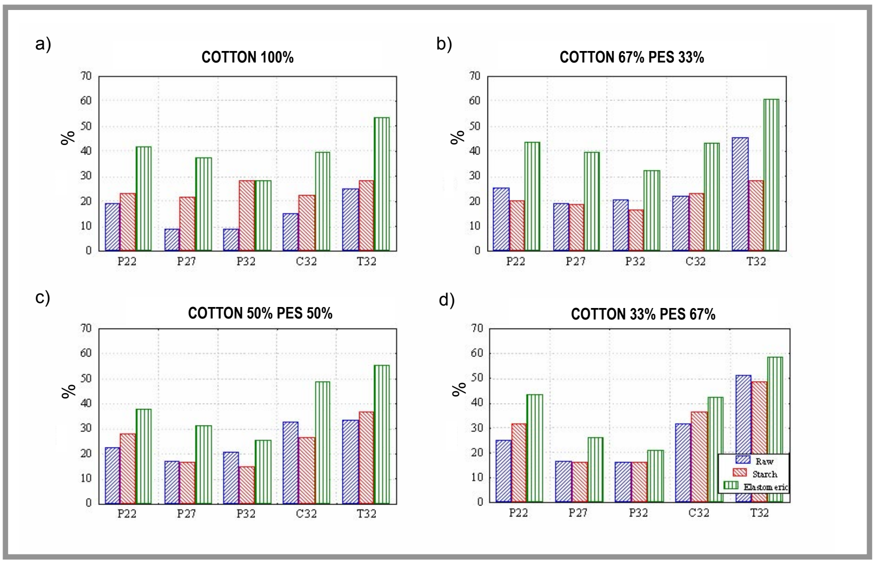

Figure 6. *Drape coefficient. P22, P27, P32 - plain fabrics, successively of the weft density 22, 27, 32 threads per cm; C32 - fabrics of combined weave of the weft density 32 threads per cm; T32 - twill fabrics of the weft density 32 threads per cm.*

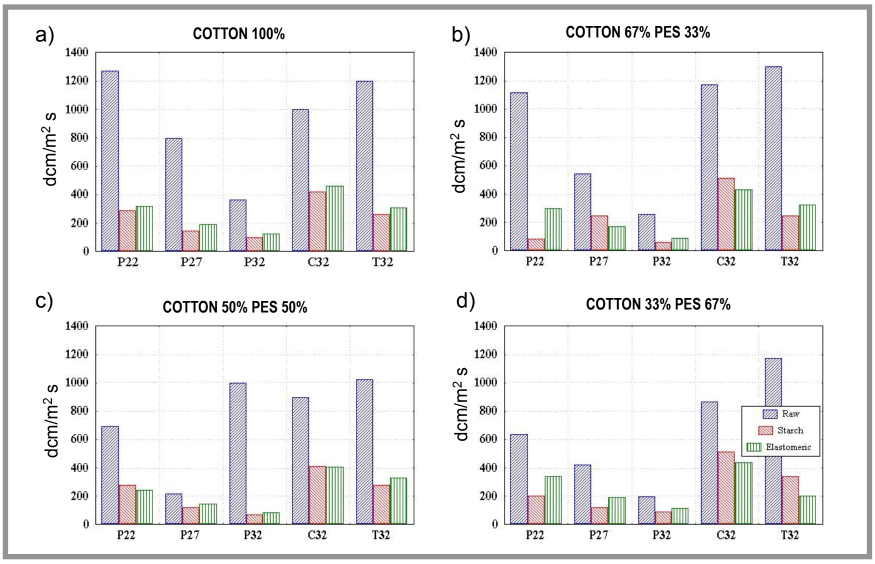

Figure 7. *Air permeability. P22, P27, P32 - plain fabrics, successively of the weft density of 22, 27, 32 threads per cm; C32 - fabrics of combined weave of the weft density of 32 threads per cm; T32 - twill fabrics of the weft density of 32 threads per cm.*

finishing, and the raw fabrics the lowest values. This results from the fact that starch finishing causes an increase in the fabrics' stiffness (i.e. a worsening of the drape ability), whereas elastomeric finishing causes its softening, which results in improvement of drape. This trend is more or less the same for all kinds of raw materials applied. On the basis of our measurements, we can say unambiguously that fabrics with elastomeric finish have better drape ability in contrast to fabrics with starch finish. For the majority of cases, but not all, starch finishing causes an increase in the drape coefficient.

Air permeability - measurement method and test results

Method

Air permeability facilitates human body ventilation and vapour removal. This property is crucial, especially for underwear and clothes worn in a hot environment. In general, fabrics manufactured from natural raw materials, from yarns with a high twist, and fabrics with a loose structure have good air permeability. Woven fabrics are less permeable in a wet environment due to fibre swelling and a decrease in the pore sizes. The measurements of air permeability were carried out by means of a standardised method in accordance with Polish Standard PN-89/P-04618. Twenty measurements were made for each fabric sample. The mean value of standard deviation for fabrics after starch finishing was 76.24, and for fabrics after elastomeric finishing it was 105.42. The test results are presented in Figure 7.

Test results

The air permeability decreases considerably after finishing, because finishing means blocking up of the pores of the fabrics. The values of air permeability are higher for elastomeric finishing than for the starch finishing measured for 100% cotton fabrics. The finishing of fabrics causes an increase in the thread density of the fabrics, and as a result a decrease in the fabric's porosity, which in turn diminishes the air permeability.

Summary

The influence of various kinds of finishing of woven fabrics manufactured from 100% cotton yarn and cotton/polyester yarn blends on the aesthetic and hygienic parameters of these fabrics has been presented.

The shrinkage values of finished fabrics in both directions (weft and warp) decrease considerably compared to raw fabrics. Shrinkage in the warp direction of 100% cotton fabrics and fabrics with a high cotton fibre content is smaller when applying starch finish than when applying elastomeric finish. Both kinds of finishing result in a noticeable decrease in shrinkage. All fabrics after starch finishing have a lower value of this property compared with those with elastomeric finishing. The shrinkage values of finished fabrics decreases considerably in both directions (weft and warp) compared to raw fabrics. The shrinkage of 100% cotton fabrics and fabrics with a high cotton fibre content which were starch finished is smaller in the warp direction than shrinkage of those fabrics which were elastomerically finished. Finished woven fabrics with a high polyester fibre content, and with weaves other than plain, are characterised by a 'hygral' expansion.

Fabric finishing significantly improves the crease resistance in weft and warp directions. It was stated that finishing causes an increase in this property for all fabrics. Fabrics after starch finishing have a lower value of crease resistance than fabrics after elastomeric finishing, irrespective of the kind of weave and weft density.

The same tendency was observed for drape ability. For air permeability similar tendencies in fabric features as for shrinkage were observed. Fabric finishing causes an increase in the thread density of fabrics and a decrease in fabric porosity, both of which diminish the air permeability.

The investigations concerned with the influence of the kind of finishing on aesthetic and utility properties of fabrics should be continued in order to elaborate general conclusions and suggestions for practical use.

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References

1. *Amirbayat J., Bowman S., The Buckling of Flexible Sheets Under Tension, Part. II: Experimental Studies, J. Textile Inst. No 1, 71, 1991.*
2. *Amirbayat J., The Buckling of Flexible Sheets Under Tension, Part. I: Theoretical Analysis, J. Textile Inst. No 1, 61, 1991.*
3. *Mihalović T.V., Nikolić M.D., Simović Lj.M., Resistance to Creasing of Clothing Wool Fabrics, Int. J. Cloth. Sci. T. Vol. 7 No 4, 9-16, 1995.*
4. *International Organisation for Standardisation (ISO), ISO 2313-1972 (E), ISO, 1972.*
5. *Chu C.C., Cummings C.L., Teixeira N.A., Mechanics of Elastic Performance of Textile Materials, Part. V: A Study of the Factor Affecting the Drape of Fabrics – Development of Drape Meter, Textile Res. J. 20, pp. 539-548, 1950.*
6. *Cusick G.E.: The Dependence of Fabric Drape on Bending and Shear Stiffness, J. Tex. Inst., 56(11), 596-606, 1965.*
7. *Marooka M., Niwa M.: Relation between Drape Coefficients and Mechanical Properties of Fabrics, J. Text. Mach. Soc. Jpn. 22(3), 67-73, 1976.*
8. *Grosberg P.: The Bending of Yarns and Plain Woven Fabrics, Mechanics of Flexible Fibre Assemblies, J.W.S. Hearle, J.J. Thwaites and J. Amibayat, Eds., Sijthoff & Noordhoff, Alphen aan den Rijn, Netherlands, 1980.*
9. *Frydrych I, Matusiak M.: Handle Resulting from Different Fabric Finishing, Fibres & Textiles in Eastern Europe, Vol. 11, No 2/2003.*

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