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COMPARATIVE STUDY ON DIFFERENT TYPES OF KNIT PRODUCTS USING SYNTHETIC INDICATORS

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Abstract: T*he work's purpose is the comparison of four types of knitted fabric with the same structure, but with different values of the constructive characteristics.*
The synthetic indicators of constructive characteristicsforfour variants of knitted fabric made of 100% cotton for sportive ware for the hot season have been determined.
The synthetic indicators are indicators of subgroups and groups of characteristics and are obtained by getting through the following steps: -determination of the importance degree of the representative characteristic, - the adoption of an evaluation scale, - reporting to the same evaluation scale, - determined the value of the synthetic indicators of quality.
For the calculation of the importance coefficient of the charcteristics, the matrix method that involves the comparison of pairs of values and completing a squarematrices was used, with 1 when the characteristic C_i is more important than Cj and 0 if C_i is less important than Cj.
Scaling was used for this study, which is a method of reproducing the intensity of manifestation of a characteristic on a linear graded space (scale), which extends from the unfavorable limit of quality up to the most favourable. On this scale, characteristics may be ordered depending on their intensity.
By comparing the synthetic indicators obtained, we could evaluate the best variant in terms of the constructive solution adopted.

Key words: *knitted fabric, synthetic indicators, constructive characteristics, the degree of importance, scale*

1. INTRODUCTION

The quality indicators are numerical expressions of quality characteristics and they can be expressed in absolute , relative or average value.

The value of the indicator is obtained by statistical calculation resulting statistical indicators, which can be: synthetic, analytical, intergral indicators.

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2. RESULTS AND DISCUSSIONS

2.1 Determination of the degree of importance for the characteristic

The determination of a synthetic indicator is based on a series of quality characteristics, which do not have the same importance for the product's users and requiresthe ranking of characteristics through the coefficient of importance [1].

Calculation of the coefficient of importance of the characteristics can be done through the following methods: direct comparison method, the matrix method, the marking method. The calculated values directly influence the value of the synthetic indicator.[2,3,4]

For this study the following quality characteristics were adopted, depending on the item's destination:

- linear coverage coefficient - δ_L
- specific weight - M [g/m²]
- knit thickness - g [mm].[5,6,7]

Samples were taken from knitted fabric and the following ranges of the values of each characteristics have been optained and at the same time the preffered order of variation for this characteristics (ascending↑ or descending ↓) was established. The results are presented in table 1.

Table 1: *The variation ranges of adopted characteristics*

No.	Characteristic	Range of the values' variation	preffered order of variation
1.	Linear coverage coefficient – δ_L	20 -30	↑
2.	specific weight - M [g/m^2]	100 - 150	↓
3.	thickness - g [mm]	0,4 - 1	↓

Measurements were made on the four types of knitted fabric and we have obtained the following values of the characteristics, presented in table 2.

Table 2: *The characteristics'values adopted for each variant of knitted fabric*

No.	Characteristic	variant V1	variant V2	variant V3	variant V4
1.	linear coverage coefficient – δ_L	21,2	20,5	23,2	24
2.	specific weight - M [g/m^2]	120	110	115	140
3.	thickness - g [mm]	0,65	0,60	0,63	0,80

For the calculation of the importance coefficient of the charcteristics, the matrix method that involves the comparison of pairs of values and completing a square matrices was used, with 1 when the characteristic C_i is more important than Cj and 0 if C_i is less important than Cj.[1,3,4]

Three constructive characteristics were chosen, depending on the destination of the article and after the analysis of the characteristics, the order of importance was determined: The coverage factor-δ_L is the most important, followed by thickness-g and the last was the specific weight-M.

The square matrix built with the three characteristics is presented in table 3.

Table 3: *The square matrix*

Ci / Cj	C1 (δ_L)	C2(M)	C3(g)	$\sum_i n_{ij}$
C1 (δ_L)	1	0	0	1
C2(M)	1	1	1	3
C3(g)	1	0	1	2

$\sum_j n_{ij}$	3	1	2	$\sum_i \sum_j n_{ij} = 6$

The importance coefficient α_i is calculated with the relation [1]:

$$\alpha_i = \frac{\sum_i n_{ij}}{\sum_i \sum_j n_{ij}} \quad \textbf{(1)}$$

The values of the coefficientsof importance obtained are presented in table 4.

Table 4: *The calculated importance coefficients*

No.	The importance coefficient	Values
1.	α_1	0,5
2.	α_2	0,17
3.	α_3	0,33

From the analysis and comparison of the important coeficients, it appears that the most important characteristic is the liniar coverage coefficient δ_L, followed by thickness-g and then the specific weight-M.

2.2. Adopting of the evaluation scale for the quality characteristics

Some conventions were established, through whichdifferent ways of expression of the characteristics to be put in accordance with numeric values, on a 0-1, 0-10 or 0-100 scale

2.3. Reporting on the same scale

Reporting on the same scale of evaluation of all adopted characteristics imposes the knowledge of the specific ranges and the preffered sense of variation for each characteristic.

Scaling was used for this study, which is a method of reproducing the intensity of manifestation of a characteristic on a linear graded space (scale), which extends from the unfavorable limit of quality up to the most favourable. On this scale, characteristics may be ordered depending on their intensity.

Values have been reported on a scale from 0 to 10 and the following values presented in table 5 were obtained.

Table 5: *The n_j scores granted to the characteristics adopted on scale (0-10) for each variant of knitted fabric*

No.	Characteristic	Score n_j	variant V1	Variant V2	Variant V3	Variant V4
1.	linear coverage coefficient – δ_L	n_1	1,2	0,5	3,2	4
2.	specific weight - M [g/m^2]	n_2	6	8	7	2
3.	thickness - g [mm]	n_3	5,8	6,6	6,1	3,3

2.4. Calculation of the synthetic indicator of the constructive characteristics

Calculation of the synthetic indicator of the constructive characteristics is done with the relation [1]:

$$I_c = \frac{N_p}{N_{p\max}} \quad \textbf{(2)}$$

Where:

N_p- average score obtained for the adopted quality characteristics

N_{pmax}- the maximum score

$$N_p = \sum_i \alpha_i \cdot n_i \quad \textbf{(3)}$$

Where:

α_j- the values of the coefficients of importance for the characteristics

n_j- the awarded score for the adopted quality characteristics

For our case N_{pmax} =10, because we have adopted a scale of 0-10.

The average values of the scores obtained and the values of the calculated synthetic indicators are presented in table 6.

Table 6: *The average values of the scores obtained and the calculatedvalues of the synthetic indicators*

No.	Variant	Average score	Maximum score	Synthetic indicators I_c
1.	V1	3,53	10	I_{c1} = 0,353
2.	V2	3,78	10	I_{c2} = 0,378
3.	V3	4,8	10	I_{c3} = 0,48
4.	V4	3,42	10	I_{c4} = 0,342

3. CONCLUSIONS

• By comparing the synthetic indicator values obtained for the four knit variants results that the indicators Ic3 > Ic2 > Ic1 >Ic4

• Variant V3 better corresponds to its destination in terms of constructive solution adopted.

REFERENCES

[1] AGIR, "*The Textile Engineer's Manual*", vol.III, Ed.AGIR, Bucharest, 2004

[2] A. Florea, "*Product Quality Control*", Ed.Gh. Asachi, Iaşi, 2001

[3] L. Lutic, *Evaluation of the Yarn Quality Characteristics Through Synthetic Indicators*, Bulletin of the Polytechnic Institute, Iași, Tomul LVI (LX), Fasc. 2, 2010

[4] E. Moisescu, "*Technical Quality Control- Knit wear*", Ed.Gh. Asachi, Iaşi, 2000

[5] M. Macsim, R. Butnaru and M. Penciuc, *Influence of finishing treatments on the physical-mechanical characteristics of cotton knitted fabrics*, rev. Industria textilă, vol. 61, nr. 6, pp. 297-303, 2010

[6] M. Slah, H.T. Amine and S. Faouzi, *A new approach for predicting the knit global quality by using the desirability function and neural networks*, The Journal of the Textile Institute, volume 97, issue 1, pp. 17-23, 2006

[7] L. Lutic, *Quality evaluation of the knitted products using the G – F – ND method*, Annals of the University of Oradea, Fascicle of Textiles, Leatherwork, vol, XIII, NO. 12, pp. 92-98, 2012