Correction coefficiency of physical and mechanical properties of fabrics and calculation of irrigation

Cite as: AIP Conference Proceedings **2432**, 040025 (2022); https://doi.org/10.1063/5.0091184
Published Online: 16 June 2022

Shamsiya Shumkarova, Marguba Rajapova, Hilola Yodgorova, et al.

Correction Coefficiency of Physical and Mechanical Properties of Fabrics and Calculation of Irrigation

Shamsiya Shumkarova[1], Marguba Rajapova[1, a)], Hilola Yodgorova[1], Sojida Gofurova[1], and Khasan Ashurov[2]

[1]*Jizzakh Polytechnic Institute, 4, Islam Karimov pr., 130100, Jizzakh, Uzbekistan*
[2]*Tashkent Institute of Textile and Light Industry, 5, Shohjahon str., 700100, Tashkent, Uzbekistan*

[a)]*Corresponding author: margubarajapova@gmail.com*

Abstract. In this article, 100% cotton fiber waste, 70% rogoza plant fiber waste and 30% cotton fiber waste bedding, 50% rogose plant fiber waste and 50% cotton fiber waste bedding, 30% rogoza fiber waste calculated the correlation coefficient on the physical and mechanical properties of upholstery fabrics obtained from a mixture of 70% cotton fiber waste and its error.

Keywords. Correlation coefficient, correlation coefficient error, correlation coefficient reliability, correlation correlation.

INTRODUCTION

A number of urgent tasks facing the textile industry today include re-equipment of enterprises, introduction of new technologies, ensuring the efficient use of raw materials, full use of secondary raw materials and fiber waste, increasing the range of new products, increasing exports. At the same time, the issue of increasing the production of non-woven fabrics and the range of products in the country is very important.

A number of urgent tasks facing the textile industry today include re-equipment of enterprises, introduction of new technologies, ensuring the efficient use of raw materials, full use of secondary raw materials and fiber waste, increasing the range of new products, increasing exports. At the same time, the issue of increasing the production of non-woven fabrics and the range of products in the country, as well as a comprehensive solution to the problems of efficient use of local raw materials play an important role in the development of light industry[1].

There are different ways to detect the shortening of yarns when weaving fabric. In our study, we are only interested in the methods of determining the shrinkage of yarns in the production of fabric, because it is this indicator that characterizes the structure of the fabric[2].

In creating an assortment of new types of upholstery in the textile industry, special attention is paid to the fiber content of raw materials, the properties of fibers, their interconnection. This is because the fibers that make up the lining fabric are important. The products to be obtained should be obtained from natural raw materials, if possible, because they are of great importance for human health[7].

METHODOLOGY

Research has been conducted to determine the mechanical properties of bedding fabrics with different secondary material resources. These fabrics were obtained mainly from a mixture of secondary material resources by the knitting method. The results of the study are presented in below (Table 1).

The 1st International Conference on Problems and Perspectives of Modern Science
AIP Conf. Proc. 2432, 040025-1–040025-8; https://doi.org/10.1063/5.0091184
Published by AIP Publishing. 978-0-7354-4345-7/$30.00

TABLE 1. Changes in the mechanical properties of upholstery fabrics obtained from different secondary material resources.

No	From secondary material resources of different composition obtained fabrics	Breaking force, N		Elongation at interruption,%		Thickness, mm	Surface density, g / m2
		along the length	along the width	along the length	along the width		
1.	100% cotton fiber waste	215	390	32	32	1,0	336,7
2.	30% cotton fiber waste with 70% rogoza plant waste	275	415	57	40	1,0	389,2
3.	50% cotton fiber waste with 50% rogoza plant waste	231	378	48	35	1,0	388,5
4.	70% cotton fiber waste with 30% fiber waste from rogoza plant	228	366	44	34	1,0	385,4

The shortening of the body and back yarns in the fabric is determined by theoretical and research (experimental) methods. There are many shortcomings in the theoretical method, through which it is impossible to obtain accurate data. The experimental research method is based on the analysis of tissue dimensions as well as the dimensions of yarns pulled from the fabric [3].

In the quantitative evaluation of the interdependence of two variables, the correlation coefficient is determined. The correlation coefficient is proportional to the variability from one variable to another: the higher the deviation in the bedding fabrics under study, the smaller the correlation coefficient.

The correlation coefficient is determined using the following formula.

$$r = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} \quad (1)$$

where: - deviation from the arithmetic mean of the two correlation series; - deviation from the arithmetic mean of the two correlation series.

The error of the correlation coefficient is determined using the following formula.

$$m_r = \pm \frac{1-r^2}{\sqrt{n}} \quad (2)$$

where: -total number of tests.

The reliability of the correlation coefficient is determined using the following formula.

$$\frac{r}{m_r} \rangle 3 \quad 3)$$

TABLE 2. The results of the calculation of the correlation coefficient based on the tensile strength along the length of the bedding.

X	Y	$X - M_x$	X^2	$Y - M_y$	Y^2	XY
230	320	15	225	45	2025	675
220	280	5	25	5	25	25
198	230	-17	289	-45	2025	765
186	250	-29	841	-25	625	725
201	340	-14	156	65	4225	-910
210	300	-5	25	25	625	-125
220	280	5	25	5	625	25
190	275	-25	625	0	0	0
230	220	15	225	-55	3025	-825
265	255	50	2500	-20	400	-1000
$\sum X = 2150$	$\sum Y = 2750$	$\sum X = 0$	$\sum X^2 = 4936$	$\sum Y = 0$	$\sum Y^2 = 13600$	$\sum XY = -645$

The correlation coefficient was calculated taking into account the longitudinal tensile strength of 100% cotton fiber waste in Option 1 and 70% fiber waste in Option 2 and 30% cotton fiber waste in Option 2.

(Table 2) below shows the results of calculating the correlation coefficient based on the tensile strength along the length of the lining fabric.

The average value of the length of the upholstery fabrics obtained from Option 1 is calculated as follows.

$$M_x = \frac{\sum X}{n} = \frac{2150}{10} = 215 \tag{4}$$

The average longitudinal value of the upholstery fabrics obtained from Option 2 is calculated as follows.

$$M_y = \frac{\sum Y}{n} = \frac{2750}{10} = 275 \tag{5}$$

The correlation coefficient is determined as follows.

$$r = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} = \frac{-645}{\sqrt{4936 \cdot 13600}} = -0{,}08 \tag{6}$$

The error of the correlation coefficient is determined as follows.

$$m_r = \pm \frac{1-0{,}08^2}{\sqrt{10}} = \pm \frac{0{,}99}{3{,}2} = \pm 0{,}3 \tag{7}$$

The reliability of the correlation coefficient is determined as follows.

$$\frac{r}{m} = \frac{-0{,}08}{0{,}3} = -0{,}27 \tag{8}$$

In our example $r = -0{,}08$ is the correlation between the results being tested $r \lhd 0{,}5$ that the feedback is even lower than strong, and that the calculations were performed correctly $\frac{r}{m_r} \leq 3_{it}$ can be confirmed that the criterion is within the limits of experimental reliability.

Table 3 below shows the results of the calculation of the correlation coefficient based on the shear strength of the upholstery fabrics.

TABLE 3. Results of calculation of correlation coefficient on the basis of tensile strength on transverse fabrics.

X	Y	$X - M_x$	X^2	$Y - M_y$	Y^2	XY
420	430	30	900	15	225	450
375	380	-15	225	-35	1225	525
360	360	-30	900	-55	3025	-1650
388	450	-2	4	35	1225	-70
410	420	20	400	5	25	100
430	400	40	1600	-15	225	-600
400	425	10	100	10	100	100
390	420	0	0	5	25	0
350	415	-40	1600	0	0	0
377	450	-13	169	35	1225	455
$\sum X = 3900$	$\sum Y = 4150$	$\sum X = 0$	$\sum X^2 = 5898$	$\sum Y = 0$	$\sum Y^2 = 7300$	$\sum XY = -690$

The average transverse value of the upholstery fabrics obtained from Option 1 is calculated as follows.

$$M_x = \frac{\sum X}{n} = \frac{3900}{10} = 390 \tag{9}$$

The average cross-sectional value of the upholstery fabrics obtained from Option 2 is calculated as follows.

$$M_y = \frac{\sum Y}{n} = \frac{4150}{10} = 415 \tag{10}$$

The correlation coefficient is determined as follows.

$$r = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} = \frac{-690}{\sqrt{5898 \cdot 7300}} = -0{,}11 \tag{11}$$

The error of the correlation coefficient is determined as follows.

$$m_r = \pm \frac{1-0{,}11^2}{\sqrt{10}} = \pm \frac{0{,}99}{3{,}2} = \pm 0{,}3 \tag{12}$$

The reliability of the correlation coefficient is determined as follows.

$$\frac{r}{m} = \frac{-0{,}11}{0{,}31} = -0{,}35 \tag{13}$$

In our example, it is possible to confirm from the correlation between the results under review that both the lower strength is in the inverse relationship, and that the calculations were performed correctly within the limits of experimental reliability.

It can be concluded that the correlation coefficient is guaranteed and can be reduced by ± 0.3 times between the longitudinal and transverse shear strengths of the upholstery fabrics. However, this error may also be due to additional random factors.

In such cases, since the correlation coefficient is inversely proportional and within the reliability limit, it is necessary to increase the number of experiments and determine the regression coefficients and confirm their reliability[15].

The correlation coefficient was calculated taking into account the longitudinal tensile strength of 100% cotton fiber waste in option 1 and 50% rogoza fiber waste in option 3 and 50% cotton fiber waste.

(Table 4) below shows the results of the calculation of the correlation coefficient based on the tensile strength along the length of the lining fabric.

TABLE 4. The results of the calculation of the correlation coefficient based on the tensile strength along the length of the fabric.

X	Y	$X - M_x$	X^2	$Y - M_y$	Y^2	XY
230	240	15	225	9	81	135
220	185	5	25	-49	2401	-245
198	220	-17	289	-11	121	187
186	260	-29	841	29	841	-841
201	200	-14	156	-31	961	434
210	240	-5	25	9	81	-45
220	250	5	25	19	361	135
190	220	-25	625	-11	121	275
230	240	15	225	9	81	135
265	255	50	2500	24	576	1200
$\sum X = 2150$	$\sum Y = 2310$	$\sum X = 0$	$\sum X^2 = 4936$	$\sum Y = 3$	$\sum Y^2 = 5625$	$\sum XY = 1235$

The average value of the length of the bedding obtained from option 1 is calculated as follows.

$$M_x = \frac{\sum X}{n} = \frac{2150}{10} = 215 \tag{14}$$

The average longitudinal value of the upholstery fabrics obtained from option 3 is calculated as follows.

$$M_y = \frac{\sum Y}{n} = \frac{2310}{10} = 231 \tag{15}$$

The correlation coefficient is determined as follows.

$$r = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} = \frac{1235}{\sqrt{4936*5625}} = 0{,}23 \tag{16}$$

The error of the correlation coefficient is determined as follows.

$$m_r = \pm \frac{1-0{,}23^2}{\sqrt{10}} = \pm \frac{0{,}95}{3{,}2} = \pm 0{,}3 \tag{17}$$

The reliability of the correlation coefficient is determined as follows.

$$\frac{r}{m} = \frac{-0{,}23}{0{,}3} = -0{,}77 \tag{18}$$

In our example, it is possible to confirm that the correlation between the results under investigation is less than the strong feedback, and that the calculations were performed correctly within the limits of experimental reliability[7].

Table 5 below shows the results of the calculation of the correlation coefficient based on the shear strength of the upholstery fabrics.

TABLE 5. Results of calculation of correlation coefficient on the basis of tensile strength on transverse fabrics.

X	Y	$X - M_x$	X^2	$Y - M_y$	Y^2	XY
420	390	30	900	12	144	360
375	350	-15	225	-28	784	420
360	410	-30	900	32	1024	-960
388	340	-2	4	-38	1444	76
410	430	20	400	52	2704	1040
430	400	40	1600	22	484	880
400	430	10	100	52	2704	520
390	400	0	0	22	484	0
350	320	-40	1600	-58	3364	2320
377	310	-13	169	-68	4624	884
$\sum X = 3900$	$\sum Y = 3780$	$\sum X = 0$	$\sum X^2 = 5898$	$\sum Y = 0$	$\sum Y^2 = 17760$	$\sum XY = 5540$

The average transverse value of the upholstery fabrics obtained from Option 1 is calculated as follows.

$$M_x = \frac{\sum X}{n} = \frac{3900}{10} = 390 \tag{19}$$

The average cross-sectional value of the upholstery fabric obtained from Option 3 is calculated as follows.

$$M_y = \frac{\sum Y}{n} = \frac{3780}{10} = 378 \tag{20}$$

The correlation coefficient is determined as follows.

$$r = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} = \frac{5540}{\sqrt{5898 \cdot 17760}} = 0{,}54 \tag{21}$$

The error of the correlation coefficient is determined as follows.

$$m_r = \pm \frac{1-0{,}54^2}{\sqrt{10}} = \pm \frac{0{,}71}{3{,}2} = \pm 0{,}22 \tag{22}$$

The reliability of the correlation coefficient is determined as follows.

$$\frac{r}{m_r} = \frac{0{,}54}{0{,}22} = 2{,}5 \tag{23}$$

In our example, it is possible to confirm from the correlation between the results under review that both the lower strength is in the inverse relationship, and that the calculations were performed correctly within the limits of experimental reliability[9].

It can be concluded that the correlation coefficient is guaranteed and the interval can be reduced by ± 0.3 times based on the longitudinal and transverse tensile strength of the upholstery fabrics. However, this error may also be due to additional random factors.

In such cases, since the correlation coefficient is inversely proportional and within the reliability limit, it is necessary to increase the number of experiments and determine the regression coefficients and confirm their reliability[12].

The correlation coefficient was calculated taking into account the longitudinal tensile strength of 100% cotton fiber waste in option 1 and 30% fiber waste from plant rogose in option 4 and 70% cotton fiber waste.

Table 6 below shows the results of calculating the correlation coefficient based on the tensile strength along the length of the lining fabric.

TABLE 6. The results of the calculation of the correlation coefficient based on the tensile strength along the length of the fabric.

X	Y	$X - M_x$	X^2	$Y - M_y$	Y^2	XY
230	210	15	225	-18	324	-270
220	250	5	25	22	484	110
198	188	-17	289	-40	1600	680
186	250	-29	841	22	484	-638
201	220	-14	156	-8	64	112
210	240	-5	25	12	144	-60
220	205	5	25	-23	529	-115
190	230	-25	625	2	4	-50
230	237	15	225	9	81	135
265	250	50	2500	22	484	1100
$\sum X = 2150$	$\sum Y = 2280$	$\sum X = 0$	$\sum X^2 = 4936$	$\sum Y = 0$	$\sum Y^2 = 4198$	$\sum XY = 1054$

The average value of the length of the bedding obtained from option 1 is calculated as follows.

$$M_x = \frac{\sum X}{n} = \frac{2150}{10} = 215 \tag{24}$$

The average longitudinal value of the upholstery fabrics obtained from option 4 is calculated as follows.

$$M_y = \frac{\sum Y}{n} = \frac{2280}{10} = 228 \tag{25}$$

The correlation coefficient is determined as follows.

$$r = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} = \frac{1054}{\sqrt{4936 \cdot 4198}} = 0{,}23 \tag{26}$$

The error of the correlation coefficient is determined as follows.

$$m_r = \pm \frac{1-0{,}23^2}{\sqrt{10}} = \pm \frac{0{,}95}{3{,}2} = \pm 0{,}3 \tag{27}$$

The reliability of the correlation coefficient is determined as follows.

$$\frac{r}{m_r} = \frac{0{,}23}{0{,}3} = 0{,}77 \tag{28}$$

In our example, it is possible to confirm that the correlation between the results under investigation is less than the strong feedback, and that the calculations were performed correctly within the limits of experimental reliability[15].

Table 7 below shows the results of the calculation of the correlation coefficient based on the shear strength of the upholstery fabrics.

TABLE 7. Results of calculation of correlation coefficient on the basis of tensile strength on transverse fabrics.

X	Y	$X - M_x$	X^2	$Y - M_y$	Y^2	XY
420	400	30	900	34	1156	1020
375	320	-15	225	-46	2116	690
360	350	-30	900	-16	256	480
388	410	-2	4	44	1936	-88
410	390	20	400	24	576	480
430	345	40	1600	-21	441	-840
400	360	10	100	-6	36	-60
390	370	0	0	4	16	0
350	350	-40	1600	-16	256	640
377	365	-13	169	-1	1	13
$\sum X = 3900$	$\sum Y = 3660$	$\sum X = 0$	$\sum X^2 = 5898$	$\sum Y = -0{,}1$	$\sum Y^2 = 6790$	$\sum XY = 2335$

The average transverse value of the upholstery fabrics obtained from Option 1 is calculated as follows.

$$M_x = \frac{\sum X}{n} = \frac{3900}{10} = 390 \tag{29}$$

The average cross-sectional value of the upholstery fabrics obtained from Option 4 is calculated as follows.

$$M_y = \frac{\sum Y}{n} = \frac{3360}{10} = 336 \tag{30}$$

The correlation coefficient is determined as follows.

$$r = \frac{\sum XY}{\sqrt{\sum X^2 \sum Y^2}} = \frac{2335}{\sqrt{5898 \cdot 6790}} = 0{,}34 \tag{31}$$

The error of the correlation coefficient is determined as follows.

$$m_r = \pm \frac{1-0{,}34^2}{\sqrt{10}} = \pm \frac{0{,}88}{3{,}2} = \pm 0{,}28 \tag{32}$$

The reliability of the correlation coefficient is determined as follows.

$$\frac{r}{m_r} = \frac{0,34}{0,28} = 1,2 \tag{33}$$

In our example, it is possible to confirm from the correlation between the results under review that both the lower strength is in the inverse relationship, and that the calculations were performed correctly within the limits of experimental reliability.[2]

CONCLUSIONS

It can be concluded that the correlation coefficient is guaranteed and the interval can be reduced by ± 0.3 times based on the longitudinal and transverse tensile strength of the upholstery fabrics. However, this error may also be due to additional random factors[14].

In such cases, since the correlation coefficient is inversely proportional and within the reliability limit, it is necessary to increase the number of experiments and determine the regression coefficients and confirm their reliability[4].

REFERENCES

1. Müller H., Maidel H. Abhdgigkeit der Rotorgarneigenschaften von der mechanischen Beanspruchung der Baumwolle beim Kardieren und Rotorspinnen / *Melliand Textilber* 1997. –78, №1,2 pp. 35.
2. Cyniak Danuta, Juzon Boguslaw. Issledovanie svoystv pryaji, poluchennoy na pnevmomexanicheskix pryadilnyx mashinax raznyx modeley. RS. *Textile industry*, №5, 1998 pp.12.
3. Onikov E.A., Kharayeva S.A. Cotton fabrics with higher resistance to abrasion interrnational textile reports // *Melliand Textilberichte*. -Germany, 2002.-№ 1.-pp.37-38.
4. Semak Z.N. Influence of raznovoloknistyx platenno – kostyumnyx tkaney on ix dielectric properties // Izv. vuzov. *Technology textiles. prom-sti.* -1981. -№ 5. - pp. 36-39.
5. Dodonkin Yu.V., Kiryuxin S.M. Assortment, svoystva i otsenka kachestva tkaney. M., 2001
6. Kareva T.Yu. Development of technologies for the production of new structures and research of construction: *Dis. doct. techn. nauk*.- M .: MTU, 2005.-pp. 332.
7. Melyachenko J.V., Nikolaev S.D. Vzaimosvyaz tehnologicheskix parameters tkachestva i parameters stroeniya vыrabatыvaemyx tkaney // Izv. vuzov. *Technol. text. prom-sti*.-1991.-№1.-pp.47-50
8. Martynova A.A., Slostina G.L., Vlasova P.A. Construction and design of fabrics. M., *RIO MGTA*, -1999.-pp. 434.
9. Ashurov Khasan Tolqin oglu, Mirpolat Kulmetov, Ubaydullayeva Dilora Khamidovna, Ismoilov Doniyor Abdulhamidovich, Usanov Mustafaqul Mahmud oglu. On The Quality Indications of Bed Fabrics Evaluation and Analysis. International Journal of Innovative Research in Science, *Engineering and Technology (IJIRSET).* Volume 10, Issue 2, February, 2021.
10. Ashurov Khasan Tolqin oglu, Usmonova Shakhnoza Anvarovna, Atanafasov Mukhiddin Rakhmonovich, Elmira Talgatovna Laysheva, Sobirov Doniyor Kholmurodovich. Evaluation of Mechanical Properties of Covered Fabrics from Different Secondary Material Resources. International Journal of Innovative Research in Science, *Engineering and Technology (IJIRSET).* Volume 10, Issue 2, February, 2021.
11. Ochilov Tulkin Ashurovich, Ashurov Khasan Tolqin oglu, Kulmetov Mirpolat, Usmonova Shakhnoza Anvarovna, Mirzaakhmedova Khuriyat Basitovna, Korabaev Sherzod Ahmadjanovich. Evaluation of Physical and Mechanical Properties of Fabric Fabrics from Different Secondary Material Resources. *Design Engineering*. Issue: 3 | pp. 101 - 110.
12. Ochilov T.A., Khalmatov D.A., Shumqorova Sh.P., Usanov MM, Korabayev Sh. A. Analysis of Quality Indicators of Mixed Spun Wool Yarns. *Annals of R.S.C.B., ISSN: 1583-6258,* Vol. 25, Issue 4, 2021, pp. 779 - 786.
13. Shumkarova S. P., Rajapova M. N. Influence of a mixture of different fibers on physical and mechanical properties of internal knitted fabrics //*Science and Education*. – 2021. – T. 2. – №. 4. – pp. 271-274