JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 04, ISSUE 10
MOPNTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

DESIGNING THE BREAKING LOAD OF MIXED YARN USING SIMILARITY THEORY

Valieva Z.F., Norbekov N.

Tashkent Institute of Textile and Light Industry

Abstract: The article presents models for predicting the mechanical characteristics of semi-wool yarn depending on the physicomechanical properties of the fibers.

Keywords: yarn, wool, linear density, strength, yarn twist, similarity theory

The mathematical foundations of similarity theory and dimensional analysis have given a significant boost to the development of many modern areas of science and technology. The general task of similarity theory and modeling is to develop a methodology aimed at streamlining the methods of obtaining and processing information about objects that exist outside of our consciousness and interact with each other and the external environment.

Thus, we can say that the similarity theory is applied in the following cases:

- when determining analytical dependencies of relations and solutions to specific problems;
- when processing the results of experimental studies of various technical devices in cases where the results are presented in generalized "criterion" dependencies;
- when creating models, that is, installations that reproduce phenomena in other installations (originals), usually larger in size, or more complex in structure, or more expensive than the models.
- Let us consider the application of similarity theory and dimensional analysis to determine the basic physical and mechanical characteristics of homogeneous and mixed yarns produced using domestic wool in a certain percentage ratio with nitron fibers.

The problem of designing yarn properties cannot be solved within the narrow framework of establishing a relationship between one of the yarn properties and the corresponding fiber property. This problem should be considered much more broadly, including the study of the structure and physical and mechanical properties of fiber and yarn, the influence of the technological process of spanning, as well as the behavior of yarn in the processes of further processing and in finished products. In addition, the solution to this problem cannot be presented in the form of a single universal formula that covers all the variables that affect the properties of yarn. It is more correct to establish a whole series of individual regularities and formulas, the consistent solution of which will lead to the desired results. A. N. Vanchikov, K. I. Koritsky, E. I. Birenbaum, and T. V. Kononenko worked on the calculation of yarn strength from fiber mixtures T. V. Kononenko.

The breaking load of a yarn depends on the strength of the fiber, the breaking elongation, the number of individual components in the cross-section of the yarn, their length and распределениияlength distribution, the uniformity with which they are distributed in the yarn, the coefficient of friction between the fibers, and other factors.

JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 04, ISSUE 10
MOPNTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

For the possibility of determining the strength of mixed yarn, namely, nitro-wool yarn, the nature of changes in the breaking load at different percentages of fibers was determined. When applying the similarity theory, the main factors influencing the properties of mixed yarn were taken:

$P_{pr}= f(P_{vol.\ see}, T_{vol.\ see}, T_{pr.}, L_{pcs.\ see}, p, K, n_1, n_2)$, (1)

Pr – breaking load of yarn.

$P_{vol.\ cm.}$ – weighted average breaking load of the fibers of the mixture;

$T_{vol.\ cm.}$ - weighted average linear fiber density of the mixture.

$Ts_{пр.}$- linear density yarn.

$L_{pcs.\ cm.}$ - weighted average staple length of the mix fibers;

p is the fiber density.

K – yarn twist.

n_1 – the number of fibers in the yarn section of the first component;

n_2- the number of fibers in the yarn section of the second component;

Using the dimensions $P_{vol.\ see,}$ $T_{vol.\ see.}$ p and using the methods of similarity theory and dimensional analysis, function (1) can be written as:

$$P_{pr}=T_{pr}\left[\frac{n_1*P_{b1}+n_2*P_{b2}}{n_1*T_{b1}+n_2*T_{b2}}\right]*\left[\frac{K*(n_1*L_1+n_2*L_2)}{AK*(n_1*L_1+n_2*L_2)\pm B}\right], (2)$$

To check the established regularity of changes in the physical and mechanical parameters of yarn made from wool and nitrone fibers, we use the results of experimental studies conducted at a production laboratory in a spinning enterprise .

Percentage of nitrone, %	Linear yarn density, T_{pro}, tex	Fiber breaking load, P $ol_{вол}$, cH	Yarn breaking load, P_{ol} N	Linear fiber density, T_b, tex	Formula	$P_{pr.ras.}$	Rejection rate, %
1	2	3	4	5	6	7	8
0	31	8,54	1, 27	0,39	$P_{pr}=P_{vol}*\frac{T_{pr}}{T_{vol}}*\frac{K*L}{5{,}4*K*L-5{,}821}$	1,269	0,08
40	22	10,88	1,45	0,394	$P_{pr}=P_{vol}*\frac{T_{pr}}{T_{vol}}*\frac{K*L}{4.1*K*L+2{,}9}$	1,451	0,07
20	22	9,54	1,02	0,392	$P_{pr}=P_{vol}*\frac{T_{pr}}{T_{vol}}*\frac{K*L}{5{,}34*K*L-2{,}6}$	1,016	0,39
100	33,3	18,5	16,98	0,40	$P_{pr}=P_{ox}*\frac{T_{pr}}{T_{ox}}*\frac{K*L}{1.02*K*L-3{,}673}$	16,9	0,47

The results of processing the initial data with different percentages of wool and nitro fibers are shown in Table 1

JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 04, ISSUE 10
MOPNTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

The calculation of weighted average parameters of fibrousresins-linear density, breaking load, staple length-is made taking into account the percentage investment of each component by the number of fibers in the mixture.

Table 2:fiber parameters: linear density of mixed fibers, staple length, breaking load of fibers and their percentage, as well as on the twist and linear density of yarn, which are shown in

Percentage of nitrone, %	**Linear yarn density, T_{pr}, tex**	**Yarn breaking load, R_{pr} N**	**Linear fiber density, T_b, tex**	**T_{pr}/T_B**	**Staple length of fibers in the mixture, L_{cm}**	**Twist K, kr/m**	**K×L**	$\frac{P_{in} \times T_{pr}}{T_V} = I$	$\frac{P_{pr}}{P} = K_{odn}$	$\frac{K \times L}{K_{odn}}$
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
0	31	1, 27	0,39	79,487	43, 0	483	20,77	6,79	0, 187	111,07
40	22	1,45	0,394	55,837	41,84	800	33,47	6,07	0,239	140,04
20	22	1,02	0,392	56,122	42,37	800	33,89	5,35	0,191	177,43
100	33,3	16,98	0,40	83,25	40,0	900	36,0	15,4	1,103	32,64

An analysis of the comparison of calculated and experimental data shows that the deviation does not exceed 5%. This allows us to speak about a good convergence of the results. At the same time, processing of the results made it possible to obtain the dependences of the breaking load of homogeneous and mixed yarns on the initial parameters of raw materials, which are fairly well described by the following equation:

$$P_{pr} = P_{vol} * \frac{T_{pr}}{T_{vol}} * \frac{K * L}{(a * K * L \pm b)} \quad (3)$$

References:

1. Разумеев, Константин Эдуардович Методы проектирования шерстяной гребенной ленты и пряжи на основе инструментального определения свойств немытой шерсти : диссертация доктора технических наук : 05.19.02 Москва 2003 https://viewer.rsl.ru/ru/rsl01002609875

2. Богачева, Светлана Юрьевна Проектирование прочности гребенной шерстяной пряжи : диссертация ... кандидата технических наук : 05.19.02 Москва 2004 https://viewer.rsl.ru/ru/rsl01002636074

3. http://www.rfej.ru/r

4. Materials-Market-Report-2023.pdf https://textileexchange.org/app/uploads/2023/11/Materials-Market-Report-2023.pdf

5. Mukhtarov, J. R., Atanafasov, M. R., Valieva, Z. F., Djumaniyazov, M. B., & Laysheva, E. T. (2022). The effect of the amount of waste of yarn on the physical and mechanical indicators. European Chemical Bulletin, ECB, 11(6), 1-15.