PRODUCTION OF VISCOSE CORD FIBRE AND 17C AND 22C CORD FABRICS

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The problem of increasing the tenacity of viscose cord fibre is among the most important ones because its successful solution will result in longer tyre life, in lower consumption of tyre materials and in a lower tyre weight. The production technology for cord yarn of a tensile strength of 17 kgf in the fabric was developed on the basis of improved viscose quality and optimal spinning parameters.

A condition for the spinning of high-tenacity cord fibre is that the viscose is of good quality (1,2) characterized by filterability and transparency. To improve the solubility of the cellulose xanthate and the homogeneity of the viscose the steeping temperature was increased from 39.5 to 42.5°C and the concentration of the caustic soda solution from 223 to 225 g/litre. The result was that filterability was improved and spinning stability increased from 87 to 95%.

Trials were carried out with systems of batching the modifiers into the shredded which showed that a single surfactant (mixture of sulphoricinate E with Oksanol O-18) pump for every two shredders did not produce a satisfactory distribution of the surfactant in the viscose. After the installation of a batching pump for each shredder the distribution of the modifying agents was much improved. An analysis was carried out with a view to discovering the sources of iron accumulations in the viscose which degrade its quality. After the introduction of appropriate measures for cleaning and washing the equipment the iron content of the viscose was reduced from 10 to 6 mg/kg.

The characteristics of the supramolecular structure, which determine the physical and mechanical properties of the fibre, come into being at the instant when the viscose coagulates /3/. An increase in the degree of esterification of the cellulose xanthate and in the ripeness of the viscose results in stronger fibre and cord /4/ because a "young" viscose coagulates more slowly so that the structural homogeneity and the strength of the fibre are increased /2/. Based on these findings, ripeness was increased to 12 - 13% NaCl and the degree of esterification of the cellulose xanthate to 51 - 53 by lowering the ripening temperature from 25 - 26 to 21 - 22°C.

One of the methods of increasing the structural homogeneity of the fibre consists of reducing the acidity of the coagulating bath. This gives a lower rate of diffusion of the hydrogen ions and consequently an increase in the proportion of skin over the cross-section together with changes in the physical and mechanical properties of the cord fibre and yarn /2/. An analysis of the results from the first cord sector for the period 1967-68 showed that these properties improved when the sulphuric acid content of the coagulating bath was reduced to 100 - 112 g/litre. This information resulted in the adoption of a viscose ripeness of 12 - 13% NaCl and a sulphuric acid concentration of 111 - 114 g/litre in the coagulating bath.

These parameters were introduced by lengthening the stay of the filaments in the coagulating bath by increasing the path length in the bath while reducing the bath acidity at the same time. The result was that a more uniform fibre was spun /5/ and that the physical and mechanical fibre properties were improved as a result of the greater hydrodynamic resistance of the bath. The length of the fibre path in the bath was increased by increasing the height of the bath trough from 420 to 500 mm.

An important point was a more precise definition of the required sulphuric acid concentration in the stretching bath. It was found to be 17 - 18 g/litre.

Cord fibre quality is influenced to a large extent by the degree to which standard conditions are adhered to. A series of measures were devised and adopted which ensure that the spinning conditions remain stable.

The end result of all these modifications was that the sectors produced 17C cord

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Balakov Fibre Combine. Translated from Khimicheskie Volokna, No.6, pp. 9-10, November-December, 1970.

fabric of the structure 5.45 x 1/2, the cord yarn in the fabric having a twist of 480/400 turns/m and a maximum tensile strength of 17.4 kgf.

The possibility of spinning a coarser cord fibre was explored in the first cord sector with a view to increasing profitability and labour productivity and reducing the cost price. The spinning of such a fibre offers technological advantages as well in that the slower spinning speed results in greater process stability and helps to improve the physical and mechanical properties of the cord fibre and yarn. The production of 22C 4.1 x 1/2 cord resulted in an extension of the range of cord fabrics being produced.

The use of 22C cord fabric permits the weight of the tyre casing to be reduced by 1.0 - 1.5 kg which, in turn, produces further economies. The manufacture of 22C type cord fabric of the structure 5.45 x 1/2 was launched at the Balakov Combine in 1967 when it was established that all sub-assemblies and drives of the spinning and finishing machines were able to cope with the heavier fibre. The spinning speed, viscose indices, spinneret type and throwing traveller were the same as for Nm 4.1 cord fibre.

The rate of the viscose flow from the spinneret increases automatically with the fibre diameter but this can be avoided either by reducing the spinning speed, i.e. the rate of metering the viscose into the spinneret, or by using spinnerets with a larger effective cross-section.

Trials with spinning speeds of 30, 33 and 35 m/min showed that 33 m/min was the best. The feasibility was explored of spinning fibre of a given diameter from spinnerets having 1500 holes 0.055 mm in diameter. It was established that with these spinnerets the viscose flow rate decreases and filament breaks in the bath are reduced by a factor of 2.6 while the per cent residual xanthate in the spinning operation and in the fibre falls and the tensile strength of the cord yarn increases by 0.6 kgf.

In the process of deciding the viscose parameters it was established that an increase in the ripeness of the viscose results in an 89 - 93% increase in the fibre strength and in the coefficient of strength utilization.

The fibre produced by this method was doubled and twisted on a Platt twister to 4.1 c 1/2 cord yarn (first twist 420±20 and second twist 360±20 turns/m). Trials were at first carried out with the conventional No.720 Anide traveller. It was found, however, that the discrepancy between the traveller weight and the fibre diameter gave rise to a large balloon so that the yarn rubbed against the separators and became tangled. The disadvantage was overcome by using a No.900 traveller which had been developed in collaboration with the Central Scientific Research Institute for Machine Components.

The result of the adoption of the manufacturing technology fo 22C cord fabric was that spinning machine productivity increased by 28% over the design value and the product range was extended by the production of a cord fabric profitable to the manufacturer and consumer alike.

LITERATURE CITED

1. G.Clare, Dtsch.Textiltechnik, No.2/16, 73 (1966).
2. A.A.Konkin, G.I.Kudryavtsev, A.T.Serkov, and R.V.Kupinskii, The Manufacture of Tyre Cord (in Russian), Khimiya (1964).
3. A.T.Serkov, Khim.volokna, No.4, 15 (1967).
4. S.P.Papkov, The Physical and Mechanical Principles of Spinning Regenerated Cellulose Fibres (in Russian), VNIIV (1968).
5. K.E.Perepelkin, E.Ya.Sorokin, and O.I.Nachinkin, Khim.volokna, No.3, 36 (1968).