ABSTRACT

Weft-knitted fabrics are particularly important in the outerwear field, and single and double jersey fabrics are typical and useful examples of this class of fabrics. They are in wide-spread use, and have a relatively simple and basic construction.

First phase of the present study deals with the production of ring and rotor spun yarns from cotton, polyester cotton and polyester fibres. Also production of carded and combed yarns from Sankar 4 (a long staple Indian Cotton) is described. Carded yarns have been found to be inferior in quality compared to combed yarns, and the ring spun yarns have been found to be superior in all properties compared to the rotor spun yarns. These were used for the production of knitted fabrics.

In this work, an integrated study is presented of the spirality, mechanical and related physical properties (such as fabric weight and dimensions, air-permeability etc.) for a wide range of plain and double jersey fabrics. Handle of these fabrics has been determined by a handle tester which was fabricated, and a new concept of representing handle has been developed. Bagginess of weft-knitted fabrics has been determined by a relatively simple and inexpensive method. Prediction of the mechanical properties has been made by neural networks. An assessment of interlock fabrics in the light of some work on double jersey fabrics has been made.
Finally, a study of pad batch method of dyeing of knitted fabrics is described. A survey of literature has shown gaps in the knowledge related to spirality and mechanical properties.

The effects of direction of yarn twist, feeding arrangements in knitting, yarn treatment, use of carded and combed yarns, different types of ring and rotor spun yarns from cotton, polyester cotton and polyester and hydrophilic acrylic and normal acrylic yarns have been examined. About 28 knitted fabrics were made for this study, and these were tested.

The mechanical properties of weft-knitted fabrics have been measured by Kawabata Evaluation System for Fabrics. Also, simpler instruments such as Cantilever bending tester, Drape tester, Instron tensile tester and Air permeability tester were used for measuring bending rigidity, drape, air permeability, tenacity and elongation.

The results show that spirality has been reduced by using a combination of SS/Z yarns, yarn treatment and by the use of ring and rotor combination. Use of combed yarns in place of carded yarns has led to a significant improvement in spirality. The advantages of yarn treatment on the reduction in spirality have been pointed out.

The mechanical properties measured by Kawabata Evaluation System show considerable differences in tensile, bending, shear, surface and compression aspects. There exists a good relationship between this method and the conventional methods of testing. Of all the mechanical properties,
it appears that bending and shear properties are those which show significant differences between the fabrics. The experimental results were analysed statistically in order to study the effects on fabric tensile, bending, shear and compression properties of each of the following variables and their interactions; the direction of yarn twist, the tightness factor and the type of dye used.

It has been found that the tightness factor affects bending and shear properties significantly, in that with increase in tightness factor, there is an increase in bending and shear. Surface properties such as coefficient of friction and surface roughness show an increase with an increase in tightness factor. Fabric knitted from carded yarn displays better handle than that produced from combed yarn.

Surface roughness of 1x1, 2x2, rib and interlock fabrics shows marked differences in wale and course ways, and these can be employed for discriminating these fabrics from single jersey types. Extension values for double jersey fabrics between wale and course ways also follow a similar trend. Knitted fabrics prepared from blends containing cotton and Lycra display exceptionally high values of extension, tensile and compressive resilience.

An assessment of interlock fabrics, which are used for outer wear purposes, shows that their dimensional properties like fabric weight can be predicted accurately and that there is a considerable scope for specifying
their standards. Structural inhomogeneity of these fabrics can be inferred from the air permeability and bending properties.

A measure known as specific handle force is capable of representing handle of fabrics. Its correlation with some of the mechanical properties has been found to be good.

Fabric bagginess has been found to be low in the case of fabrics containing Lycra. That there exists a good relationship between the tensile properties determined by Kawabata system and bagginess tester has been pointed out.

The WD value, Euclidean distance, a new concept in characterization of handle, has been found to be handy in view of its advantages over the total hand value. The mechanical properties, as predicted by neural networks, are found to be in close agreement with those obtained experimentally showing the potential of this computation method.

That pad batch method of dyeing has a great deal of potential, and that a simple pretreatment namely, treatment of fabric with alkali in cold condition given to it results in darker shades have been pointed out. Also the advantages of this method vis-a-vis exhaust dyeing method have been discussed.

The industrial implications of these conclusions in terms of costing, efficiency, rates of production are therefore obvious, and these are discussed.