ABSTRACT

The current study primarily is concerned with the comfort and mechanical properties of a series of commercially available and laboratory made polyester fibre samples. A wide spectrum of samples comprising textured polyester, microfibre polyester, and commercial polyester fabric samples was used. Besides these a series of silk union fabrics was also used. The samples have been divided into seven groups, each group is designed to illustrate a particular effect.

An extensive review of the literature on comfort and mechanical properties is presented in Chapter 2. The mechanical properties of fabrics were measured using Kawabata evaluation system, and also by Fabric Assurance by Simple Testing means. It has been found that there is a good relationship between the shear and bending properties of fabrics. That the parameter shear hysteresis determined at 5° shear angle for all the fabrics has exceeded the norm, which is very important for tailoring, has been pointed out. The mechanical properties are very sensitive to fabric geometrical properties.

In order to determine the handle of fabrics by a single parameter which gives a multiple of fabric mechanical properties, a simple method has been developed which involves measurement of the extraction force of the fabric sample when it is extracted through a highly polished stainless steel bush. A wide spectrum of fabric samples tested by this technique shows that
this method has the potential, and the influence of type of yarn, yarn linear density, fabric geometrical properties and finishes can be precisely studied. The excellent correlation obtained between the handle force and fabric mechanical properties bears testimony to the fact that this method has the potential. Of the two textured fabric samples, the sample produced with spun warp and textured weft combination is far superior to the sample produced with textured warp and spun weft sample. It has been pointed out that handle force can be regarded as a measure of comfort of fabrics.

The comfort properties were measured by air-permeability, thermal conductivity, wicking and surface properties using Kawabata’s compression and surface roughness instruments. Thermal conductivity was determined for group I fabrics using Thermolabo instrument.

Thermal conductivity has been found to be dependent on fabric weight and thickness. Fabric samples woven with polyester spun yarns in warp and textured yarn in weft show a higher thermal conductivity and higher $q_{\text{max}}$ values, implying that they offer a cooler effect on skin. Silk fabrics woven with polypropylene weft are characterised by a significantly higher thermal insulation value.

As regards fabric compression at higher pressures, there is no relationship between the compressional parameters and areal density of fabrics. Percent compression has been found to be significantly higher in the case of polyester shirting compared to suiting fabrics.
The fabric response during an extraction process through the bush is shown to be governed by the mechanisms as influence sliver behaviour during a tensile test. The deformation behaviour can be separated into different regions of behaviour. The first region is characterised by fabric extension, consolidation of fabric layers, and increase in contact length between fabric and surface, and force build up; this is shown to correspond to the behaviour of a continuous elastic model. The second region is characterised by slippage of fabric on the surface and decline in force which can be modelled by the withdrawal of a fibre from a series of frictional restraint points.

Some modifications have been suggested in the theoretical model developed to predict fabric handle force, and design features of the instrument for precise measurement of handle and comfort are provided. It is hoped that these will be used in a textile processing house, and in a Garment Industry for day to day control of fabric quality.