ABSTRACT

The thesis is concerned with the study of dimensional and physical properties of single jersey, 1 x 1 rib, interlock and pique fabrics. The spirality in single jersey fabrics, and the effect of chemical treatments on the mechanical properties of single jersey, 1 x 1 rib, interlock and pique fabrics were also examined.

The spirality in weft knitted fabrics by knitting a series of fabrics from new types of yarns such as lyocell, treated ring spun yarns, ring and rotor yarns was investigated. Although rotor spun yarns and treated yarns had led to a reduction in spirality, they had an effect of making the fabric harsh. A novel technique of producing wet spun yarns by wet spinning, whereby the cohesion and friction of cotton are enhanced, was developed. It was found that the use of wet spun yarns had led to a significant reduction in the spirality.

The dimensional properties of 1 x 1 rib cotton fabrics knitted from double rove yarns with various twist level and conventional two fold yarns were investigated. It was found yarns could be profitably used in the place of conventional two fold yarns without any adverse effect.

The dimensional properties of pique fabrics showed a marked increase following full relaxation treatments. The machine tightness factor had a significant effect on the weight per unit area of fabrics as opposed to single jersey fabrics. In view of this, it is necessary to follow suitable procedures for stabilizing the finished pique fabrics. This work emphasizes that, while finishing of the knitted fabrics, in particular, pique fabrics, the
dimensions are to be considered for achieving acceptable level of shrinkage of the finished fabrics.

The influence of chemical treatments on the low stress mechanical properties of single jersey, 1x1 rib, and interlock fabrics was studied. It was found that, regardless of the geometrical structure of the fabrics, mercerisation had resulted in a drop in extension and increase in bending and shear rigidities, that is making the fabrics stiffer. Resin finish has led to a drastic reduction in tensile and extension. Resilience of fabrics, as measured by the ratio of initial load to extension, was found to be lower in treated fabrics.

The low stress mechanical properties of a series of single jersey and pique fabrics which differed in loop length, were investigated. It was found that pique fabrics had a higher shear rigidity and surface roughness. The handle of single jersey fabrics was found to be better than that of single jersey. Also, single jersey fabrics had wicked better than that of single jersey fabrics.

The elastic recovery of single jersey and pique fabrics was investigated by using a simple instrument which is based on the principle of hanging weights. Data for elastic recovery of knitted fabrics subjected to various treatments demonstrated that coursewise recovery was found to be higher than that of walewise recovery. Pique fabrics are characterised by higher values of elastic recovery. Elastic recovery was found to be dependent primarily on machine tightness factor (K). A significant revelation was that pique fabrics exhibited a lower extension compared to single jersey.

The surface mechanical property measurements of a set of single jersey and pique fabrics were carried out using a simple instrument in which a fabric's specimen could be passed through a higher polished stainless steel bush. Besides measuring the withdrawal of a circular fabrics by passing it through the bush, a novel softness parameter "S" was
developed to characterize the handle fabrics. The results showed a unique behavior with enzyme treated fabric samples. The results reflect the importance of finishes in improving the handle of fabrics. This development has opened new avenues of research in the field of hand evaluation of textiles.

The final part of the thesis focuses on the classification of 55 samples of knitted fabric which were subjected to various chemical treatments by artificial neural network based cluster analysis. All the 55 samples formed into five clusters on the basis of their low stress mechanical properties. It is pointed out that this is the most scientific method of classification. The industrial implications of this research work have been fully discussed.