ABSTRACT

Surface modification of polyester by alkaline treatments has been well established as a finishing treatment imparting silky feeling to polyester fibres.

This study is mainly concerned with the alkaline hydrolysis of polyester substrates like filament, 100% spun yarns and 100% polyester fabrics, polyester/cotton and polyester/jute blended fabrics. Although a number of workers have investigated the effect of alkaline treatment on polyester, it is for the first time that the low stress mechanical properties of alkali treated jute/polyester, alkaline oxidised polyester/cotton dress material, 100% PET fabric subjected to treatments like boiling water shrinkage, heat setting and repeated hydrolysis etc., are reported in depth.

In the first phase of the study, the effect of draw texturing parameters on draw textured yarn following alkali treatment has been studied. Factors like heat setting temperature, draw ratio and D/Y ratio are found to have profound influence on weight loss, density and critical dissolution time of fibres.

It is for the first time, the effect of spinning parameters on the 100% polyester sewing thread has been considered. The study has revealed that the parameters are invariant to weightloss.
The effect of ageing mechanism through alkaline hydrolysis also has been dealt with. It is interesting to note that as the ageing period increases, the weight loss registers a decreasing trend due to densification concept.

In the second phase, the study of the low stress mechanical properties of polyester and polyester blended fabrics has been considered. A search of literature shows that these properties have not been reported in detail, and hence the thrust of the present work was to explore the effect of pretreatments on the fabric handle following alkaline hydrolysis.

Weight reduction of jute/polyester blended fabric under the treatment conditions used in this study leads to a linear reduction in weight with an enormous improvement in fabric bending, shear, tensile, compression and surface properties.

The performance of alkaline oxidised polyester/cotton blends, as revealed by the low stress mechanical properties, has been found to improve as a result of silky handle following alkali treatment.

The study on the tensile, bending, shear, compression, surface and primary hand value of 100 percent polyester dress material fabrics subject to heat setting, boiling water shrinkage, repeated hydrolysis etc., shows that the fabric handle is very sensitive to these treatments following alkaline hydrolysis. As the heat setting temperature increases from 160°C to 180°C, handle of the fabric improves, and thereafter there is a deterioration. The response of the fabric handle to boiling water shrinkage is all the more
interesting one leading to an enormous improvement in the low stress mechanical properties. At the same time, fabric handle deteriorates at higher bath ratio indicating the significance of lower liquor ratio for alkaline hydrolysis. Similar trend was observed in the case of repeated hydrolysis.

A study of fabric handle of weight reduced 100% polyester using ethylene diamine (EDA) shows that it is very sensitive to the concentration of EDA in the alkali bath.

It is for the first time an attempt has been made to explore the potential of using multivariate analysis to compare the various fabrics considered for the study following alkaline hydrolysis. Techniques like factor analysis, cluster analysis and biplot have been employed for the analysis of the mechanical properties of fabrics to elicit some important relations between the mechanical properties and also to classify the fabrics into various groups based on their trends.

The industrial implications of the study have also been discussed.