ABSTRACT

‘Cool’ finished fabrics are meant to be used for the purpose of apparel and also technical textiles. Unlike the finishing of cotton fabrics by hydrophilic poly vinyl acetate (PVA), a hydrophilic emulsified polyester resin softener in addition to PVA was used to impart soft handle and ‘cool’ touch. Sodium perborate (SPB) is accepted as a novel bleaching agent, in the light of past research, for eco-friendly bleaching process of textiles. Use of SPB was made in the present work to reduce the total dissolved solids (TDS) in the bleach effluent. The technical advantages of the bleaching agent (SPB) and the finishing agents resulted in a novel process of producing ‘cool’ finished fabrics. Higher thermal insulation value (TIV), higher moisture transport coupled with soft handle are responsible for ‘cool’ touch in the finished fabric. The finish that gives these comfort characteristics is known as the ‘cool’ finish.

‘Nano Lotus finish’ is a fluoro carbon type of fluoro alkyl emulsion acclaimed by researchers as a finishing agent successful to impart ‘lotus effect’. Nano lotus finish is a special effect produced by using fluro alkyl based emulsion, developed to simulate the surface texture of a lotus leaf. This effect has high commercial and functional importance in view of repellency for oil and water with soil release characteristics. Fluoro alkyl non ionic nano emulsion was applied on the cotton fabric by Pad – Dry - Cure technique at three finish liquor concentrations of 15 gpl, 25 gpl and 35 gpl with 65 to 70 percent expression at padding. The tactile (total hand value), thermal and transport characteristics were tested on Kawabata Evaluation System (KES) and Thermo Lobao - model II. From the test results it was found that the
properties that showed development of ‘lotus effect’ were geometric roughness (SMD), fabric stiffness (G & B) and fabric compressional resilience (RC).

The combined effects of ‘cool’ finish and ‘lotus’ finish are obtained by using a silicone based softener in conjunction with hydrophilic poly vinyl acetate (PVA) and also dimethyl dihydroxy ethylene urea (DMDHEU) based cross linking agent. This type of formulation of finish, produced in the finished fabric soft feel, water/oil repellency and highest thermal insulation value (TIV) due to silicone softener. The hydrophilic PVA/PES has the function of improving the moisture transport capacity of the finished fabric apart from improving the stiffness of the fabric. The cross linking agent accomplished wrinkle resistance and crease recovery characteristics to the finished fabric. The finish that gives these multifunctional characteristics is known as ‘Lotus plus Cool’ finish.

Biaxial stress elongation and relaxation are very essential for wearability, fitness, drapeability, tensile and compressional resilience of an apparel fabric. In the fabrics meant for technical textiles, the elongation and recovery characteristics are marginal. Hence the measurement of these quality parameters helps in controlling and assuring the end product serviceability. In the case of apparel fabrics, the elongation and recovery characteristics directly contribute to the functional performance of the fabric especially to the wearer. This is equally important for woven and knitted fabrics of a variety of end uses. Bi-Axial Stress elongation and relaxation Tester (BAST) is designed and developed by the author of this research work, to undertake investigative trials in the measurement of elongation and relaxation at 500gf instantaneous load. This simulates the actual and practical conditions of application of tensile stresses to the fabric by the wearer. Obviously, the nature of practical
results are found to differ from the tensile tests, performed on INSTRON and/or KES.

A neural network was introduced for grading/ranking cotton fabrics according to Total Hand Values (THV) and 3T Values (3TV) which are representatives of combined comfort and hand values. Here the fabric image corresponds to the ‘octagonal diagram’ obtained by graphical plot of the low-stress mechanical test data. The Learning Vector Quantization algorithm (LVQ) as a tool of the artificial neural network facilitates classification, grading and prediction of woven fabric handle or comfort more effectively with selected optimum test data. The results demonstrate that fabric grades of THV or 3TV in the range of 1 to 5 (major 5 grades including their decimal grades totaling to 41 grades) can be categorized using the test data of low-stress mechanical as well as comfort characteristics.

The subjective quality of cotton fabrics was subjectively evaluated in this study and correlated with objective measurements by the use of ‘Correlation Matrix’. The ‘Regression Equations’ for the objective evaluation of the comfort and handle quality for apparel fabrics were derived from their mechanical and comfort characteristics by the use of 3T values. As a result, it has been clarified that the mechanical characteristics related to silhouette formation, handle in regard to geometric roughness and softness all contribute to the objective and subjective evaluation of tailored-type fabrics.

The research focus of the present work was embarked on the comprehensive evaluation of fabric handle and comfort using ‘3T’ Values and further industrial and commercial implementation through the use of computerized and statistical models. Thus, for a comprehensive evaluation of handle and comfort characteristics of apparel fabric, statistical and computerized regression models are of primary importance for automatic grading and ranking of the fabric quality.