STUDIES ON HAND VALUE OF WOVEN FABRICS PRODUCED FROM INDIAN WOOLS AND THEIR BLENDS

by

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CERTIFICATE

1. I am satisfied that the thesis presented by Mr. D B Shakyawar is worthy of consideration for the award of degree of **Doctor of philosophy** and is a record of the original bona fide research work carried out by him under my guidance and supervision and that the results contained in it have not been submitted in part or full to any other university or institute for the award of any degree or diploma.
2. I certify that he has pursued the prescribed course of research.

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ABSTRACT

The work described in this thesis is concerned with the structure-property relationship of wool fibres, yarns and fabrics along with exploratory work to develop quality fabrics from Indian wools and their blends using various methods of fabric engineering such as fibre mix, yarn structure, weave design and finally finishing technique. In each of the approaches, fabric objective measurement of hand value has been considered the main criteria of fabric quality. The hand values of the fabrics developed in this project are measured for winter suit, slacks and jacket applications.

The structure property correlation of native, exotic and crossbred wool fibres and the role of fibre structure linked to their genetic and environmental factors that influence fabric hand value is reported in detail. The properties and structure of selected Indian wools are also compared with that of exotic wool. Most of the mechanical properties of wool fibre like tenacity, modulus, bending rigidity and resistance to compression are significantly influenced by proportion of para cortex in the cross-section, whereas the coefficient-of-friction is mainly governed by scale profile, scale frequency and fibre diameter. In general, the properties of crossbred wool fibres are falling in between the properties of native and exotic wool fibres. The fabric produced from native (Chokla) wool gives considerably higher bending & shear rigidities and their hysteresis, coefficient of friction and compressional energy as compared to fabrics produced from crossbred (Bharat merino) and exotic (Australian merino) wool fibres. The fabric extensibility, bending rigidity, compressional energy and coefficient of friction are related with corresponding fibre and yarn properties. The Chokla fabric gives higher Koshi (stiffness) value than other two fabrics, however, it exhibits lower Numeri (smoothness) and Fukurami

(fullness and softness) values. The Australian merino and Bharat merino fabrics are found to be quite similar in respect of Total Hand Value (THV) for all kinds of men's wear applications, whereas a significant difference between the THV of Australian merino and Chokla fabrics is observed.

The role of fibre, yarn and fabric structure in the context of blended yarns and fabrics is described in detail. The primary hand values such as Numeri and Fukurami of all blended fabrics are lower as compared to pure wool fabrics. The blending of polyester and viscose fibres with Bharat merino and Chokla wool decreases the Koshi value whereas the Koshi value of Australian merino fabric increases after blending. The blending of polyester and viscose fibres with Austrian merino and Bharat merino (finer) wool fibres decreases the THV of blended fabrics by 10-15% as compared to pure wool fabrics. However, the blending of these fibres with Chokla (coarser) wool increases the THV by 5-10% compared to pure Chokla fabrics for all kinds of men's wear winter applications. The primary hand and total hand values of the fabrics are significantly influenced by twist, spinning system and weave structure. The fabrics produced from Dref spun yarns give higher Fukurami value than those of Siro & worsted fabrics irrespective of their fibre mix. High Fukurami value enables Dref fabrics to achieve better/comparable THV as compared to Siro and worsted fabrics. Among the fabrics with different weave structure, the plain woven fabric gives highest Koshi value followed by twill and satin fabrics whereas the twill and satin fabrics give higher Numeri, Fukurami and THV values than plain fabric. The fabric of low twisted yarn gives higher THV than the fabric of high twisted yarn.

Finally, the effect of different softening treatments on low stress mechanical properties and hand values of fabrics is described in detail. The extensibility, tensile resilience, coefficient of friction, compressional energy and thickness of all fabrics significantly increased after softening treatments whereas the bending & shear rigidities and their hysteresis, and compressional resilience are found to be reduced. The Amino silicone softener is more effective than cationic softener. The Koshi values of wool and wool blended fabrics decreased by 5-10% of that of untreated fabrics after softening treatments. However, the Numeri and Fukurami values have increased by 10-40%. The fabrics treated with cationic and amino-silicone softeners show higher THV than the untreated fabrics; THV increased by 5-20% and 10-20% for winter suit and jacket applications respectively.

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