DEVELOPMENT OF HIGH QUALITY LIGHT WEIGHT SUITING FABRICS USING SUITABLE FIBRE MIX, YARN PREPARATION TECHNIQUE & DESIGN ENGINEERING

by

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1. Worsted suiting fabrics
2. Suiting fabric - light weight

Dedicated to the
Vision & Mission,

"India: A Developed Nation"

CERTIFICATE

1. I am satisfied that the thesis presented by Rajesh Kumar Mishra is worthy of consideration for the award of the Degree of **Doctor of Philosophy** and is a record of the original bonafide 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 award of any degree/diploma.

2. I certify that he has pursued the prescribed course of research.

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THANK YOU ALMIGHTY.

Rajesh Kumar Mishra

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ABSTRACT

In the present context of stiff market competition, it has become more and more vital to emphasize on quality aspects of textile products. The rapid change in fashion trends and market demands have compelled the manufacturers to adapt into an engineered product design and development system rather than relying upon experience based manufacturing. Apparel goods have experienced a dramatic shift from durability needs to aesthetic and functional needs because of the manifold improvement in consumer awareness and their purchasing power.

The Hand Evaluation and Standardization Committee (HESC) set up under the chairmanship of Prof. S. Kawabata have established guidelines for high quality apparel fabrics in terms of appearance, handle and wearing comfort. The Kawabata Evaluation System (KES) has long been established as an objective and scientific method of evaluating fabric mechanical comfort. However there has been a continuous lacuna in development of any objective method for evaluating fabric appearance in realistic terms.

The present research work addresses to some current issues relating to development of high quality light weight worsted suiting fabrics based on present market trend and consumer response. Therefore the first step taken is to develop an objective evaluation system for quantifying fabric appearance as a function of major aesthetic attributes namely pilling, drape, wrinkle and texture which are basically secondary determinants of low stress mechanical properties. These attributes are measured objectively by using digital image processing system and a standard procedure is developed to evaluate fabric appearance by combining above parameters into a weighted average approach. This

integrated appearance index is termed as Fabric Appearance Index (FAI). In order to determine weightage of each attribute, an expert panel is constituted and a survey was conducted to decide the contribution of each of the above four attributes to fabric appearance.

Some natural fibre based non-conventional worsted blends were developed and yarns were spun on state of the art spinning systems. A cold sizing kit and recipe were developed to prepare the single yarns so as to enable them to be used as warp for manufacturing light weight suiting fabrics. Weavability study was carried out on Reutlinger weavability tester for all single unsized, single sized and equivalent 2-ply unsized yarns. The single cold sized yarns proved to be better than 2-ply unsized yarns with respect to abrasion loading cycles on the weavability tester.

Fabric samples of comparable areal densities were developed from single as well as equivalent 2-ply warp yarns. The aesthetic attributes and comfort aspects were studied and compared for all such fabrics. Single warp yarn woven fabrics proved to be better than equivalent 2-ply warp woven fabrics in all comfort aspects e.g. total hand value, air permeability, water vapor permeability and thermal insulation. However the light weight constructions sometimes lead to poor fabric appearance due to non uniform texture and high pilling propensity.

A radial basis function based neural network was used as a tool for predicting the aesthetic and functional properties of worsted suiting fabrics. In the first step, the network was trained to predict these properties from basic fibre dimensional and mechanical properties & fabric constructional parameters as input. In the second step it was tested to predict the desired output parameters from the input parameters prescribed in ten equal intervals within the minimum and maximum value range. The prediction was found to have good correlation with actual experimental results and shows minimum acceptable error percentage.

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