STUDY ON COMFORT CHARACTERISTICS OF HIGH ACTIVE SPORTSWEAR

by

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CERTIFICATE

This is to certify that the thesis titled "**Study on Comfort Characteristics of High Active Sportswear**" being submitted by **Mrs. Manpreet Manshahia** to the Indian Institute of Technology Delhi, for the award of the degree of **Doctor of Philosophy**, is a record of bonafide research work carried out by her. She has worked under my guidance and supervision and fulfilled the requirements for the submission of the thesis, which has attained the standard required for the Ph.D. degree of this institute.

The results contained in this thesis have not been submitted, in part or in full, to any other university or institute for the award of any degree of diploma.

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ABSTRACT

In high active sports, high amount of metabolic heat is generated due to strenuous physical activity. It leads to increased heat and sweat generation so thermo-physiological comfort becomes most important characteristic for high active sportswear. Thermo-physiological comfort deals with heat and moisture transmission through the clothing which determines the comfort sensation and may affect the performance of player. The other important comfort characteristic of high active sportswear is ability to stretch so that no restriction is imposed to movements of body limbs. The focus of this thesis is to study the effect of various parameters on comfort characteristics of high active sportswear.

The impact of various important clothing related parameters on thermo-physiological comfort characteristics of commercial active sportswear has been examined. It has been observed that various structural characteristics of fabrics, i.e. structure type, fabric porosity, fabric tightness, fabric thickness, and the structural characteristics of filaments, i.e. the cross-sectional shape of filaments and filament fineness, have considerable effects on heat and moisture transfer through polyester knitted sportswear. Moisture management properties of plated knitted sportswear have been studied by taking various combinations of profiled polyester filament yarn in plating construction. It has been found that the effect of shape factor of filament on inner side is more pronounced as compared to shape factor of filament on outer side on liquid moisture management of fabric.

Performance of players can be improved, by inducing enhanced compression to limbs, using compression athletic wear (CAW). Interface pressure profile under dynamic

conditions and elastic recovery of compression athletic wear (CAW) has been studied. Fabrics knitted with lower loop length, coarser elastane and modified cross-sectional shape of polyester filament show higher interface pressure with lower rate of pressure drop and good elastic recovery. Incorporating elastane in structure to get desired compression may affect the thermo-physiological comfort of compression athletic wear (CAW). Thermo-physiological comfort characteristics of compression sportswear have been studied by incorporating elastane using two approaches, i.e. core-spun yarn and plating construction. Permeability to air and moisture vapour as well as liquid moisture transmission properties of fabric found to be higher at lower range of elastane content and elastane stretch of core-spun elastane yarn. In second approach, thermo-physiological comfort characteristics of polyester elastane plated fabric mainly affected by cross-sectional shape of polyester yarn and found to deteriorate with increase in elastane linear density and fabric tightness.

Mathematical models have also been developed to predict the liquid moisture transmission properties of knitted structure which will help to design the high active sportswear to achieve the maximum comfort sensation. Capillary flows at two levels of porosity, i.e. macro scale and micro scale have been considered to develop mathematical models. Macro scale model has been developed assuming sinusoidal irregular capillary flow through capillaries formed between yarns in the fabric. Micro scale capillary model has been developed considering capillary progression, through capillaries formed within yarn, equivalent to tortuous stream tube. A good correlation has been found between experimental equilibrium wicking height and predicted equilibrium wicking height by micro scale capillary model.

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