ABSTRACT

Moisture transfer property is an important aspect of any fabric which decides the comfort level of the fabric. Whatever heat the human body produces must flow out through the fabric via the body surface by conduction, convection and radiation. Sports which involve higher level of physical exertion causes the body to sweat and it should be evaporated in making the body cool. So the clothing must ensure a higher level of moisture transmission. Fabric must have the property of transferring the sweat out of the body and making the wearer feel comfortable. So moisture management can be defined as the ability of a fabric to transport moisture away from the skin to the fabric outer surface and to release it into the surrounding air. Hence wetting, wicking and moisture vapour transmission characteristics are the critical aspects of a fabric in deciding the clothing comfort of the wearer.

Moisture transfer properties of fabrics have great influence on thermo-physiological comfort of human body in maintaining the perspiration. The cloth worn next to skin should be able to transfer the perspiration to the atmosphere so that the thermal balance of human body can be maintained. The mechanism of moisture transfer through clothing during transient conditions plays a key role in deciding the dynamic comfort of the wearer.

The properties of any clothing is decided by the constituent fibres, yarn and fabric structure. As clothing it should satisfy the wearer both in functional and aesthetic aspects. Thermal comfort is related to the temperature of the body and micro environment between the fabric layer and the skin. The heat generated by the human body during strenuous activity must be dissipated to the external environment through the clothing. So the clothing worn next to skin should have the property of transferring the perspiration from the skin and to transfer the moisture to the atmosphere thus making the

wearer feel comfortable. Moisture transfer refers to the transfer of both moisture vapour and liquid perspiration away from the body.

Through this research work, an attempt has been made to study the influence of yarn type, yarn fineness and tuck density on moisture transfer characteristics of double-face knitted fabrics and moisture management properties of double-face knitted fabrics.

Study of influence of yarn type on moisture transfer characteristics of double-face knitted fabrics was carried out to find out the type of yarn which gives better level of moisture transfer characteristics. In order to study this effect, five different yarns such as cotton, polypropylene, polyester, acrylic and nylon were selected. The polypropylene, polyester, acrylic and nylon yarns selected were multifilament dope dyed yarn of each 120 denier (24 filaments) and the cotton of 120 denier combed cotton yarn. The selected yarns were knitted by using high speed double circular knitting machine with a speed of 25 rpm. Different double-face fabrics made of cotton/polypropylene, cotton/polyester, cotton/acrylic and cotton/nylon having 3 mm stitch length with tuck stitch at every 6^{th} wale and every 9^{th} course were produced. The double-face fabrics produced were dyed and tested for the moisture transfer characteristics such as wetting, longitudinal wicking, transverse wicking, moisture vapour transfer and dryness, air permeability and thermal conductivity. Comparing all the selected double-face knitted fabrics, it was found that cotton/polypropylene fabric had given better level of moisture transfer properties and suits in making sportswear.

Study of influence of yarn fineness on moisture transfer characteristics of double-face knitted fabrics was carried out to find out the type of yarn denier which gives better level of moisture transfer characteristics. In order to study this, three different denier of combed cotton yarn such as 120 denier, 180 denier and 240 denier and three different denier of polypropylene dope dyed yarns such as 120 denier (24 filaments),

180 denier (36 filaments) and 240 denier (48 filaments) were selected for the study. The selected yarns were knitted using high speed double circular knitting machine with a speed of 25 rpm. Different double-face fabrics were produced with 120 denier, 180 denier and 240 denier cotton yarns and 120 denier, 180 denier and 240 denier polypropylene yarns. The double-face fabrics produced has 3 mm stitch length with tuck stitch at every 6^{th} wale and every 9^{th} course. The double-face fabrics produced were dyed and tested for the moisture transfer characteristics such as wetting, longitudinal wicking, transverse wicking, moisture vapour transfer and dryness, air permeability and thermal conductivity. Comparing all the selected double-face knitted fabrics, it was found that the combination of 120 denier finer cotton and 240 denier coarser polypropylene double-face fabric had given better level of moisture transfer properties and suits in making sportswear.

Study of influence of tuck density on moisture transfer characteristics of double-face knitted fabrics was carried out to find out the type of tuck density which gives better level of moisture transfer characteristics. In order to study this, combed cotton yarn of 120 denier and polypropylene dope dyed yarn of 240 denier (48 filaments) were selected for the study. The selected yarns were knitted using high speed double circular knitting machine with speed of 25 rpm. Different double-face knitted fabrics was produced from 120 denier cotton yarn and 240 denier polypropylene yarn as 6×9 double-face fabric, 6×6 double-face fabric, 3×3 double-face fabric, 9×9 double-face fabric and 12×9 double-face fabric. The double-face fabrics produced were dyed and tested for the moisture transfer characteristics such as wetting, longitudinal wicking, transverse wicking, moisture vapour transfer and dryness, air permeability and thermal conductivity. Comparing all the selected double-face knitted fabrics, it was found that 6×9 double-face fabric having optimum tucks per unit area had given better level of moisture transfer properties and suits in making sportswear.

The moisture management properties of double-face knitted fabrics have also been studied with respect to yarn type, yarn fineness and tuck density. With respect to yarn type, 120 denier cotton and 120 denier polypropylene double-face knitted fabric have shown better results for the moisture management properties than the other three fabrics. Moisture management test results show that water poured on the surface of polypropylene layer has found to get wicked and transferred to the cotton layer after 65 seconds but in case of polyester, acrylic and nylon the water poured on their surface remains even upto 120 seconds. With respect to yarn fineness, no significant difference has been found among the nine double-face knitted fabrics for the moisture management properties. With respect to tuck density, 120 denier cotton and 240 denier polypropylene double-face knitted fabrics (6×9 fabric) have shown better results for the moisture management properties than the other four fabrics.

Based on the research work, it was concluded that the moisture transfer characteristics of the double-face knitted fabrics were influenced by the type of yarn, fineness of yarn and tuck density of the fabric. The selection of yarn, fineness of yarn and the tuck density of the fabric decide the moisture transfer characteristics of the double-face knitted fabrics which suit in making sportswear.