5.SUMMARY AND CONCLUSIONS

In this study, the air permeability, thermal properties and the moisture management properties of the two knitted structures – Plain Jersey and Pique produced by using four fibres, two yarn counts, four tightness levels, were investigated. The selected fibres were Cotton, Viscose, Modal and Excel.

To address a mathematical relationship between the thickness of fabric, tightness factor, porosity of the knitted samples and air permeability, a linear regression equation was used and apllied on the air permeability values. Multiple Regression analyses were made between thermal properties and fabric parameters. Thermal properties are defined as dependent variables (Y), and yarn count, loop length, tightness factor, fabric thickness and porosity are defined as independent variables (X). Multiple linear regression analysis have been applied to the measured values and obtained the best fit equations using MINITAB16. The results (expressed as means/standard deviation) of all assays were compared using ANOVA in order to investigate the effect of fibre type and fabric structure on air permeability, thermal conductivity and thermal resistance. A series of indexes were defined and calculated to characterize liquid moisture management performance of the fabric sample. According to AATCC Test Method 195-2009, the indices were graded and converted from value to grade based on a five grade scale (1-5). To find the possible relationship between tightness factor and moisture management properties of knitted fabrics, scatter plots with regression lines of MMT indices and Tightness factor were generated. For the evaluation of the statistical importance of the tightness factor on the moisture management properties of the knitted fabrics, Pearson correlation was found. In order to decide the statistical significance of the variable on the related property, p value was also used. The results (expressed as means/standard deviation) of all assays were compared using ANOVA in order to investigate the effect of fibre type and fabric structure, on indices.

The test results indicate the following:

- Air permeability has a direct relationship with the count of the yarn. Air permeability, is a function of knitted fabric thickness, tightness factor and porosity. Air permeability showed a negative correlation with fabric thickness and tightness factor. Increase in yarn fineness and more open structure of the knitted fabric improved air permeability. Both the structures shows better correlation index in fabric weight and tightness factor. Better correlation is obtained between air permeability and porosity in case of both the single jersey and pique fabrics knitted with 15Tex. Tightness factor which can be used for fabric air permeability forecasting. The high correlation between the permeability to air and tightness factor confirms that. The effect of the loop length has more influence on porosity than the stitch density and the thickness. Porosity is affected by yarn number or yarn count number. Increasing loop length, looser the structure and so the values of air permeability increases.

- The highest air permeability value was obtained for, modal fabric knitted with 15Tex with tightness factor 1.16 in both single jersey as well as pique structure; this was followed by excel fabric knitted with 15Tex with tightness factor 1.16 in both single jersey as well as pique structure which could be because of lower fabric cover factor. For summer wear or sportswear modal could be used as it is characterized by higher air permeability, creating a cool feeling to the wearer by allowing more air to penetrate through to bring the heat away from the body and accelerate the sweat evaporation at the skin and fabric surface. And for winter garments the choice could be cotton as it is characterized by lower air permeability, creating, warm feeling for the wearer.
- The lowest thermal resistance obtained was for modal knitted fabric. These fabrics were followed by excel, cotton and viscose, in turn. Because of their structural properties, pique fabrics have remarkably lower thermal conductivity and higher thermal resistance values in all the fibre types investigated. According to the results pique structures, being thicker, due to their high thermal insulation values, could be preferred for winter garments in order to protect from cold. On the other hand, single jersey structures should be chosen for active sports or summer garments for better moisture management properties that gives a cooler feeling at first contact with the skin. However, as they demonstrated fair drying ability, fabrics can become wet and damped, creating discomfort to the user (heavy, sag, feel cold when activity ends). Therefore, different solutions must be proposed, according to the activity level. If the wearer performs mild activities, skin wetness is very low and thermal comfort is managed by skin temperature. In this case, fabrics' air permeability and thermal resistance are determining properties for thermal comfort. Fabrics must have high air permeability and low thermal resistance. Modal fabrics with single jersey structure fulfill these requirements.
- ANOVA for air permeability, thermal conductivity and thermal resistance indicated that there was significant impact of fibre type and fabric structure on thermal conductivity and thermal resistance. Together, fibre type and fabric structure accounted for 82.31% of the

variance in air permeability, 85.41% of the variance in the thermal conductivity and 85.75% of the variance in the thermal resistance.

- ANOVA for dependent variables [wetting time on top surface (WTt)/ wetting time on bottom surface (WTb), absorption rate on top surface (ARt)/ absorption rate on bottom surface (ARb), top maximum wetted radius (MWRt)/ bottom maximum wetted radius (MWRb), top spreading speed (SSt)/ bottom spreading speed (SSb), accumulative one-way transport index (AOTI), overall moisture management capacity (OMMC)] indicated that there was significant impact of fibre type on all and of fabric structure on wetting time on top surface (WTt), absorption rate on bottom surface (ARb), top maximum wetted radius (MWRt), bottom maximum wetted radius (MWRb), top spreading speed (SSt), bottom spreading speed (SSb). SM16 have the highest thermal resistance which makes them the best choice for cold weather sports activities.
- As a conclusion, knitted fabrics in single jersey and pique structure with different tightness factor, fibre type and yarn count have different moisture management properties and performance attributes, thus potentially it is possible to engineer fabrics of such construction with improved water transport property in order to meet the requirements of active wear and sportswear by varying their tightness factor and fibre type and yarn count.
- Fabrics SC5, SM16, SE1 and SE2 were classified into moisture management fabrics according to the possible commercial classification and these fabrics with excellent thermal and breathability properties are suitable for active sportswear.

FUTURE SCOPE OF THIS WORK

The results obtained can be a starting point for further research to develop a neural network model to predict the water transport of knitting structure as function of:

i. porosity,
ii. air permeability,
iii. thermal conductivity,
iv. weight per unit area and
v. moisture management property.