CHAPTER 10

SUMMARY AND CONCLUSIONS

10.1 INTRODUCTION

Microfibres comprising of polyester, modal, lyocell and viscose are currently available for producing novel fabrics. The primary objective of the study is to carry out a comprehensive study of microfibres other than polyester. Unlike fine cotton, there are a number of problems which are to be solved in order to make them suitable for regular processing. They are fraught with fibre breakage during carding and the impact of carding variables on their processing performance is also not known. With advent of new spinning technologies such as compact and rotor spinning systems, questions arise as to how they will respond during mechanical processing of them. The present work addresses these issues and tries to provide answers to the queries. To sustain competition, it is always better to develop new products and microfibres constitute the most appropriate candidate in today’s textile scenario.

An extensive summary of literature on micro denier fibers is presented in Chapter 2.

The experiments conducted included a thorough investigation of carding performance of microdenier fibres, production of compact yarns, study of fibre migration, study of knitted fabrics for various properties, measurement of friction and development of novel products.
The conclusions reached are given under various chapter headings as follows:

### 10.2 CONCLUSIONS

The influence of carding variables on fibre properties of semi-high production and high production carded sliver produced from microfibres.

The following conclusions may be drawn from the above study:

1. Carding variables such as doffer speed, delivery hank and flat speed have a significant effect on mean length, short fibre content and neps of card sliver.

2. An analysis of the mean length in card sliver shows that microfibre follows different statistical distributions.

3. An increase in doffer speed has led to higher fibre disorder.

4. Cutting ratios for micromodal, microlyocell, micropolyester and micropolyester-cotton blend at a speed of 160 mpm were unchanged implying that hooks are independent of the fibres used.

5. Sliver cohesion was affected by doffer speed irrespective of micro modal, micropolyester-cotton blend and microlyocell fibres.

A study of yarn characteristics of regular ring and compact yarn produced from micro modal and microlyocell fibers. An analysis of results leads to the following conclusions:

1. The quality of compact yarns produced from micromodal and microlyocell fibres has been found to be higher in comparison
with regular yarns. The variability in tenacity, elongation has been found to be lower than that of regular yarns. Hairiness and uniformity were better for compact yarns.

2. Packing density of compact yarns was found to be higher.

3. Yarn quality index (YQI) was superior for compact yarns at all twist levels studied.

4. The compact yarns showed a lower friction.

5. Abrasion resistance of compact yarns was found to be lower than that of regular yarns in all cases. Twist seems to improve the abrasion resistance of all types of yarns.

6. Specific flexural rigidity of compact spun yarns is higher than that of regular yarns.

7. There is not much of difference in compressional properties of regular and compact yarns.

8. Wickability of compact and regular yarns was found to be similar.

The following conclusions are drawn from the migration study of Micro-fibre Ring and Rotor yarns:

1. There is a reduction in mean fibre position of rotor-ET & rotor-HT yarn compared to ring yarn to the tune of 22.6% and 37.2% respectively.

2. There is reduction in RMS deviation to the tune of 13.5% and 11.2% respectively for rotor-ET and rotor-HT yarn compared to ring yarn.
3. There is a reduction in migration intensity to the tune of 20.3% and 18.2% respectively for rotor-ET and rotor-HT compared to the ring yarn. The equivalent migration intensity and migration factor are also lower.

4. Packing density of ring spun yarn was found to be higher compared to rotor spun yarns.

A study of properties of knitted fabrics made from various microfibres.

1. Micro denier fabrics have shown superior properties when compared to normal denier fabrics in various aspects of physical and dimensional behaviour. The microfibre fabrics are characterised by high drapeability, acceptable spirality, excellent moisture transmission properties such as drying rate, total absorbency, wicking rate, drop absorbency and water absorbency.

2. Microfibre knitted fabric is dimensionally more stable when compared to that of normal denier knitted fabric because of less loop shape deformation and characterised by lesser lint shedding propensity. The superior properties of microfibre fabric can be conveniently utilized to explore and optimize new products for apparel and sports wear.

The results from Kawabata evaluation systems clearly indicate the superiority of micro modal fabrics over blend with cotton.

3. A comparison of micro modal knitted fabrics with those of micromodal-cotton blends shows that the former has a higher extension, lower initial modulus, lower bending rigidity, lower
shear rigidity, higher compressions, lower friction and better handle. Elastic recovery also has been found to be good for micromodal knitted fabrics.

4. Comfort properties such as $q_{\text{max}}$, thermal conductivity for both the fabrics are found to be similar. In view of this, the use of microdenier modal fibers with blends of cotton is recommended.

A study on experimental evaluation of smoothness of polyester microfibre knitted fabrics.

1. The results show that that the sliding friction apparatus and the composite factor, “R” can very well serve as simple objective tools to quantify the smoothness of fabrics. More importantly, the limited study on micro and normal fiber knitted fabrics has shown that microfiber fabrics have lower “R” values showing that they are smoother than normal denier fabrics.

2. An important outcome is that the work has objectively shown that microfiber knitted fabric is smoother than regular fiber knitted fabric. This result will be of immense use to the textile industry. In addition, the study has validated the failure of Amontons’ law of friction proving that the coefficient of friction is not a valid parameter to quantify the friction of textile and polymeric materials.

Design and development of bilayer socks from microfibres.

1. The results show that the socks made using micropolyester filament yarn in the core and micro modal staple yarn in the sheath are much better than the socks made using macro
denier nylon filament yarn in the core and cotton yarn in the sheath in terms of moisture comfort which one of the sensitive parameters for assessing the comfort.

2. Bilayered knitted fabrics has lower thickness, lower air permeability, higher wickability, higher moisture vapour transmission rate in comparison with normal socks.

10.3 SUGGESTIONS FOR FURTHER WORK

Since the mid-1980s the market importance of microfibres, has been rising throughout the world. They are opening up new marketing opportunities to the fabric manufacturers and inspire the fashion designer to new creations. Microfibre holds a lot of promise for the future. The much friendlier properties of microfibres as compared to those of other man-made fibres, have been able to revitalise the man-made fibre market.

There are several areas which require further attention. From the view point of a fibre and polymer scientist, various microfibres are yet to be fully characterised. Studies aiming at the structural characterisations due to stress and treatment temperature are necessary. The understanding of the macromolecular characteristics of the microfibre would give important inputs for the downstream processing machinery. There have been some research on use of microfibres in the medical sector but there is wider scope of them. The high surface area can be a real boon for various medical components which rely solely on surface activity.

Weaving of microfibres is a field which calls for more attention. Weaving such yarns in shuttleless looms in high speed is crucial with out breaks. This demands a much better yarn processing machinery. Splicing of yarns from microfibres in high speed auto winders need more attention and change of settings in splicers like air pressure, time of spray of air, demand
more intensive studies for productive operations. The dyeing behaviour of the microfibrils is a critical field and needs additional systematic studies.

Microfibrils have been put to various uses but still many areas remain to be explored. There have been complaints of static generation from furniture using fabric from microfibril. More research needs to be directed at production of durable anti-static finish on such fabrics. Use of cellulosic microfibrils as reinforcement with biodegradable matrices is one such important and potential area which need attention. Extensive research is also called for to produce these fibrils at a much lower cost.

10.4 RECOMMENDATIONS FOR FUTURE WORK

The study reported in this thesis has concentrated on studying the properties of yarn and knitted fabrics produced from microfibrils. The research activity has laid foundation for future study with a number of products such as sewing threads and woven fabrics. The research has opened many new avenues for research which are worth further investigations such as

1. Development of sewing threads from micropolyester and its blend with cotton for studying the seam efficiency of various types of garments.

2. Texturing of microdenier polyester with a view to developing novel types of stretched yarns and sewing threads.

3. New product development from woven microfibre fabrics and evaluation of handle.

4. Fibre migration studies for micromodal and microlyocell compact yarns vis-a-vis regular yarns are required to have a better understanding of the structure of compact yarns.
5. A variety of knitted structures such as rib, interlock and pique can be developed to study the low stress mechanical properties.

6. Production of Eli-twist (SIRO spun compact) yarn from micro denier polyester, modal and lyocell to produce a low cost double yarn in ring frame itself.

7. Production of fine count rotor spun yarns for apparel production.

8. Study on air jet yarns spun from microdenier fibres is required.

Furthermore, the work can be extended to study the influence of different fibre blends with microfibres and finishing treatments on the low stress and surface mechanical properties of woven and knitted fabrics. This will help to create a data base of low stress mechanical properties of fabrics which will be of immense use to the garment industries.