CHAPTER 1

GENERAL INTRODUCTION.
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India is the second largest silk producing country in the world after China. India is the only country producing all the four commercially known varieties of silk (Mulberry, Tasar, Eri and Muga). The production contribution of mulberry silk is the maximum (90.7%) among other varieties of silk (Tassar 3.9%, Eri 4.9% and Muga 0.5%). Spun silk spinning system is mainly intended for consuming waste silk. The present system of producing spun silk yarns involves so many processes like mixing, opening, filling, dressing, drawing, roving preparation, spinning, gassing and winding and hence requires a long sequence of machines. The yarn thus produced is quite uneven, not suitable for knitting and hence mostly used in weaving sector. Approximately 95% of the filament silk produced goes into weaving industry.

The main products of classical silk fabric are crepe-de-Chine and twill silk. But these days, knitted fabrics are becoming more popular due to their shape fitting property. The market for knitted fabrics has been unquestionably deeprooted because of comfort qualities and stretch imparted by looped yarn structure. Knits also provide lightweight, warmth, wrinkle resistance and ease of care. A combination of high degree of extensibility with good recovery properties may be regarded as distinguishing characteristics of knitted fabrics.

There has been an apprehension among the Indian knitwear manufacturers about the use of silk for knitting. Manufacturers have not taken initiative into silk knits, inspite of enquiries from importers due to lack of evidence of the suitability of silk to knitting. Thus there exists a need to explore the possibility of producing silk knitted fabrics by overcoming the processing related difficulties if any.

In the past, most of the countries interested in natural silk knitting have made more or less unsuccessful trials in this field. All the trials were in the field of filament silk knitting. The gummed filament silk has too little elasticity for knitting. Hence trials of silk knitting were unsuccessful. Many researchers have tried spinning of staple silk on cotton spinning system but
they were not very successful because of high length variability, lack of crimp and cohesion resulting in process difficulty and an uneven yarn.

For producing an acceptable quality of knitted fabric, yarn will have to meet some pre-specified quality standards like evenness, tenacity, sufficient elongation at break, loop and knot strength ratio. Hence feasibility of producing good quality silk and silk blended yarns on cotton spinning system has been investigated. Cotton spinning system is the most common spinning system in Indian textile industry. Hence, if it is possible to produce good quality silk and silk blended yarns on cotton spinning system, then it will help cotton spinning units in product diversification. It will also be possible to produce good quality knitted fabrics for export purpose from these kinds of yarns.

Pure silk garments are very costly due to high price of raw silk. The price of silk garments can be reduced by two ways, either by blending or core spinning technique. Both the aspects have been studied in this thesis.

World wide there is an increasing demand for fabrics made of 100% natural silk and in combination with other fibres. While silk continues to be in demand because for apparel substrates, the place of silk fibre is undisputed amongst all the natural and synthetic fibres. This is largely due to its excellent lusture, high moisture absorbency, heat processing properties and dyeing characteristics. It is to be appreciated that silk fabrics have the distinct advantages of providing warmth in winter and coolness in summer, with special properties of moisture absorption combined with the luxury of well dressed feeling. But silk takes moisture quickly, but releases it more slowly. Therefore very damp or wet silk garments remain unpleasant for a longer time. Resistance to washing, perspiration and durability are not very satisfactory for garments made from silk filaments. Further there are no easy care properties for silk. Hence silk fibre particularly at higher humidity exhibit low degree of crease recovery. This deficiency in functional behaviour maybe improved by blending some component like manmade fibre to silk mix.

Blending of silk with synthetic fibres offers an excellent scope, considering the overall characteristics of yarns and fabrics. The polyester fibre is quite tough, durable and crease resistant compared to silk. So it's
presence in the blend can overcome the shortcomings of silk while the comfort and aesthetic aspects of silk compliment polyester fibre. However this will be at the cost of loosing hygroscopic nature of the final fabric in comparison to 100% silk fabric. Introduction of viscose rayon as blend partner with silk would compliment hygroscopic nature of each other. Hence feasibility of preparing silk blends with polyester fibre and viscose rayon on cotton spinning system has also been studied.

The bulk of silk yarns is low due to fine denier of silk filaments and it's low bending rigidity. Hence more number of threads/cm are required to produce fabric with required cover factor. Besides the possibility of silk to be used as winter garments can be enhanced if one can produce bulky silk yarn. One way to achieve this objective is to produce high bulk silk yarn following the principle of high bulk acrylic staple yarn manufacture. In the case of silk the shrinkable blend partner could be acrylic. Hence the possibility of production of high bulk silk yarn and fabric were investigated.

Since the beginning of the 80s, the world silk industry has made great efforts to develop silk products of better performance and renewed style so as to please the ever changing clothing fashion. As a result, a number of new types of silk yarns have come into production such as silk covered yarn, elastic silk yarn etc. However most of these yarns are finer and therefore lead to production of lightweight fabric. Thicker silk yarns are required to prepare medium weight and heavy fabrics for silk outerwear (western-style garments for example), which sell well in the international market. Therefore, if new types of silk fabrics are to be developed, new types of silk yarns must first be worked out. So to produce a coarse silk yarn with improved use characteristics, production of core-spun silk yarn was thought. The core may contain a continuous filament yarn like polyester or viscose, which is constrained to lie permanently at the core, while silk act as the covering fibre around the central core. Depending upon the proportion, the cost of the yarn can also be optimized.

Sportswear and activewear is an emerging area. In these applications the fabric should have skin fit property, crisp unwrinkled look for a longer time, comfort as well as freedom of movement. The introduction of spandex based fabric, fits the body well and allow easy
movements of the body. If spandex is introduced in silk and knitted
structure are made out of it, then all the desirable properties of such
garments like wrinkle or crease resistance, shape and appearance
retention can be manifested along with the unique lusture property of silk.
Thus silk may find new application.

Hence in the present thesis, the following aspects has been studied
- Possibility of spinning silk on cotton spinning system.
- Production of silk blended yarns on cotton spinning system.
- Producing bulk silk yarns and fabrics by blending shrinkable acrylic fibre
with silk.
- Producing silk covered polyester and viscose filament core yarns and
fabrics.
- Producing elastic silk yarn and fabric by introducing lycra in the core of
silk yarn.
- Producing single jersey fabrics from all these yarns on weft knitting
machines.
- Evaluation of the yarn and fabric properties including moisture transport
and low stress mechanical properties.