High Performance—Rayon, Staple Fibre

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For a country like India, where the population is quite large and growth rate is comparatively higher than that of other countries, the demand for textiles as one of the basic needs for civilised people, will be very great and this need cannot be met by the natural fibres as their production has already reached a saturation point. Apart from importing food grains India also imports natural fibres, cotton and wool. This import of cotton can be replaced by man made fibres.

Textile Industry which is highly competetive and is exposed to much unpredictable influences as changes of fashions amongst the consumers, constantly requires new and improved fibres. This urge made the textile Scientists and Technologists to continuously search for better and newer man made fibres with superior Physical, Chemical and aesthetic properties over the conventional ones, and as a result, approximately one quarter of the world's textile fibres are made by man today. The contribution of regenerated cellulosics, the oldest man made fibre, had been significant in the textile field and in recent years the achievement of modified rayons in the world have become prominent.

The viscose Rayon Staple Fibre is divided into two main categories, namely Regular and High performance. High performance Rayon Fibre include 'Polynosic' and High Wet Modulus (H.W.M.) types. Regular viscose Rayon staple Fibre has several advantages over cotton. It can be spun very uniform in diameter and therefore in denier or counts, of any desired lustre, and most important of all it can be made more cheaply than cotton. The attribute which first popularised Viscose Rayon was its continuity of filaments and its resemblance in this respect to real silk. This, added to the brightness of the early Rayons, gave something novel and showy that sold easily.

Fashions changed, people grew tired of the high lustre and now-a-days much more Viscose Rayon is used as staple fibre than as continuous filament. In this form, its competitor is cotton. The function of regular staple fibre in the textile industry has been that of a naturalizing influence in blends with nylon, polyester and acrylics by imparting comfort, eliminating static, and producing a better hand. The percentage of regular staple fibre in these blends with synthetics has been up to the judgment and skill of the fabric designer and it can be spun in 100% also. Regular staple fibre, unlike cotton, showed relative weakness in strength when wet and possess very little dimensional stability in the final fabric and is low in abrasion resistance, particularly after resinating. Its strong points are ability to absorb and hold moisture, easy dyeability, reactivity to a wide variety of finishing agents, and a kind hands.

The Rayon producers have therefore worked for many years on the development of improved staple fibres. These efforts were primarily directed towards improved dimensional stability, better abrasion resistance and firmer hand of the final fabrics. The search for High performance Rayon led the evolution of two distinct process, using different spinning systems. One process employs a zinc spinning bath and the product is generally known as 'High Wet Modulus Rayon' (H.W.M.). The system is predominantly being used in U.S.A. and some European countries. The second process does not employ Zinc Spinning bath and the product is generally known as 'Polynosic Rayon'. The system is predominantly being used in

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Japan and European Countries. Though the process employed is varying, the products are similar in many respects in overcoming the major drawback of normal Rayon Staple Fibre.

The process employed for the manufacture of High Performance Rayon Fibre is more complex than that used for the manufacture of normal Rayon Fibre. The plant investment are higher, raw material, wood pulp is of a purer grade. Further the process control is more sophisticated. However, the process well adapts to large scale manufacture and the cost of the finished product is comparable to that of medium grade cotton. The fabrics using this fibre will be priced no higher than similar cotton fabrics.

Fibre Characteristics

High performance rayon fibre have been developed with a view to attaining a balanced combination of the various technologically important fibre characteristics such as strength, extension, modulus etc. These fibres possess a fine staple microfibrillar structure which is very similar to cotton and is totally absent in regular Rayon Fibre. The specific combination of properties ensures high resistance to wear, high dimensional stability, optimum moisture absorption and excellent wearing comfort of resulting textiles. The advantage of high performance rayon group of fibres is their ability to blend with cotton and polyester. The Polynosic fibre with its low wet elongation and better caustic resistance can be blended with cotton and mercerised, while high wet modulus fibre is more suitable to blend with Polyester than cotton. A major drawback of synthetic fibres is low moisture absorption and static and thereby loss of wearing comfort. High performance rayon fibre have a high moisture absorption and overcome this drawback of synthetics.

Application

High performance rayon can be used for most applications where long staple superior cotton is used. The usage leads to improvement in certain fabric characteristics and often a reduction in manufacturing costs. It can be used for suiting, ladies wear, children's wear, furnishing fabric, knitwear, and sheeting applications. The fibre can be converted

Physical properties of High Performance Rayon Staple Fibre

	Regular	High Tenacity	High Performance Fibre		Cotton
			Polynosic	High Wet Modulus	
Denier	1.5	1.5	1.5	1.5	—
Tenacity (g/den) Conditioned	2.5	4.1	4.5–5.5	3.8–5.0	3.7
Wet	1.5	3.0	3.0–4.5	2.6–3.7	4.2
Elongation % Conditioned	22	30	10	15	10
Wet	28	37	12	20	13
Wet Modulus at 5% elongation	3	6	21	12	15
Ratio wet/dry tenacity	60	73	80	70	100
Water imbibition%	110	70	60	60	60
Wt. loss in 5.5% NaOH at 20°C	11	4	1.5	2.5	1.5
Increase in diameter on swelling %	26	—	12	15	13
Degree of Polymorization	240	300	500	320	2000
Moisture regain	13	12	12	12	7

to 100% high performance Rayon fabric, blended with cotton, polyester, wool, silk or other fibres. Due to high tenacity, these fabrics also found application in industrial coated and laminated fabrics. These fabrics are easy to dye, print and finish.

Cotton/High performance rayon fibre blends form excellent fabrics with many advantages over 100% cotton fabrics. In blends with cotton, a better yarn and more even fabric is obtainable than with pure cotton. This means higher yarn, strength, uniform yarn, higher spinning efficiency, clean, smooth. and soft fabric with a silky touch. The appearance of blended carded fabrics is similar to that of combed 100% cotton fabrics.

The use of High Performance Rayon Fibre shall provide to the textile industry a number of advantages. The fibres can be converted to yarn and fabric on the existing cotton spinning and weaving machinery. The fibres do not present any problem either during spinning or weaving. High performance Rayon Fibre being man made fibre will be available in uniform length and diameter consequently the processing cost will be reduced due to a better utilization of machinery and the process optimization. Another advantage is that high performance Rayon Fibre shall tubstitute imported long staple cotton for a number of application. M/s South India Viscose Limited, Sirumugai, Coimbatore proposes to manufacture Polynosic fibre in technical collaboration with SNIA VISCOSA, ITALY in the near future.

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