VALUE ADDITION OF PASHMINA PRODUCTS : PRESENT STATUS AND FUTURE PERSPECTIVES – A REVIEW

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Received : 23-02-2011 Accepted : 10-04-2011

ABSTRACT

Pashmina fibre has its celebratory both in national and international level due to the development of high fashion garments and novelty products. Pashmina products are mainly produced by the skilled artisans in small scale cottage sector of Jammu & Kashmir and Himachal Pradesh with their traditional technologies since 1700’s. Artisans are devoting more man time for each product. However they did not fetch worthwhile remuneration for their skills since there is no proper marketing of the Pashmina products. Pashmina fibre has similar characteristics to fine wool, even though there is no novel finishes streamlined for their products. The development of novel value addition for pashmina products can meet out the requirements of fashion fabrics. It can also fetch more income for artisans those are involved in pashmina products. This paper highlights the conventional processing involved in value addition of pashmina products with focus on their future prospective for improving their demand.

Key words : Pashmina, Processing, Shawl, Value, Wool.

Pashmina fiber, the finest natural fibre reared from domesticated goat of Leh and Ladakh region of Jammu & Kashmir (Chanthangi); Lahul and Spitti of Himachal Pradesh (Chegu) (Koul et.al., 1987; Thakur et.al., 2005) . The fibre has great demand both at national and international levels due to its fineness (10-14m), warmth, durability, lightness, softness and ability to absorb more moisture and dyes than fine wool (Acharya and Sharma, 1980). The pashmina fleece reared in India has two distinct fibers: the coarse outer hair and the ultra-fine undercoat. Generally fine pashmina fibre is utilized for the production of aesthetic products like knitwear in Scotland; blended suit fabrics in Italy/Switzerland; shawls, stoles, rumals and other high quality apparels in India/Nepal (Ali,2000 ; Anonymous, 2000). The shawl prepared from fine pashmina fibre is traditionally hand woven. It mainly involves highly skilled labours starting from sorting, spinning and weaving on specified handlooms in Kashmir valley. The coarse outer hair is mainly used for rope, felt, blankets, and durries.

Recently novel chemical processing like nano-finishing, plasma treatment, enzyme treatment and aroma finishing are established for the value addition of woolen products. Pashmina fibre has similar physical and chemical characteristics to fine sheep wool; however the above said novel finishes are not streamlined for pashmina products. The development of novel value addition can meet out

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the requirements of fashion fabrics with more diversification. The marketing of diversified products could also fetch more income for artisans involved in pashmina products. This paper highlights the conventional value addition processes involved in pashmina products along with future prospective required for improving their demand in order to compete in the international market.

**Speciality hair fibers**

Textile fibres obtained from fleece of goat, camel and camelid family are also used in the manufacture of clothing and other textile assemblies. They are sometimes used alone but often in conjunction with wool fibre for producing special effects like additional beauty, texture, colour, softness, resilience, durability and luster. The largest groups of these fibers are known as “specialty hair fibers” or “luxury fibers”. Figure 1 shows the classification of luxury fibers based on their source (Berger, 1963; Bobswen, 2001; Ammayappan and Moses 2005).

**Goat hair:** Based on the fineness and physical attributes of the hair obtained from goat family, they have been classified as Mohair/Angora, Cashmere/Pashmina, Cashgora (crossbred) and guard/goat hair (Oztuk and Dellal, 2000). Mohair fibre is obtained from long lustrous coat of the angora goat with fibre fineness ranged from 22 to 32μm with 84-130 mm fibre length. South Africa, U.S.A., Turkey, Australia and Argentina are the main harvesting countries of mohair fibre (FAO, 2002; Hunter, 1993). Cashmere fibre is obtained from Cashmere goat of family Capra hircus and its fineness ranged from 14 to 20 μm with 35-50 mm fibre length. China, Mongolia, Iran, Afghanistan, former USSR, Pakistan and Turkey are the main producer of Cashmere fibre with annual world production of 17 metric tonnes (McGregor, 1990). Cashgora fibre is obtained from Cashmere goat of family Capra hircus and its fineness ranged from 14 to 20 μm with 35-50 mm fibre length. China, Mongolia, Iran, Afghanistan, former USSR, Pakistan and Turkey are the main producer of Cashmere fibre with annual world production of 17 metric tonnes (McGregor, 1990). Cashgora fibre is obtained from crossbred of cashmere and angora goat, developed in New Zealand. The cashgora fibre has 18-24μm fineness with 30-90 mm fibre length. Its production is declined in recent years (Bigham and Horton, 1987; Couchman, 1987). The common goat hair (40-80μm fibre fineness with 40-90mm fibre length) is generally obtained from the local goats of each country and used by farmers themselves for ropes and namdas (Pokharna, 2003).

**Pashmina fibre properties**

The appeal and unrivalled status of pashmina fibre as a luxury fiber brings on three key factors.

- Fiber fineness (10-14μm).
- Visual appearance and its extreme softness.
- Scarcity and image or mystique.

Chemically it is identical with fine wool and mohair fiber (McGregor, 2003). It has a predominance of ortho-cortical and meso-cortical cells. Mesocortical cells have higher micro fibril packing density and order than wool of the same diameter and this may be associated with the low crimp exhibited by the pashmina fibre. It has bilateral structure and the percentage of ortho and para cortex is 50.4% and 49.6% respectively. The number of scales per 100 micron ranges from 6.5 to 7. The cuticle profile of pashmina fibre did not protrude as much as those of fine wool, which leads to smoother and lustrous surface with, lower shrinkage.

It is 10 % weaker than the fine wool and about 40% weaker than mohair fiber. It has a superbly textural feel, drapes beautifully, feels soft, warm and light to the touch and will serve a user well for years. The amino acid composition pashmina fibre is very similar to fine wool except cystine, tyrosine (12% more than wool) and proline (9% lower in Pashmina). The lipid composition is also lesser than fine wool. It is also observed that pashmina fibre had more of the polar amino acids called serine, threonine and tyrosine than fine wool, so its cuticle is more
hydrophilic than fine wool (Frank, 2000; Berger, 1963).

**Processes involved in the value addition of pashmina products**

Many mechanical and chemical processes are involved in the value addition of pashmina products i.e. from harvesting to embroidery for pashmina shawl. The making of one quality pashmina shawl requires nearly 4 to 200 men hours with involvement of two to four man powers (Wani and Gupta, 1989b; Wani et.al., 1999; Kumar, 2000; Wani et.al., 2004). The processes involved in the production of pashmina shawl are given below.

- Collection /harvesting of fleece
- Sorting of fibre
- Dehairing
- Scouring
- Preparatory process for spinning
- Spinning/Yarn manufacturing
- Preparatory process for weaving
- Weaving or knitting
- Colouration/Finishing
- Embroidery/fringes

The value addition processes are broadly classified into mechanical and chemical (Table 1) and important processes are given in Figure 2:

**Harvesting:** The pashmina fleece is collected by either combing or shearing during every spring season since goats molt during that period. Each goat produces from 80 to 450 grams of pashmina fibre each year (Darokhan and Tomar, 1983). For manufacturing of one quality pashmina shawl, it requires fibre of three goats. The average fibre fineness is ranged from 11.6 to 15.4 µ with average fibre length of 50 mm. The buck yield more (390-450g) pashmina fleece than doe (40 to 280g) (Sharif, 2000).

**Dusting:** Before sorting, the pashmina fleece can be dusted to remove adhered impurities like sand, dust etc., manually. The percentage dusting loss comes between 19 and 22%.

**Sorting:** Pashmina fleece from Chanthangi goat is white in colour, while from Chegu goat is in white, brown, grey and mixed in colour. The fleece can be sorted manually based on its fibre length, colour and quality. The matted fibre can become waste. Sorting is also done after spinning of pashmina yarn based on their count for their suitability of end products.

**Dehairing:** Raw pashmina fibre fleece contains 50-60% guard hair. Since guard hair is much coarser than undercoat fine fibre, their proper elimination is essential for better processing. Dehairing is the process to remove maximum amount of guard hair either manually or by specially designed machine. It may depend upon the processor. Metal comb / wood teasel can be used to manual dehairing, while it is a time consuming process. Modified cotton card is generally used as dehairing machine that removes the guard hair from the soft under down (Turpie, 1969; Couchman, 1989). In market, 3% residual guard hair can be allowed and legally considered as Pashmina fibre for export; 0.5% acceptable for weaving of shawl and 0.2% or lower level for knitting. The left over coarse hair/ medullated / Kempy fibre adversely affects product quality and price realization (Pokharna 2003).

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<th>Table 1 : Value addition techniques involved in Pashmina products.</th>
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**Blending:** Blending of pashmina wool with other fibres is preferred for the development of new products and also for its better price realization. Pashmina fibre is blended with fine wool, acrylic, angora and silk fibres for production of good quality shawl, blankets, stoles and apparels. Blending with fine wool reduces cost up to 30-40% and increases the mechanical properties of the final product. Fine wool has natural crimp that improves cohesiveness of pashmina fibre during spinning. It can be also blended with yak fibres for fashionable products (Arora, 1988).

**Scouring:** Raw pashmina fibre contains less than 5% contaminants like wool wax, skin flakes, suint, sand, and dirt. Generally scouring is carried out in yarn stage before dyeing. It can get entangled, if it carried out in fibre stage. Scouring in presence of 0.2ml/litre non-ionic detergent and 0.5 gpl Na₂CO₃ at 45-50°C for 30 minutes followed by hot wash, cold wash and then drying is the most effective method. The fibre yield is came between 75 and 98% that depended on the percentage of guard hair and fleece quality (Wani and Gupta, 1990b; Pokharna, 2003).

**Carbonizing:** The Pashmina fleece may have burrs, seeds, twigs, leaves and straw. The presence of these vegetable matters can cause series problems during spinning, weaving, dyeing and chemical finishing. Carbonization is required only if it contains > 5% burr. However it is not preferred for Pashmina fibre, since it could deteriorate the final colour of fibre (Turpie and Godawa, 1974; Turpie, 1988).

**Bleaching:** Bleaching can be preferred for preparing pale shade / pure white products. Hydrogen peroxide bleaching in mild alkaline pH is preferred for improving the whiteness of the product. Use of sequestering agents showed up to 50% strength loss under similar bleaching conditions (Bereck, 1990).

**Gluing:** It is the sizing process for pashmina fibre as well as yarn before hand spinning and weaving respectively. The sizing of fibre/yarn may depend of

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**Luxury Fibers**

![Classification of luxury fibers.](image-url)

Fig. 1: Classification of luxury fibers.
the traditional processing set up of each region. Fibre sizing is predominant in Nepal and yarn sizing is in Jammu & Kashmir.

**Hand spinning:** The Pashmina fibre is manually spun in a hand spinning wheel locally known as ‘Charkha’. Prior to spinning, the raw material is combed and parallelized well to make each fibre individually and placed in a source. By inserting twist uniformly to the fibre bundles, the yarn can be wound in a wood pirn. It requires immense patience, dexterity, dedication and is amazing process to watch. The amount of hand spun yarn required for a single pashmina shawl can consumes 15 days. It is observed that yarn fineness of 108Nm having <22% uster CV can be spun on Charkha. The warp yarn is prepared with more number of twists and the weft yarn is less intensively twisted in order to give fluffy texture to shawl. The yarn is wound manually in a wooden frame similar to number 8 and can be sold in market.

**Machine spinning:** To enhance the production and reduce the manual faults in spinning, generally pashmina fibre blends are preferred to be spun in semi-automated spinning or in modified cotton

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**Fig. 2:** Some of the important value addition processes in production of Pashmina Shawl.
spinning system. If pashmina fibre blends is machine
spun as blends, after converting it into fabric,
processors will remove the component fibres and
make it into 100% pashmina fibre.

**Preparatory process for weaving:** For quality
shawl manufacturing, the required amount of yarn
is treated with gluing agent. The hand spun yarns
are collected as warp sheet in a warping machine
for hand loom. After winding, as per the weave
structure, they will make the warp sheet for one or
two shawls. After warping, the warp can be fitted in
the loom.

**Handloom Weaving:** Pashmina shawl must have
five kinds of deficiencies if they machine dehaired
and machine spun. They are shortening of fibre,
chances of adulteration, dyeing defects, shrinkage
in the fabric and nepes on the yarn and they
alternatively decreases the value of the products. So
hand loom woven pashmina shawl has more
demand in market than power loom woven. The
hand loom weaving is usually done by men who
have highly skilled in working with the fine pashmina
threads. They need one week time for weaving of
one pashmina shawl which has approximately 2,200
warp and 100,000 weft threads. After weaving, the
fabric is hand massaged for relaxing the stresses
inserted during weaving and spinning.

**Knitting:** Hand spun yarn is also used in knitting
for manufacturing of Pullover and Sweaters. Machine
Knitting is preferred for products like sweater and
mufflers from Pashmina fibre blends than the 100%
pashmina fibre.

**Dyeing:** The pashmina shawl is sold in the market
as plain, shaded-omdre, beaded, embroidery and
hand print shawls. Each type depends upon the major
post-weaving processes involved in pashmina
products and there are up to 30 sub-processes
depending upon the final product. Before dyeing,
Pashmina products are mild scoured with non-ionic
detergent at 40°C for 30 minutes in order to remove
impurities adhered during weaving. Generally dyeing
is carried at a temperature just below boiling point
for one hour since Pashmina fibre is exceptionally
absorbent, dyes easily and deeply (Roberts, 1978). Local dyers prefer red, blue, yellow, orange, black,
green, magenta pink and white shade for dyeing
Pashmina yarn and it can be used for traditional
embroidery designs. Natural grey or brown shade is
also preferred for dyeing of Pashmina blended shawl.
Since pashmina shawl is worn close to the face of
fashioner and the color must suit each person’s skin
tone. So the colors must be particularly fashionable
and the preferable shades are purple, pale lilac to a
deep violet, shade of prune and some pale shades.
To get these shades, dyers preferred carcinogenic-
free synthetic dyes and some natural dyes. Metal
complex dyes are preferred for pale shades with very
good fastness property (Lewis, 1992). Natural dyes
from pomegranate, walnut, majeet, madder, kamala
and locally available sources are preferred (Gulrajani
and Gupta, 1992).

**Finishing:** Pashmina fibre has natural softness, after
some mechanical and chemical processing it can
lose from 10 to 20% of its softness. To retain the
softness, it is finished with cationic silicone softener
(0.5-2% owm) at 40°C in pH 5-6 for 30 minutes by
exhaustive method. Some pashmina products are
finished with high performance nano-finishing to
impart both water and soil repellent property. Since
fashion designer seeks aesthetic as well as fragrance
stole, some processors prefer aromatic/fragrance
finish through modified polysiloxane on pashmina
products. The felting of pashmina fibre is generally
low and so anti-shrink finish is not preferred.

**Fringes and Designs:** Fringe and designs of
pashmina shawl is distinctly different from other
shawls and it adds extra beauty. It is artistic and
delicate process carried by the expert and it takes
many working hours to make fringes and designs
on each pashmina shawl. To give imitated
embroidery design, pigments without colours are
printed on pashmina shawl by block.

**Embroidery:** The genuine 100% plain pashmina
shawl sells for £114.48-171.72 depending on the
quality of weave, style and design. The better in the embroidery work, the price could be realized high. In history, the embroidering work on Pashmina product is resembled as caring of a pet animal in a house and it took from two weeks to two years. The extent of embroidery can determine the duration and generally done by women.

**Felting:** The guard hair of pashmina goat is generally preferred to develop handmade felt products or blends with low grade waste to form low grade namdhas.

**Identification of pashmina fibre**

Pashmina fibre is famous for its pashmina shawl and the most common size in the market is 1x2 metres, but now smaller sizes have been introduced for stoles, scarves and special ladies shawls. A fully-embroidered pashmina shawl can cost up to £1431.19 (Singher, 1999). Many times fine wool shawls made on mechanised looms, treated with silicon softeners are passed off as pashmina shawl. Labels such as “100% miscellaneous odd lots” and “100% pure pashmina” are still found in the market. In UK market it was reported that from 35 to 69% garments were mislabeled in the year from 1995 to 2006. To avoid such mislabeling, fibre researchers have focused on reliable identification and description of pashmina products. Increasing emphasis on quality control provides another reason for development of quantitative analytical techniques (Hausman, 1920; Appleyard, 1978). The following methods are some of the important techniques used to differentiate of pashmina fibre from other wool /synthetic fibers.

**Microscopy:** Light microscopy techniques like scanning electron microscopy (SEM) may permit accurate fibre and fibre-blend identification. It does require a high degree of skill and experience. SEM analysis revealed that each hair fibre has characteristic scale pattern, however differentiation between fine wool and Pashmina fibre is difficult. The transmission electron microscope (TEM) is gaining favour as a definitive method for identifying fibres, particularly blends of specialty fibres with fine wool, where there are major differences in scale heights. Pashmina fibre has surface scales on its structure like the sheep wool, however the number of scales per micron is lesser than wool. There are significant contributions in identification of animal hair fibre but there is no strong recommendation for using this technique (Brunner and Coman, 1974; Wildman, 1954).

**DNA Sequencing:** DNA polymorphism like restriction fragment length polymorphism (PCR-RFLP) technique is used to differentiate pashmina/cashmere and fine wool fibres. The presence of DNA in animal hair shafts has enabled the isolation of DNA from cashmere/pashmina and fine wool fibres. DNA analysis can be able to distinguish between these fibres in the raw state, but not if they had undergone any heat or chemical treatment (Subramanian et al., 2005; McCarthy, 1999).

**PAGE method:** In conjunction with transmission electron microscopy and lipid analysis, 2D-PAGE (two-dimensional polyacrylamide gel electrophoresis) technique is used an alkaline gel in the first dimension and SDS in the second dimension. It also can be distinguish pashmina fibre from other goat hair. The amount of sterol and fatty acid extracted using Soxhlet extraction from different animal fibres can be a useful additional procedure to the conventional methods for distinguishing (Tucker et.al., 1990a).

**Chemical staining method:** Staining with phosphotungstic acid followed by magnification of wool / pashmina fibre in transmission electron microscope is used to identify the difference between pashmina fibre and fine wool. Fine wool has bilateral structure of ortho and para cortex, while pashmina fibre has a range of structures from classical bilateral to non-bilateral. Para-cortical cells are stained as black by tungsten ion that can be used to identify the fibre (Tucker et.al., 1988).
**Others**

1. Scale height is a useful criterion for distinguishing pashmina fibre from other animal fibres, but a detailed investigation revealed some overlap in the distributions (Hocker, 1990).

2. Estimation of cystine and cysteic acid content as a means of identification was also used, but not successful due to variability in distribution of amino acids between fleece and guard hair (Tucker et al., 1990b).

3. The alkali solubility, urea-bisulphite solubility, effect of acids, alkalis and enzymes of wool and pashmina fibre may be different, however these tests are not very sensitive and the interpretation of many of them is often difficult.

4. From simulation experiment by using different properties of animal hair like fiber diameter, the diameter of high ratio, scale height, scale projection width, scale thickness at right angles and scales diameter difference followed by their distribution leads to identify. This method is very effective in identifying common wool from other hair (Shang et al., 2010).

**Future prospectus**

Pashmina fibre has a distinguish place in the fashion market; however it competes with other natural fibres for economic marketing since it is one of the costliest natural fibres. Being high cost involved in the manufacturing of pashmina products, fakers introducing their products by mislabeling their products as pashmina. They sold imitated wool products at low price and consumers preferred that products without knowing the real value. So the artisans of pashmina are not able to fetch more value by selling pure pashmina products. Generally customers prefer to spend their money as worth as possible and also they want quality products. However stole or shawl is not the only possible product from pashmina fibre. To survive the pashmina industry, it is the right time to make suitable policies for streamlining the marketing of pure pashmina products, identify suitable technologies for better value addition and development of diversified products from pashmina fibre. Such approaches/policies could improve the economy of artisans involved in the manufacturing of Pashmina products. The possible opportunities for diversification and higher value addition of pashmina fibre are given below.

1. Pashmina fibre is one of the costliest fibres, and their products are not affordable by every person. It is wise to develop diversified blended products by blending it with various natural as well as synthetic fibres. It can reduce the cost of the final product as well as increase the consumption of Pashmina in other fields in a shorter duration, which leads to more demand of pashmina fibre.

2. Being soft fibre, processors are not preferred to give some advanced finishing to pashmina fibre products. The well adopted finishing technology for wool textiles like nano repellent finishing, aromatic finishing and fragrance finishing can be standardized for small scale sectors and applied to pashmina products. This value addition can be used to increase diversification of products as well as demand in the market.

3. Pashmina fibre products are geo-specific i.e. Jammu & Kashmir of India, Indian government should take suitable rules and regulations to identify and explore the pure pashmina products in the markets by giving a unique label like wool mark. It will reduce the adulteration of other wool products in the market.

4. Since there is no specific method available for identification and differentiation of pashmina fibre from other wool fibres, fast and reliable method should be developed in order to assess the mislabeling on the spot rather than sending to laboratories.

5. Spinning and weaving of pashmina fibre is a laborious work. Suitable technology intervention is required to reduce the processing time by modifying the conventional spinning and weaving either by semi-automation or reduce wear and tear.
CONCLUSION

Pashmina products facing the following problem in the market even it is a soft natural fibre: production and productivity of pashmina fibre per animal in India is minimum, production of shawl requires more man month, mislabeling of other wool products as 100% pashmina and improper marketing of pashmina products. Pashmina products still have its own demand and have potential to meet out the requirements of customers. To keep the demand, it is the right time to take future perspective steps to streamline the marketing of pure pashmina products, identify suitable technologies for better value addition and development of diversified products from pashmina fibre. The diversification, value addition and proper labeling could improve the demand of pashmina products, that will increase the economy of artisans involved in the manufacturing of pashmina products.

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