CHAPTER-5

TOOLS AND TECHNIQUES REGARDING THE MUGHAL TEXTILES
A Brief Introduction of Textile Techniques:

Indian textile industry constituted an important part of India’s export during the Mughal period and textiles were at the top of the list of India’s export. Culture and Craft, in India, are closely associated. Hand weaving in our country has truly been termed as an art and craft for it has produced some best known varieties of fabrics which include the Banaras Brocades, the beautiful patolas of Gujarat, the finest muslins, the exquisite Kashmiri shawls and other well-known varieties of other centers. The equipment which assists this synthesis of art and craft is the simple Handloom. ¹

This chapter of the present work is an attempt to examine the various Technical aspects involved in the production of the textile materials in Mughal period viz., Cotton, Silk and Woollen. It also presents a detailed study of the Manufacturing process involved with clothes during the Mughal period e.g. what equipment were used to produce the textile material, what was the technique used in this process.²

Basics of Textile Production Techniques under the Mughals:

Cotton Textile Production Techniques-Cleaning:

The Indian textile fabrics are passed through the several technological developments as we get them in raw form, i.e. cotton fibres need cleaning before spinning into yarn. The cotton seeds are first left in the sun so that they could be easily separated from the floss. For this purpose two methods are required i.e. the roller and board and the cotton-gin or charkhi.³ The roller was a cylindrical drum used on a flat surface this is also visible in the frescoes of Ajanta. But the Ajanta remains are not supported by the text. It was first supported by the Miftah-ul-Fuzala, a Persian dictionary of 15th century, which describes that chubakin or chuhlin⁴, was an instrument used for separating the seeds from cotton (Plate 41).⁵ This was the method similar to that of used in medieval China. Perhaps it was a wooden roller was dragged by hands or feet.

¹ Sharma Suguna, Studies in Indian Textiles, Delhi, 1998, p.79.
² Alam Ishrat , “Textile tools as depicted in Ajanta and Mughal Paintings” in “Technology in Ancient and Medieval India” by Anirudh Roy and S.K. Bagchi, Delhi, 1986, p. 129.
³ Ibid.
⁴ Ibid.
This foot roller consisted of two teakwood rollers. A handle was used to turn the upper roller and the lower roller was dragged along with it. The cotton was drawn with the help of these rollers. With the help of this process seeds were thrown out of cotton.\(^6\) This type of roller was used only for dealing the cotton with hard seeds. Whereas charkha was more common which was made of two wooden or iron rollers. These rollers were drawn by hand labour.\(^7\)

Even after clearing the seeds cotton was not fully cleaned, it was full of dirt and knots. After cleaning the cotton, ginning was the next process. The ginners were cleaning the cotton with the help of a bamboo stick, which was stretched into a curve and joined together with the help of a leather string called \textit{tant}. In India ginners are identified with an exclusive class.

The cotton ginning technique was also used in India since ancient period, which is depicted in Ajanta frescoes. Cotton ginning was done through charkha (\textbf{plate 42}). It is placed in a rectangular frame.\(^8\) In this charkha cotton is feeded between the two rollers and the rollers are moved with other hand.

A Mughal painting of late 16\(^{th}\) century ‘Idris giving instruction to mankind in the art of weaving gives the glimpses of stock for beating cotton.\(^9\) During 17\(^{th}\) century the bow-string device\(^{10}\) is side by side used with beating method. But beating with stick has its own weakness, it might led to the breaking of fibres therefore the bowstring method was much better. Irfan Habib points out the earliest use of bow-string in Islamic world was about in 11\(^{th}\) century A.D.\(^{11}\)

The important part of the bow-string device is the mallet. The mallet has double tapering heads. The mallet was holed from the middle by the bower in his right hand (\textbf{Plate 43}). The bow-string was gripped by the ridge of the upper head, when the string was stroked by the bower with the mallet. When it was stroked, bow-string was tensed and slipped off the ridge which helped in losing the cotton fibres. This bow

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\(^{8}\) Steingass, F. \textit{Persian English Dictionary}, New Delhi, 2nd ed., 1981, p. 403 explains the word \textit{Chubakin} as a wooden or iron instrument for separating cotton from its seed.

\(^{9}\) Schlingloff, D. \textit{op. cit.}, p. 89.

\(^{10}\) Anirudh Roy and S.K. Bagchi, \textit{op. cit.}, p. 130.

string device is also survives now a days for like it was in medieval times. The cotton carder was called dhuniya in Hindi, and the process was called dhunnai.12

**Spinning:**

Spinning was the other important process which was used before weaving. Before the invention of spinning wheel spindle was the main instrument for spinning yarn.13 The spinning wheel came in India during the time of Ghorian attack in 13th-14th centuries.

The spinning wheel is depicted in a miniature of Jahangir’s reign, where the Persian example is shown, in which the wheels are without handles.14 In another miniature spinning wheel is depicted by Bichitra during Jahangir’s reign, in which a half handle with a whole for a small wooden peg-handle can be seen. (Plate.44) In a miniature of Aurangzeb’s reign a spinning wheel with a piece of wood mounted on the axle at an angle is visible.15

When in spinning wheel yarn is spun, it has to be transferred to the spool. The earliest illustration of this tool could be found in Miftah-ul-Fuzala.16 Yarn was also collected in form of coils. This is depicted in the late 16th century Mughal Miniature.17 In it a man is shown transferring the collected yarn from the cage spool on to the wooden pegs driven into the ground in a circular manner. Then the coiled yarn was collected and dyed. Before weaving yarn was collected on the weft-spool to use in the shuttle. For weaving, the yarn is wound from the skin on a reed. The reed was pushed over the spindle head and the yarn was wound from skin on to the reed which served as the weft spool.18

In comparison to cleaning, spinning is less technical and less complicated process, it was generally done by women.19 In most of the houses in villages there

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16 Anirudh Roy and S.K. Bagchi, op.cit., p. 132.
19 Orme, R. ‘Historical Fragments of the Mughal Empire’, 1783, p. 413.
were spinning wheels.\textsuperscript{20} For spinning two types of equipment are used, one was a spindle for fine quality of yarns and other was spinning wheel used for coarse yarns.

The spindle was made of bone, ivory or wood.\textsuperscript{21} It consisted of a hook on its head in which the yarn was kept while the operation of twisting was going on.\textsuperscript{22} In it some wood was attached to its bottom for lending weight.\textsuperscript{23} The length of Indian spindle is not clear but according to Forbes it was about nine to fifteen inches\textsuperscript{24}, whereas the weight and dimensions of the spindle was determined by the strength of yarn.\textsuperscript{25} The spindle was sometimes accompanies with a distaff, a plain or ornamental stick which was about one foot to three feet long. Distaff was used for holding fibre from which the threads were spun. This process was held under the left arm of the operator.\textsuperscript{26} When the spindle was operated, it was turned round with the left hand and the cotton was feed with the right.\textsuperscript{27}

The Indian cottons were produced by revolving left to right which is known as Z spun in place of the cottons produced by revolving from the right to left which is known as S spun. In Z spun method there is less damage of material\textsuperscript{28} and the yarn produced through this method was very fine\textsuperscript{29} and strong too.\textsuperscript{30}

The coarse yarn was spun on a heavy one thread wheel of teakwood.\textsuperscript{31} Forbes gives us information about this wheel. He says that this wheel is a combination of lathe, spindle with its whorl. At one side of the base board two long uprights are placed in which the driving wheel axles are placed. Two shorter uprights are placed at the other end to support an ordinary wooden spindle with its whorl horizontally. The operators sat on the ground alongside the wheel. The wheel was derived by the right hand and the thread was kept in the left hand, when the thread was stretched to a full arm length, the wheel was stopped by the spinner.\textsuperscript{32}

\begin{footnotes}
\item[22] Ibid.
\item[23] Bains, op. cit., p. 68.
\item[24] Forbes, op. cit.
\item[25] Ibid. p. 153.
\item[26] Ibid.
\item[27] Baines, op. cit.
\item[28] Forbes, op. cit., 151.
\item[29] Baines, op. cit.
\item[30] Forbes, op. cit., 156.
\item[31] Baines, op.cit.
\item[32] Forbes, op.cit.p.156.
\end{footnotes}
The introduction of spinning wheel no doubt revolutionized the production output. No doubt that the use of spinning wheel led to the increase in production in comparison to the earlier rate of production. This provided to the people a complete occupation.\textsuperscript{33} This process required less labour which affected the production and price of the yarn.

**Weaving:**

The loom which was used in India was not so perfect. The Indian loom consisted of two bamboo rollers, used for both the purposes warp and weft. For weaving process a single shuttle was used for the job of batten, was made like a large netting needle and a pair of paddles.\textsuperscript{34} For weaving firstly the labourers were employed to undo the thread then it was winded on a small bobbin which is a small piece of reed popularly called *narkul*. These threads are inserted to a shuttle or *nar* for making *woof* or *bana* and are wetted before use. The threads are wounded on a larger reed and are used for laying the warp or *tana*. Slowness of Indian weavers has been propounded by several people as they were stretching the whole length of warp, because it required more time and more labour.\textsuperscript{35} At certain intervals the *narkul* stalks are stuck upright in the ground. On the ends of long reeds two large *naris* are fixed by wedges. A person who walks along round the upright drops by a skilful movement of his hands. The two threads one from each *nari* so as to lap on the alternate uprights. When the warp is laid it was dried by dressing it with the help of paste of flour. After this process it is taken to the loom.\textsuperscript{36} In India the loom used is horizontal which resembles with the loom of ancient Egypt.\textsuperscript{37}

At Dacca looms are always erected under a roof. For making looms four bamboos are firmly fixed in the ground, connected by side species.\textsuperscript{38} The loom consists of several units such as cloth beam, batten fitted with reed, healds with needle horse or pulleys and harness, cords and strings, lams and paddles.\textsuperscript{39} The reed through which the warp passes is fixed to the ‘Slay’. It is manually operated by hand. The

\textsuperscript{33} Naqvi Hameeda Khatoon, *Urban Centres and Industries in Upper India, 1556-1803*, Bombay 1969, Bombay, p. 152.
\textsuperscript{34} Baines, op. cit., 69.
\textsuperscript{35} Naqvi, op. cit. p. 154.
\textsuperscript{36} Ibid.
\textsuperscript{37} Watson J. Forbes, *The Textile Manufactures and the Costumes of the People of India*, London, 1866, p. 68.
\textsuperscript{38} Ibid.
\textsuperscript{39} Sharma Suguna, op. cit. p. 88.
treadles are attached to the healds and in conjunction with the lease rods provide the necessary shedding for the shuttle to pass through in the process of weaving. The shuttle contains the pirn on which the weft yarn is wound. The warp beam is primarily designed to provide the required tension while weaving and the cloth beam is used to reel the cloth woven. The shuttle is thrown by hand from one end to the other.\textsuperscript{40}

When the apparatus of the loom are adjusted the process of weaving begins. Two persons are employed in the process of weaving. One throws the shuttle from the edge as far as he can across the warp; it is then seized by the second weaver who throws it on the opposite end and then returns it. Weaving of the fabric goes on till the warp threads reach quite close to the healds.\textsuperscript{41}

There is a controversy about the working area of weavers whether they were working in an open area or in a covered area. The houses were not so large which could accommodate their whole length of the piece of cloth.\textsuperscript{42} The weavers working in urban area were working within their lodging in comparison to the weavers of rural areas, who were facilitated by the large open areas, where the whole length of warp could be stretched out.\textsuperscript{43}

This is also clear from the statement of Abul Fazl who says that at Lahore the weavers were busy in working within where the one thousand karkhanas of shawls were placed. Bernier also talks about the large halls of work at Delhi.\textsuperscript{44} In Abul Fazl’s \textit{Ain-i-Akbari} we find the reference of Ghiyat- Din Ali Naqashband who was an excellent weaver of his time. Akbar received textiles signed by Ghiyat- Din Ali Naqashband as a part of the presents received from the Persian court.\textsuperscript{45} Some merchants and Amirs were also running their private karkhanas. Sometimes some weavers were hiring the workshops to work.

The weaving process consists of interlacing of two series of the two series of threads, the warp and the weft at right angles. It was done by the loom. The loom

\textsuperscript{40} Ibid. p.84.
\textsuperscript{41} Ibid. p. 90.
\textsuperscript{42} Baines, op. cit. p.69.
\textsuperscript{43} Naqvi, op. cit., p. 155.
generally used by Indian weavers was the horizontal loom. The use of pit loom is first shown from Ziauddin Nakshabi’s *Tuti-Nama* (1580-85). In the pit loom the pair of treadles are placed in a pit in the ground. The weaver works by sitting on the edge of the pit. The treadles are well depicted in the late 16th century Mughal miniature.

In the miniature of Tuti Nama the warp beem is not there instead of it a man is shown busy in arranging a continuous flow of cross warp. Whereas in a painting of 16th century warp beam is visible. This warp beam is tightened by a thick wooden peg. The warp tying string is shown near the beam. This string is loosened by the weaver to take the unfinished warp thread.

The number of man required for the production were either one, two or three. The two persons were required for the production of stripped stuffs or figured muslin, i.e. *doreah*. The ordinary muslin was woven by a single man. The production of *khes* required three men.

**Bleaching:**

After weaving, the cloth was sent to the bleachers and then to the dyers. The bleachers in India belonged to a particular caste who washed the cloth to earn their livelihood. Lime and some other ingredients were used to boil the clothes and were taken by the bleachers to a river or pond. Where these clothes were beaten on a stone, then these clothes were washed and cleaned. According to Tavernier lemon was an important ingredient for bleaching, lemon and soap were used in certain proportion by the washer men. Iraqi was a variety of soap used for brightening the cloth. When the cloth was dyed then *khar* or carbonate soda was used for bleaching. Sulphur was also used as bleaching agent. Thick soup of boiled rice was also used to starch the cloth and give it a whitish effect, it was also mixed with some indigo. Tavernier did

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47 Aniruddha Roy and S.K. Bagchi, op. cit., p. 133.

48 Ibid. p. 134.

49 Indian Heritage, Pl. 23, p. 32. Cited from Technology in Ancient and Medieval India by Aniruddin Roy and S.K.Bagchhi.,p.134.

50 Falk and Archer, Pl. 3, p. 47, op. cit.

51 Naqvi,op.cit.p.157

52 Tavernier,2,p.28


not find the upper Indian bleaching to the satisfactory level because of the poor effect it had. In upper India the bleaching process was not proper i.e. in Samana when *semianos* were washed, the two merchants were required to stay for the whole year.\(^{55}\)

The process of bleaching was also carried on at Dacca. Abul Fazl mentions a place called Catarashoonda, in Sunargong, was famous for its water which gave a complete whiteness to the cloth. According to Tavernier, Baroach was famous as a bleaching centre.\(^{56}\) The best season for bleaching is from July to November. At this time the water is clear and pure. The bleachers were generally Hindus who belong to the *Dhobee* caste.\(^{57}\)

Besides these, the chief centers of *muslin* manufacture today are Banaras, Dacca, Hyderabad, Jaipur, Mysore, Kotah, Gwalior and Indore. The Indian weaver was an expert of the *'jamdani'* or the loom figured muslin with the exquisite delicacy of manipulation and their complicated designs. The following is a description of *jamdani* weaver as given by Taylor.\(^{58}\) In manufacturing figured *muslin* two weavers sit at the loom. They place the pattern drawn upon paper below the warp, and range along the track of the woof a number of cut threads equal to the flowers or parts of the designs intended to be made; and then with two small pointed bamboo sticks they draw each of these threads of the warp as may be equal to the width of the figure which is to be formed. When all the threads have been brought between the warp they are drawn close by the stroke of the lay. The shuttle is then passed by one of the weavers through the thread and the weft having been driven home it is returned by the other weaver. The weavers resume their work with their pointed bamboo sticks, shuttle in the manner above described, observing each time to pass the flower threads between a great or less number of the threads to be formed”.

The weaving and the spinning of silk is done in the same crude ways as that of cotton but the results produced are magnificent. In *patola* weaving warps and wefts are separately dyed. Firstly the silk warp is dyed in the lightest colour. Some measured distance is marked with pencil through which the dye cannot penetrate. Then the yarn is dyed with the brightest colour and this process continued till the

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\(^{55}\) *E.F.I.* 1618-21, p. 168.


The weft is also tie-dyed in the same way, when it crosses the warp each of its colours come in contact with the same colour in the warp. In colour design of *patola* we do not find harshness and abruptness. In it the colour flow one into another.

**Technical Complexity of Shawl weaving:**

The misconception about the traditional Kashmir shawls was related to the technical complexity of weaving process of shawls. By seeing an especially fine shawls it is generally considered that complex weaving techniques extremely sophisticated weaving equipment, and highly advanced loom were required in its production. But this is not the fact. The basic weaving technique is ‘tapestry weaving’, which is one of the oldest form of shawl weaving ever developed. It is very easy to learn.

**Looms:**

The loom on which tapestry woven cloth is woven is in vogue since ancient times, and it was too simple. For this purpose a rectangular frame, vertical or horizontal is required on which a continuous warp can be tied, and it was joined with a coloured discontinued weft, by hand, if a colour is changed it is required by the design. Therefore no mechanical device is used in tapestry weaving. If the weft of a single colour is used it means that the weft will not be a tapestry weft, but an ordinary continuous weft running from selvedge to selvedge in a 2:2 twill weave, from thousands of years, most of the tapestry weaving around the world are done in a plain weave (plate-45). It was found useful by the weavers to design some system of simultaneously raising and lowering every other warp so that the tapestry wefts, like the wefts of any other plain woven fabric, can be inserted more rapidly through the opening (known as shed) created by this separation of alternate warps. A simple shed can be formed by just using one’s fingers or by inserting a rod or flat stick or a ‘lease stick’ between alternate warps. Or a mechanical device including threads and draw cords which lift and lower groups of warps can be built into a loom used for tapestry weaving, just as it would be for many other looms. When most of the woolen shawls

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60 Ibid.
61 Ruth Barnes, Stevan Cohen, Rosemary Crill; “Trade, Temple and Court Indian Textiles from the Tapi Collections”, 2002, Mumbai,p.113
produced in Kashmir either it is tapestry woven or woven in a single colour without decorative pattern,\(^{62}\) (plate 46), rather than a plain weave. Some more developed system of four shafts is used to sequentially raise and lower alternate pairs of warps, but it is the highest level of standard Kashmiri shawl loom. This is not very advance, loom technology. This tapestry technique was so simple that even an inexperienced child soon learned it.

The tapestry technique in weaving a Kashmiri shawl remains the same except the type of join (double interlocking is used most often (plate 47), but ‘single interlocking is found in a few late example (plate 48).\(^{63}\)

Both the warps and wefts can be unbelievably thin. Its extreme was about that the warps are only 0.80 mm wide, the weft only 0.12 wide and there may be as many as 39 warps and 45 wefts in every square centimeter of that shawl. Because this is twill (2:2) rather than a plain weave, all of the warps are grouped in pairs, therefore during the weaving process only half of these pairs will be raised while the other half are slightly depressed. Which means that the weavers must use his left hand to further open the shed while his right hand inserts an almost invisible, fragile weft wrapped around a small wooden needle-like tool known as (toji) between 11 or 12 raised, paired warps for every centimeter of the pass. When the colour change is required, we must connect the two differently coloured wefts to one another at exactly correct point. As the weaving process was done by hand, the technique used was simple and the loom is also simple.\(^{64}\)

**Twill Tapestry in India: Its possible origin:**

The twill tapestry technique of weaving Kashmiri shawls was not indigenous to India. Now the question arises where did it come from, and when was it introduced. According to the current theory, the tapestry weaving entered India from Central Asia, and Iran was the second possibility.\(^{65}\) China was also famous for a fine pictorial tapestry weaving known as Kesi or Ko-ssu. But, the material used for this tapestry weaving was not wool but silk as the Chinese were most familiar with it. This tapestry weaving was introduced in China through contact with Uyghur nomads massed on

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\(^{62}\) Ibid.


\(^{64}\) Trade, Temple and Court, op. cit., p.114

\(^{65}\) Ibid. p.118.
China’s worth-western border. The Uyghur tapestry weaving was done on woolen plain weave while the Chinese preferred silk as discussed above.66

Similar were the conditions in India led to the development of tapestry technique. And its development can be traced back to the thousand years back. Thousands years ago there mounted nomads moved out of their original homelands to the vast grassy steppes of Mongolia, Siberia and Western Central Asia. Among these who reached India by passing through the Khyber or the Bolan Pass of Afghanistan and founded their short lived dynasties in India. The Scythians, known as Shakas in India were followed by the Yuch-chi or Kushana who controlled over northern India including Kashmir in the 1st century A.D.67

Around 6th century A.D. Hunas invaded India, who destroyed the local Guptas of northern India which some other tribes like Gurjaras and later the Turks continued to invade India for centuries which was later followed by Mughals in 1526.

Here point is that any of these invaders could have introduced the art of weaving Kashmir shawls known as tapestry weaving. But if it was introduced by the central Asian nomadic people, it seems that it could have introduced in India during the first few centuries A.D. When this activity was at its peak. And the plenty of time was there for the development of tapestry technique. Out of which unique goat hair weft faced 2:2 twill tapestry technique was introduced in Kashmir.

Dyeing Techniques:

After process of bleaching the cloth was now ready for dyeing. In simple dyeing all shades required a separate treatment.68 The natural resources were used for dyeing. A contemporary source gives us information about the seventy seven process of dyeing for making forty eight shades.69 Most of the ingredient of dyeing were taken from flowers.70 Those who produced dye from indigo are known as nilgars or indigo makers. The dye was derived from Indigo plant, which was cultivated from Lahore to

66 Ibid.119.
67 Ibid.119.
69 Naqvi. op. cit.159.
70 Naqvi, op. cit., p. 159.
Oudh. But the dye produced in Biana and surrounding areas was considered the best.\(^{71}\)

Indigo was the famous ingredient used for dyeing piece-goods blue. The shades produced with the help of Indigo are watery blue, greenish and sky blue\(^{72}\), blue black, dark blue, light blue, purple, lavender, mauve, lilac, emerald blue\(^{73}\), dark-blue green and yellow green.\(^{74}\) If turmeric was applied first and indigo afterwards, it would be dark blue green, when the process was reversed then the colour would be yellowish green.\(^{75}\)

The colours were generally fixed by some mordanting agents like sulphate of iron, lime, carbonate of soda and some sugar.\(^{76}\) When a substitute was employed, the use of indigo was disregarded mainly for compounded colours like bottle green\(^{77}\), mango green\(^{78}\), purple.\(^{79}\)

The dyes included indigo were fugitive by nature, agents were used for fixing the pigments in the fibres of cloth. These fixing agents were called mordants.\(^{80}\) Forbes wrote about the mordant, “is usually a soluble salt of aluminium, chromium, iron or tin precipitated on the fibres along with the dye by an alkali. Mordant and the dye then form a lake which adheres strongly to the fibres and this gives fast colour”.\(^{81}\) A number of ingredients were used as mordants in the dyeing industry of India.

For red shade dyes lac (Coccus lacca) \textit{shahab, majetha} (Rubiatinctorium), \textit{patang} (Sappan wood), safflower (Carthamustinctorius), \textit{al} (mordindatinctaria) were used. \textit{Lac} is taken from the lac insect formed on the bark tree.\(^{82}\) It was found in Punjab and Oudh area, it was very costly and was applied on silk generally and seldom on calicoes. \textit{Shahab} is identified with safflower. \textit{Shahab} and safflower are the

\(^{71}\) Naqvi, op. cit., 159.
\(^{73}\) Liotard, \textit{Memorandum on Dyes of Indian Growth}, Calcutta, 1881, p. 97.
\(^{74}\) Naqvi.op.cit.p.160.
\(^{75}\) Liotard, op. cit., p. 97.
\(^{76}\) G. Watt, \textit{India Art at Delhi}, official Catalogues of crafts exhibition, 1902-1903, Delhi, 1904. p. 77.
\(^{77}\) Naqvi.op.cit.p.159.
\(^{78}\) Ibid.
\(^{79}\) Ibid.
\(^{80}\) Naqvi, Ibid. p. 161.
\(^{81}\) Forbes IV, op.cit. p. 132.
\(^{82}\) Forbes (iv) op.cit., 104-5; Liotard, op. cit. p. 32.
different names of carthamus tinctorius. Safflower was assessed for revenue by Emperor Akbar in the subahs of Lahore, Delhi, Agra, Oudh and Allahabad.83

*Majetha* was like *al* founded in the areas of U.P., Oudh, Ranipur and Hathras. The root of its plant used for the purpose of dye. For getting dye the root was dried and beaten then finally dye was taken in form of glucoids in a red layer. Then actual dyed was separate from the colouring materials.84

*Al* was also found in the areas of Oudh, Mau, Ranipur and Hathras85, but it was particularly found at Kotah Boondi. It was also being assessed for revenue during Akbar’s time from the parganas of Karrah, Jajmau, in the Subah of Allahabad86, Eraj87 and in the subah of Agra.88 Here also root was used for colouring material.

*Patang* or *sappan* wood was imported from Deccan, its wood was pale but to contact with air it was turned reddish from which red colour dye was taken. When it was compounded with acid and alkali, was turned into yellow and violet colours. The vegetable dyes were also in vogue. Yellow colour was obtained from several vegetable products, main among them were turmeric (*Curcuma longa*), rind of pomegranate (*Punica granatum*), seeds of tun the flowers of *dhao* (*grisleadtomentosa*).

Yellow colour was also obtained from Harsinghar (*nyctanthes arborists*). It is saffron coloured stalk of the flowers which yield the dye from the milk-white petals.89 It was mainly used with turmeric and safflower for dyeing silk cloth.90 When it was used with safflower, orange or scarlet colour could be obtained, it depended on the proportions which was used for making the colours.91

From safflower besides red, yellow dye could also be obtained by washing the dried flowers. This yellow dye was used to produce prussion blue, mauve, deep purple and other shades of purple by mixing it with indigo.92 The yellow dye was also

84 Naqvi, op. cit., p. 163.
85 Liotard, op. cit., p. 57.
87 Ibid. 99.
88 Ibid. 101.
89 Abul Fazl *Ain-i-Akbari*, vol. 1. trans. H. Blochman, reprint ed. in, Delhi, 2011. p.76 and 83
90 Liotard,p.59
91 Liotard,p.26
92 Liotard,p.26

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obtained from *Genda. Dhak* flowers (butea frondosa) from the wild growth trees were also used to produce yellow dyes.\(^{93}\)

Brown dye was obtained from the bark of *babul* (acacia Arabica), catechu (accacid catechu) and *hena* (lawsoniq inermis). When the babul bark is boiled in water, it produces shades of brown. The dye is obtained by adding catechu to the water and water was still boiled.\(^{94}\) When sulphate or iron is added to it in place of catechu and lime, it produced a black dye. Catechu too yielded various tints of brown. Catechu was also used as the principal ingredient for obtaining the Agra’ I color and its shades. Its tree was found in Bihar, Delhi and other parts of India.\(^{95}\)

Hena is a very popular dye. It was produced throughout India. It is also used for dyeing hands and feet.\(^{96}\) Deep orange dye can also be produced with it. It was used as main ingredients in producing Shutri and abbasi colours.\(^{97}\) The black dye was found on the banks of rivers, Ganges, Jamuna and Sind, it was obtained from the galls of tamarisk.\(^{98}\)

This black dye was produced by adding iron salts with galls of tamarisk.\(^{99}\) It was mainly used as an addition in place of a principal dye.\(^{100}\)

In Hindustan the process adopted for dyeing the cloths was very ordinary and inexpensive. The implements used in this process are: a copper vessel to boil the cloth,\(^{101}\) an earthen vat, a wooden stick to stir the cloth into the boiling infusion, a wooden club to beat the cloth into smoothness and some old muslin to strain off the solution.

In the process of dyeing first the solution was made according to the prescribed proportion. Then the cloth was dipped into the solution and it went through several processes i.e. rinsing, drying. This all could be done either in sun or shade and finally the cloth was beaten to its smoothness. These were the main steps used for

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\(^{93}\) Liotard, p.77.  
\(^{95}\) G. Watt, Commercial, p.9.  
\(^{96}\) G. Watt, Commercial, p.706 and p.707.  
\(^{97}\) Naqvi, op.cit.p.165.  
\(^{98}\) Liotard, p. 14, 15.  
\(^{100}\) Liotard, p. 15.  
\(^{101}\) Ibid. p. 132.
dyeing cloths in India. But in some cases all these steps were not necessary i.e. boiling was not needed in pink and orange shades.\textsuperscript{102}

Though the main process of dyeing cloths remained the same but few instances of slightly different processes are as follows: For dyeing fifty two pieces of Kharwa cloth in Bundelkhand, three seers of halilah (terminalia chebula), three seers of alum, five seers of dhao, eight seers of gum, one maund and ten seers of al were required. For separate infusions were made: halilah and water, alum and water, al and dhao well dissolved in sufficient quantity of water and at last gum and water. In first two liquids, the cloth was steeped first then dried, the operation to be performed in the order given above. When the bales were immersed in the third solution, it was allowed to take a deep dye and then washed with soap and water. Then in fourth solution the cloth was steeped and washed. Then finally each piece was by applying gum on its surface and after. This all it was beaten smoothly.\textsuperscript{103}

For making emerald green nine ingredients were required, nil I khasa weighing six dams, turmeric quarter seer, peeled fun quarter ser, small Kakar-singi (pistacia or shus integessina)\textsuperscript{104} quarter seer, sind of pomegranate half a seer and ahar (starch). The nil (indigo), halilah and kasis were finely powdered and boiled together. The turmeric, peeled tun, Kakar-singi, sind of pomegranate and alum were similarly finely powdered and boiled together. Both the solutions were cleaned before use. Then the cloth was dyed dried in both the solutions on after the other. After this whole process ahar was added in the second infusion, and the cloth steeped in it, rubbed with hand dried and beaten smoothly.\textsuperscript{105} For obtaining gulabi qarari (permanent pink) only alum equaling two dams and the bark of Kachnar were required. The cloth was first steeped in alum and water then it was dried. In this process alum was used as a mordant to acquire the pink dye permanently. Then bark of Kachnar boiled and cleaned and the cloth was dyed in this liquid and dried after the whole process.\textsuperscript{106}

For gul-i-anar, turmeric equaling one dam, shahabi Khasa according to taste or little more than ordinary pink and some lemon were required components. Water pounded with turmeric was required. Then the cloth was steeped in the solution and it

\textsuperscript{102} Naqvi.op.cit.p.170.
\textsuperscript{103} Ibid., p.171.
\textsuperscript{104} Ibid.
\textsuperscript{105} Ibid., p.172.
\textsuperscript{106} Ibid.
was dried partly in shade when lemon was added to shahab the cloth was dipped again and finally dried in the shade.\textsuperscript{107} To obtain orange the proportion of components was altered; the amount of shahab was reduced, turmeric of about two dams was added. The process for obtaining the colour was same as used in gul-i-anar.\textsuperscript{108}

Another method was tie-dyeing, which was common around Delhi,\textsuperscript{109} (pl. 49) The plate 49 exhibits emperor Jahangir wearing a double patka in which the short one is tie-dyed. Berar and Orissa during the declining days. In some types of printing wooden dyes were employed for stamping the patterns on the fabrics.\textsuperscript{110} These dyes were cut in four classes flowered borders, which could be used continuously, secondly single flowers, which were impressed by one stamp of the dye; flowers and stripes were used to print in running diagonal; letters and quotations, pictures and figures were required to use successive dyes.

But before the printing the cloth had to pass through several processes i.e. washing, bleaching, mordanting and dyeing. The washing of cloth alone took several days as it was boiled in impure carbonate of soda and other ingredients, and beaten smoothly with wooden clubs and again boiled in a copper vessel and if the cloth as coarse the whole process was repeated again. Then it was left in sun to dry.\textsuperscript{111}

Bleaching was another process which was mainly done by scheduled caste chamars or dhobis.\textsuperscript{112} In this operation an emulsion of castor or linseed oil was prepared in which the cloth was dipped, dried on grass under cover then it was dried for an hour in the sun drom three to fifteen days in the shade.

\textbf{Printing and Painting:}

Printing was another process used for making the cloths more magnificent. It was more complex method in comparison to the process of dyeing. It is an art of applying different colours in different manner on a particular part of a cloth and the rest of the part of a cloth remained white or the entire cloth was dyed in one colour by leaving some parts of the cloth where some other colours were employed.\textsuperscript{113} This art

\begin{flushleft}
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\textsuperscript{107} Ibid. \\
\textsuperscript{108} Ibid. \\
\textsuperscript{109} Mirat. op. cit. 462-3. \\
\textsuperscript{110} Liotard, op. cit. p.132. \\
\textsuperscript{111} Ibid., p.132. \\
\textsuperscript{112} Ibid. \\
\textsuperscript{113} Ibid. \\
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was expanded in India by the low price chintz which according to Abul Fazl was of two dams per yard.\footnote{Ain- i- Akbari, vol.1, p.95.}

Lahore was a center of printing coarse stuffs where the prices of Tavernier’s account resembles with that of Abul Fazl’s, which was from rupees 16 to 30 per twenty pieces.\footnote{Naqvi, op.cit.p.173} At Patna Chintz was produced for local consumption on coarse cloth.\footnote{Ibid.} In later times, the Chintz of Lucknow\footnote{Ibid.} and Farrukhabad\footnote{Mukherji, T. Art and Manufactures of India, Calcutta, 1888, p.351.} got high esteem.

There were several types of printing process used in Mughal Hindustan. The first one was stamping of gold and silver leaf. It was mainly used for curtains, quilts, razai etc. Lucknow and Farrukhabad were the main centres for producing these printed stuffs. For \textit{Chikan} work patterns were stamped on thin fabrics like \textit{tanzeb} and muslin. Printing was also done on other fabrics like ordinary chintzes, beddings, prayer carpets etc.\footnote{Tavernier, vol.2, p.5.} It might be possible that the method of engraving patterns on these wooden dyes would be the same as used for engraving seals, coinage or inscriptions.

Besides the direct application of pigment on to the surface of prepared cotton yardage, the techniques of fixing colour to woven cloth to create patterns and compositions again involves either the use of resist, mordant resist, or combinations of the two, applied with a pen, brush, metal or wooden block. In order to resist the dye, areas of the cloth that are to form the pattern or design are coated with impermeable substances such as wax, gum or rice paste, resin, starch or mud.\footnote{Gillow John and Barnard Nicholas, Traditional Indian Textiles, London, 1993,p.39.} Once the cloth has been dyed, the resist substances are removed by immersion in hot or cold water, or by ironing or brushing. Mordant-resist textile decoration techniques involve the painting or printing of dyestuffs that will react with mordant-prepared cloth; or alternatively, the painting or printing of mordants on to cloth which, when immersed in a colour bath, will cause the dyes to react and be fixed by the patterns of applied mordant.\footnote{Ibid. p.39.}
Indians were well known with the practice of printing, even it is considered an Indian practice other were only adopting the things from here. The practice of printing and include several methods i.e. the ancient methods resist and mordant method of painting, a direct colour printing by blocks was also used on a large scale. Indian calicoes were exported on a large scale to the other countries of the world, these all were the printed calicoes. The painted cloth was produced only at Masulipatam which was only for the royalty. During the 17th century Iran was importing Indian printed calicoes to a great extent, at the same time, used the same terms chapa for block printing and chit for calico printing.

The Gujarat region was one of the great textile-exporting areas of India. Textile patterns were usually applied by block printing, and evidence of Gujarat's block-printed wares have been excavated at Fostat, near Cairo, the oldest of which have been dated as fifteenth century or earlier. These textile fragments are resist printed with unsophisticated yet pleasing designs typical of the hand-printed textiles of the region today. (pl. 50) This plate illustrates a piece of block-printed Indian cloth found from Fostat Egypt.

At ancient sites we find the use of day stamps, but these were used most probably on plastic material like wet mud walls was hardly used for printing on cloth. For the printing of cloth wooden or stone stamps were used. We find so many evidences of cloth-printing from the Mughal times. A number of Mughal nobles patronized the experts. The word shit was used for the cloth printed with wooden stamps during 17th century, and was of Indian origin, it was a corrupt form of Chhint or the European ‘Chintz’. The Author of Ma’asir-i-Rahmi (1616) gives us information that the chint designs were made at Sironj for which the block printing

122 Habib Irfan, Technology and society in Mughal India, 1980, Tokyo, p.27.
123 Indian Travels of Thevenot and Careri, ed.by S.N. Sen, 1949. p.51
125 Thevenot quoted in Irfan Habib’s Technology and society in Mughal India, 1928, p. 27.
126 Technology and society in Mughal India, op.cit. 1980, Tokyo, p.27.
127 Gillow John and Barnard Nicholas, op. cit., p.89.
128 Habib Irfan,Technology in Medieval India c.650-1750,Delhi,2009,p.45
129 Ibid.

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method was used. Sironj was the main centre of chintz manufacture.\(^{130}\) Thevenot gives us information about the colour impression of block-printing at Agra.\(^{131}\)

The report of a Frenchman George Roque is the first known source on cloth printing which gives us the information about the material and technique used in block printing. He tells us information about the wooden blocks.\(^{132}\) He writes that the printer differentiate the outlines by the lines and hollow of the first block. After it other block was used, which was of same type. But the second block had the hollow structure whereas the outlines of the first block are raised.\(^{133}\)

No confusion is made to the use of mordants and it is supposed that this printing was only applied, with a sort of ink, for the mere outline and not for the colours—and this was done only when skilled hand-painters were not available. The filling in of the design with the various colours was always done by hand, thus there is no doubt about their origin being dyed mordants.\(^{134}\)

There is a question now the printed cottons were traditionally made in India. We find the fact of their existence from the documentary evidence of the 17th century and earlier.\(^{135}\) The actual “printing” of cotton in India, was done either with mordants, resists, or real colours. The famous Dr. Edward Bancroft (1744-1821), who studied cotton printing throughout his life, when describing the manufacture of Indian chintz after Querelles-Beaulieu and Coeurdoux, he gave emphasis to the fact that the use of the word “printing”, discounted the fact that neither mordants nor other method of printing had ever been applied by means of blocks or forms, as in Europe. Only the brush, he argued, was known in India. This statement raises the contradiction to the documentary evidence already mentioned, and we must admit in this connection that Bancroft the historian was less well informed. We know that two; sorts of chintz were

\(^{130}\) Abul Fazl, A’in-i-Akbari, ed. Blochmann, I, 1866, p. 82.


\(^{132}\) Thevenot, Account of India tr. Levant, part.3. (1687, rptd. Indian Travels of Thevenot and Carari, Sed. S.N. Sen, New Delhi, 1949, p. 51.

\(^{133}\) Quoted in Paul R. Schwartz; Printing on Cotton at Ahmedabad in India in 1678 (Museum Monograph, No. 1, Ahmedabad, 1967, p. 8).

\(^{134}\) Irwin John and Schwartz P.R.; Studies in Indo-European Textile History, Calico Museum of Textiles Ahmedabad India, 1966. p.121

\(^{135}\) Ibid.
made in India—the painted and the printed. The painted were much better in quality in comparison to printing.\textsuperscript{136}

The possible printing with real, but fugitive, colours will be left aside, as the fastness of all Indian chintz was its most celebrated quality. The only information available about block-printing in the East concerns not India, but other countries.\textsuperscript{137} For instance, the French traveller Thevenot, who died in 1667, said that he saw in Persia coarse cottons printed with blocks “besmeared with colours”. We do not know if these were actual pigments (evidently not fast) or mordants. For the latter it must be borne in mind that the mordant for black and violet is yellowish, and the mordant for red colourless, the latter being only slightly tinged with red from Sapan wood. Thus, this information is too vague to be taken as evidence for one or the other way of printing cloths.\textsuperscript{138}

In old times, fastness of colours on cotton could only be obtained by the help of mordant (with the exception of indigo blue, which dyes directly in a reduced state of white indigo). These were put either on the cloth or in the dyeing vat itself. From the technical point of view, the following can be said that the printing of a resist with a wood or metal block and subsequent dyeing fast in as many vats as are necessary offers no difficulty. Whereas the printing of mordants is quite different from their painting and supposes a much more elaborate technique and this for the following reason: the best mordant is that which abandons easily a maximum of its metal to the cotton fibre.\textsuperscript{139} An aqueous solution of appropriate natural alum gives excellent results when painted, especially on a cloth prepared with an astringent (tannin); but to be printed with a block the mordant must be thickened, and here things change greatly. First of all, the drying of a thickened mordant is a very delicate matter: by numerous operations the thickening agent like starch and gum must be taken off as completely as possible before dying, moreover thickened alum does not abandon its aluminium oxide to the cotton in a way convenient to obtain colours of a high standard.\textsuperscript{140}

\begin{itemize}
\item \textsuperscript{136} Ibid. p.122.
\item \textsuperscript{137} Ibid.
\item \textsuperscript{138} Ibid.
\item \textsuperscript{139} Ibid.
\item \textsuperscript{140} Ibid.
\end{itemize}
Mr. John Irwin tells me that there is plenty of documentary evidence to show that the bulk of 17th century Indian chintz exports (at any rate from Western India) were of the kind described by contemporary traders as “printed”. He also says that these “printed” cottons mostly had coloured grounds.\textsuperscript{141} However, all such evidence (including the evidence of French reports of the late 17th and early 18th century), while showing that both printed and painted cottons were produced contemporaneously in many parts of India, always stress the fact that the latter were superior in beauty. Could the so-called “printed” cottons, admittedly coarse, have been produced by the resist process, being thus similar to the samples found in Egypt and identified as Indian export cottons of the 12th to 16th centuries.\textsuperscript{142}

The solution of such technical problems lies in detailed analysis of cottons, the origin and age of which are definitely known. This does not seem to have been yet made with the necessary care. So, far the time being, the question of when and how the Indians began to print their chintz with mordants remains open. It has hitherto been generally assumed that this technique was discovered in Europe. Is there any reason to revise this conclusion, and to attribute the discovery to India.\textsuperscript{143}

In conclusion I would like to say that the textile techniques developed in India during the Mughal period were no doubt inferior to the technologies of today’s India. But, the quality of the textile material produced during Mughal period was very fine. Some of the techniques are replaced by the machinery but some are still continuing even today e.g. block-printing, tie and dye method etc.

\textsuperscript{141} Ibid. p.123.
\textsuperscript{142} Ibid.
\textsuperscript{143} Ibid. p.124.