

MANGO KERNEL STARCH -AN EFFECTIVE SIZING AGENT FOR COTTON YARNS

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Abstract

Starch is a sizing agent used in textile industry for stiffening of warp yarns before putting them on warp beam. Starch can be extracted from waste mango kernels after processing by a simple laboratory method. Mango kernel starch is white, odorless and has good pasting and film forming property. It is environmental friendly, bio-degradable and a low cost non-conventional starch. Eco-standards relating to textile finishing can be suitably adopted in the use of mango kernel starch as sizing agent on warp yarns. Cotton yarns sized with mango kernel starch exhibited decrease in yarn count, elongation percent and yarn hair count per 100 mt. of yarn and increase in the strength and RKM with the increase in the percent of mango kernel starch applied.

Introduction

In the textile industry, starch is particularly used for sizing of warp yarns, stiffening and printing of fabrics. Approximately 80% of the starch used in textile industry is used in sizing where individual fibers of yarn must be shaped or formed into a warp that passes through a sizing solution which coats the surface of the twisted warp. Sizing, a process of coating yarns is done to reduce or eliminate yarn breakage, provide lubrication to the yarns so that they can resist the abrasive forces (Yue Zhang, 2013). Many of the chemical compounds used for textile wet processing are currently obtained from petrochemicals. There is a need to develop textile auxiliaries manufacturing technologies for making textiles more "environmentally friendly". This is possible with better utilization of agricultural processing waste for natural processes e.g. starches can be procured from unconventional sources like waste mango kernels.

Mango (*Mangifera indica* L.) is the most important commercially grown fruit crop. India ranks first among world's mango producing countries accounting for about 50% of the world's mango production. During the processing of mango, its peel and seeds are generated as waste which is approximately 40-50% of its weight (Ashoush and Gadalla, 2011). From the annual crop of mango nearly two/ three million tons of mango kernels go waste as they are thrown away which creates a big problem to the environment as well as to the mango processing industry but it can successfully be utilized as a best source of starch. The mango kernels are rich in starch content which can be used as substitute for cereal starches in the preparation of sizing agents for warp yarns before placing on loom. Mango kernel starch is environmental friendly and bio-degradable. Mango kernel starch can be extracted by a simple laboratory method. Starch is white, odorless and has good pasting and film forming property. It is low cost non-conventional starch. Eco-standards relating to textile finishing can be suitably adopted in the use of mango kernel starch as sizing agent on warp yarns.

Material and methods

Application of Mango Kernel Starch as Sizing Agent by Boiling Method

Preparation of starch paste in cold water (MLR- 1:5)

Addition of starch paste in boiling water (At boiling temperature, MLR - 1:30)

Continued boiling of solution for ten min

Cooling of starch solution in open air for two hours

Filtered starch solution through muslin cloth

Soaked the yarns in starch solution for fifteen min (MLR- 1:15)

Extraction of Mango Kernel Starch

Waste mango kernels were collected after the raw mangoes being cut for pickle preparation. Mango kernels were steeped in tap water for twenty four hours with change of water for every six hours. The supernatant liquid containing tannin was discarded. The steeped mango kernels were then washed with water and then ground in grinder with addition of 1% Potassium Meta-bisulphate. The paste was mixed with water with MLR 1:20. The milky suspension of ground mango kernels was then passed through double fold muslin cloth. The residue was again ground and process was repeated until no starch passes through muslin cloth. The milky water was then allowed to settle. The supernatant was siphoned off after six hours of sedimentation. The sediment was washed with water. The crude starch was then treated with 0.1 N Sodium Hydroxide solutions. The suspension was agitated from time to time and allowed to settle. The supernatant was siphoned off again and the residue was washed with distilled water. The washed residue was then treated with 0.1 N Hydrochloric acids to get white starch. The decolorized starch was washed with distilled water again and again. Finally the starch was made free from moisture by treating it with Acetone and by drying under the shade in open air.

Selection of cotton yarn

The cotton yarns being used in the local textile mills for weaving of cotton fabric were used for the study. The yarn selected for the study was grey, unfinished yarn in raw form and was of 38 count.

Concentrations of mango kernel starch applied on yarn

Mango Kernel starch was applied to the yarns in the three varying concentrations from one percent to three percent on the basis of weight of yarns.

Application of mango kernel starch

The boiling method of application of starch to the yarns was found to be appropriate for applying mango kernel starch as sizing agent on cotton yarns.

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Removed the yarns from starch solution

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Slight wringing of sized yarns

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Dried the sized yarns in open form in direct sun

Testing textile properties of the sized yarn

The testing of yarns was done following test method as described below

Yarn Count: Count is a measure of the fineness of yarn. It is expressed as number of hanks of 840 yards in one pound weight of yarn.

Single yarn strength (gf/tex)

Sized cotton yarn was tested for the single yarn strength. Single yarn strength (gf/tex) and extension percentage of the yarn was recorded.

Yarn elongation (%)

The distance that material will extend under a given force is proportional to its original length; elongation is quoted as strain or

percentage extension. Extension percentage of sized cotton yarn was assessed using Premier Tensomaxx 7000

Yarn hairiness (number of hairs/ 100 mt)

The hairiness (no. of hairs/ 100 mt) of sized cotton yarns in the present study was recorded. Yarn hairiness was measured by Zweigle hairiness tester based on optical principle.

RKM- This can be expressed by the “Length of yarn in km” at which yarn will break of its own weight”. This is equivalent to breaking load in g/tex. RKM is the short expression for “Reisskilometer” – “Breaking-kilometer”

Properties of Cotton Yarn Applied with Mango Kernel Starch as Sizing Agent

Mango Kernel Starch %	Yarn Count (Ne)	Yarn Strength (gf/tex)	Elongation %	RKM	Yarn Hair count per 100 mt.
Grey Yarn	38.00	224.80	3.95	14.47	1644
1	37.45	250.65	3.52	15.92	568
2	37.00	262.00	3.36	16.42	20
3	36.85	295.00	3.10	18.98	6

Table shows properties of cotton yarn applied with mango kernel starch as sizing agent. The yarn count found to be decreased from 38.00 Ne to 36.85 Ne with increase in concentration of mango kernel starch applied on yarns as well as elongation percentage of stiffened yarns from 3.95 to 3.10. The strength (224.80 gf to 295 gf) and RKM from 14.47 to 18.98 of stiffened yarns found to be increased with the increase in the percent of mango kernel starch applied. There found to be drastic reduction in the yarn hair count with the increase in the percent of mango kernel starch applied.

Conclusion

Mango kernel starch is suitable as sizing agent for warp yarns before putting them on warp beam. The boiling method of stiffening is suitable for sizing the cotton yarns. The yarn count, elongation percent and yarn hair count per 100 mt. of sized yarns found to be decreased with the increase in the mango kernel starch percent applied while strength and RKM of sized yarns found to be

increased with the increase in the percent of mango kernel starch applied.

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