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MANGO KERNEL STARCH – A NATURAL AND INDIGENOUS SIZING AGENT FOR COTTON FABRIC

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ABSTRACT
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. From the annual crop of mango nearly two-three million tons of mango kernels go waste as they are thrown away. The mango kernels contain starch which can be used as substitute for cereal starches in the preparation of sizing agents for wet processing of textiles. Mango kernel starch is environmental friendly and bio-degradable. Mango kernel starch when applied on cotton fabric by boiling method exhibited he more tensile strength while the tear strength was less than the control sample. With the increase in the concentrations of mango kernel starch applied on cotton fabric the bending length and flexural rigidity of fabrics increased and so also the thickness as well as weight in gram per square meter of the fabric. Air permeability of fabrics decreased with increase in concentration of mango kernel starch applied on the cotton fabric.

KEY WORDS- Mango kernel starch, Cotton fabric, Sizing agent.

INTRODUCTION
Mango (*Mangifera indica*) is the most important commercially grown fruit crop. India is the largest producer of mangoes with 44.14 % of the total world production (Kusuma and Basavraja, 2017). During the processing of ripe mango, its peel and seed are generated as waste, which is approximately 40-50 % of the total fruit (Ashoush, I.S. and Gadalla, 2011). From the annual crop of mango nearly two/ three million tons of mango kernels go waste as they are thrown away. Disposal of mango kernels as agro waste is big problem for the processing industry. Nowadays, the increasing environmental pollution due to difficulty in recycling synthetic material has encouraged the researchers towards the development of biodegradable/edible films and coatings (Anjum Nawab, 2017). Sources of polysaccharides and plant seeds are guar gum; sea weed like alginate; plant gum exudates, gum Arabic, Jhingun gum and gum tragacanth *etc*. Sago, wheat/maize flour, arrow root, rice starch and tapioca etc, are sources of starches used for textile printing and sizing. However sizing agents from food sources includes high nutritive value, awareness in demand over natural thickening agents, high price and scarcity of them has increased the focus on locally available alternative material to traditional thickeners (Miah *et al*., 1993). There is a need to develop textile auxiliaries manufacturing technologies for making textiles more "environmentally friendly" which is possible with better utilization of processing waste for natural processes *e.g.* starches can be procured from unconventional sources like waste mango kernels. Jack fruit seed and mango kernel powders were wheatish in color; they were suitable as sizing agent (Padma Alapati, Khateeja, 2016). The mango kernels are rich in starch content which can be used as substitute for cereal starches in the preparation of sizing agents for wet processing of textiles. Mango kernel starch is bio-degradable and environmental friendly. It 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 wet processing can be suitably adopted in the use of mango kernel starch as sizing agent.

MATERIALS & METHODS
Extraction of starch from mango kernels
A simple laboratory scale method of isolation of amaranth starch has been developed by Perez *et al.* (1993). The method involves steeping of sliced mango kernels in dilute alkali, neutralization and ambient air drying without using expensive or highly hazardous chemicals (Chart 1).

Selection of fabric
Muslin is loosely constructed, fine, thin and soft cotton fabric and it has got good wearing quality. Being a fine cotton cloth, it is very soft, clings to the wearer and requires sizing.

De-sizing of market fabric
For conducting the experimental trials of different concentrations of mango kernel starch as sizing agents on cotton fabric, it was required to have muslin fabric free from starch or from any other sizing agent. Hence a laboratory procedure for desizing prescribed at IS: 1967-1961 was conducted.

Concentrations of mango kernel starch applied on fabric
There is variation in the degree of stiffness desired by the users for their clothes. Mango kernel starch was applied on muslin fabric in varying concentrations from 1% to 10%. The team of evaluators judged the starched samples for

stiffness. The mango kernel starch was applied on de-sized muslin fabric in four various concentrations from 2 to 5%

Application of mango kernel starch as sizing agent on cotton fabric

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

Application of mango kernel starch as sizing agent by boiling method

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

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

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Continued boiling of solution for ten min

↓

Cooling of starch solution in open air for two hours

↓

Filtered starch solution through muslin cloth

↓

Soaked desized fabric in starch solution for five min (MLR- 1:15)

↓

Removed the fabric from starch solution

↓

Slight wringing of starched fabric

↓

Dried the starched fabric in open form in direct sun

Subjective evaluation of sized fabric

A panel of fifteen judges was constituted for subjective evaluation to study their preferences for cotton fabric applied with mango kernel starch as sizing agent on the basis of various parameters. The each sized sample was judged and ranked by each panel member for stiffness, texture, whiteness and overall appearance by visual inspection and feel. This subjective evaluation was done using ranking system. The ranks allotted were 1- poor, 2- fair, 3-good and 4- best.

Objective evaluation of sized fabric

The textile properties of the stiffened fabric *i.e.* tensile strength, tear strength, fabric stiffness, flexural rigidity, weight per square meter, fabric thickness and air permeability were tested on the basis of International Standard test methods

RESULTS & DISCUSSION

Table 1 shows mean scores obtained by fabrics applied with different concentrations of mango kernel starch. Statistical results showed significant variation in mean scores for stiffness, texture, whiteness and overall appearance obtained by the samples applied with different concentrations of mango kernel starch. The highest mean scores for stiffness and texture were obtained by the samples treated with 4% concentrations of mango kernel starch while highest mean score for whiteness was obtained by the fabric treated with 2% and for overall appearance by the fabric treated with 3% concentrations of mango kernel starch.

Table 2 shows tensile as well as tear strength of fabric applied with mango kernel starch as sizing agent. Tensile strength of cotton fabric stiffened with 4% mango kernel starch was found to be maximum in warp way direction while it is maximum in fabric stiffened with 5% starch in weft wise direction. The tear strength of fabrics seemed to be maximum in samples stiffened with 2% mango kernel starch in warp direction while it is maximum in samples applied with 5% starch in weft wise direction. The tensile strength of the samples increased and tear strength seemed to be decreased in both warp and weft directions as compared to control sample. Table 3 shows stiffness of fabric applied with mango kernel starch as sizing agent. The bending length as well as flexural rigidity of the samples seemed to be increased in both warp and weft directions with the increase in the percent of mango kernel starch applied. Table 4 exhibits weight and thickness of fabric applied with mango kernel starch as sizing agent. There seemed to be gain in thickness and weight the of fabric with the increase in the percent of mango kernel starch applied. Table 5 indicates air permeability of fabric applied with mango kernel starch as sizing agent. The control sample has more air permeability than stiffened samples. Air permeability seemed to be decreased with the increase in the percent of mango kernel starch applied.

TABLE 1: Mean scores obtained by fabrics applied with different concentrations of mango kernel starch

Starch Con. %	Stiffness	Texture	Whiteness	Overall appearance
2	1.53	2.40	3.33	2.53
3	2.40	2.53	2.93	3.26
4	3.66	3.53	2.46	2.66
5	2.40	1.67	1.53	1.46
Grand Mean	2.50	2.53	2.56	2.48
F- Value	49.78**	41.42**	27.00**	23.56**
SE	0.12	0.11	0.14	0.15
CD	0.34	0.33	0.41	0.42

GG - Significant at 1% level

TABLE 2. Strength of fabric applied with mango kernel starch as sizing agent

S.no.	Mango kernel starch percent	Tensile Strength, (Kg f.)		Tear Strength, (g f.)	
		Warp way	Weft way	Warp way	Weft way
1	Control	8.6	5.3	1104.0	832.0
2	2	16.3	9.0	704.0	522.0
3	3	16.9	9.4	640.0	556.0
4	4	18.0	10.4	624.0	598.0
5	5	17.7	11.0	682.0	608.0

TABLE 3. Stiffness of fabric applied with mango kernel starch as sizing agent

S.no.	Mango kernel starch percent	Bending Length (cm.)		Flexural Rigidity (mg.cm.)	
		Warp way	Weft way	Warp way	Weft way
1	Control	2.47	1.75	60.28	21.44
2	2	4.40	3.45	377.37	181.91
3	3	4.55	3.70	414.46	222.87
4	4	4.67	4.10	453.22	306.70
5	5	5.10	4.52	599.58	417.40

CHART 1

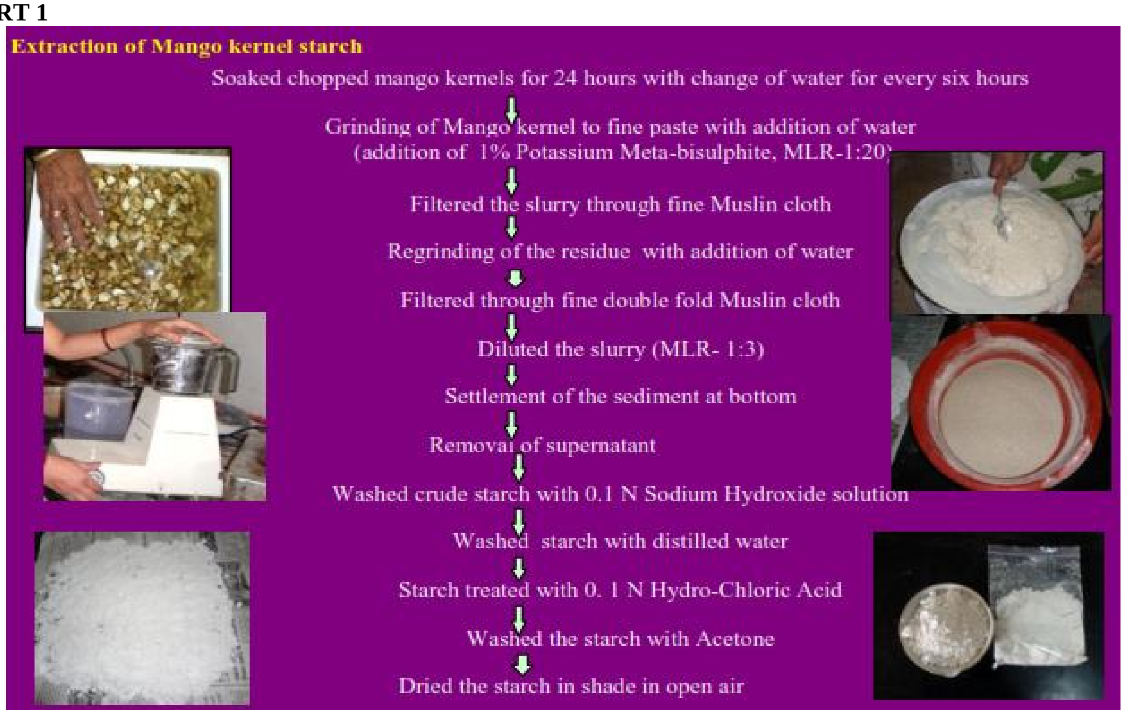

TABLE 4: Weight and thickness of fabric applied with mango kernel starch as sizing agent

S.no.	Mango kernel starch percent	Fabric Thickness (mm.)	Fabric GSM (gm.)
1	Control	0.21	40.00
2	2	0.22	44.30
3	3	0.22	44.00
4	4	0.22	44.50
5	5	0.23	45.20

TABLE 5: Air permeability of fabric applied with mango kernel starch as sizing agent

S. No	Mango kernel starch percent	Fabric Air Permeability value ($cm^3/cm^2/sec.$)
1	Control	357.00
2	2	347.00
3	3	342.00
4	4	334.00
5	5	303.50

CONCLUSION

The standardized concentration of mango kernel starch for sizing cotton fabric was 4%. Mango kernel starch when applied on cotton fabric by boiling method exhibited more tensile strength and less tear strength than the control sample. With the increase in the concentrations of mango kernel starch applied on cotton fabric the bending length and flexural rigidity of fabrics increased and so also the thickness as well as weight in gram per square meter of the fabric. Air permeability of fabrics decreased with increase in concentration of mango kernel starch applied on the cotton fabric.

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REFERENCES

Anjum Nawab (2017) Mango kernel starch-gum composite films: Physical, mechanical and barrier properties, International Journal of Biological Macromolecules, Vol- 98, 869–876

Ashoush, I.S. and Gadalla. M.G.E. (2011) Utilization of mango peels and seed kernels powders as sources of phytochemicals in biscuit. World Journal of Dairy & Food Sciences, 6(1) 35-42

Kusuma and Basavraja. (2014) Analysis of mango export markets of India, Markov Chain approach, Karnataka J of Agric. Sci, 27(1), 36-39

Miah, A.S. (1993) Formulation of printing pastes using carboxymethyl cellulose and microcrystalline cellulose as thickener. B. J. Jute fiber Research, 18(1& 2) 47-53

Miles, L.W.C. (1981) Textile Printing, H. Chartesworth & Co. Ltd., 239-251

Padma Alapati, Khateeja Sulthana Shaik, (2016) Explored Agro-waste Starches/Gums as Thickening/ Binding Agents for Textile Printing/Sizing, International Journal of Science and Research (IJSR), Volume 5 Issue 8, 1468-1471

Whitler, D. (1973) “Industrial Gums”, London Academy Press, U.K, 2nd Edition, 54.