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SAPINDUS EMARGINATUS VAHL AS A NATURAL SCOURUNG AGENT IN DYEING OF COTTON WITH *CARISSA CARANDAS* LEAF EXTRACT

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ABSTRACT

Comparative study of *Sapindus emarginatus* vahl as natural soap and synthetic soap for scouring of cotton was carried out. Scoured samples were tested for physical properties expressed as cotton scoured with *Sapindus emarginatus* vahl. showed high tearing strength. Scoured cotton samples were mordanted with *Terminalia chebula* Linn, *Punica granatum* Linn as natural mordants and stannous chloride, potash alum as metal mordants. Physical and fastnesss properties of mordanted and dyed cotton samples were assessed. Significant improvement was noted in terms of *Sapindus emarginatus* Vahl. as natural soap compared to synthetic soap. Natural soap was also found suitable in improving sunlight and wash fastness compared to synthetic soap.

Key words : *Sapindus emarginatus* Vahl. *Carissa carandas* Linn, cotton, natural soap ,physical and fastness properties. .

INTRODUCTION

Today there is a growing awareness for the protection of environment. Major emphasis is being given for the development of environment friendly production technology in all the areas of manufacturing activities including textiles, particularly chemical processing, of textiles, which includes preparatory process such as desizing, degumming, scouring, bleaching, dyeing, printing and finishing operations.

Glover (1995) compared the feasibility of natural dyes with that of synthetic dyes and suggested that the dyeing industry can reduce the environmental impact of synthetic dyeing processes by continuing its present effort to minimize waste and improve the environmental compatibility of the dyes. Mehra et.al. (1995) suggested to avoid the use of scouring assistants containing chlorinated hydrocarbon solvent emulsion. It has been further stated that, to give a good scour which will also remove harmful pesticides present on cotton or use of alternate chemicals wherever possible and develop alternate chemicals with equal efficiency and cost.

The present study focuses on the use of *Sapindus emarginatus* Vahl as a natural soap in scouring process. *Sapindus emarginatus* vahl is a deciduous tree. The trunk of the tree is straight and cylindrical, approximately 4-5 m in height. The fruit is small leathery. Skinned drupes which are 1-2 cm (0.39 – 0.79 in) in diameter which is yellow and turn blackish when ripen, containing one to three seeds cout. Saponin has been reported by Rastogi and Mehrotra (2001 and 2004). Arora et al. (2012) also reparted presence

of saponin. The use of natural soap may help in reducing the waste during the preparatory process of dyeing with *Carissa carandas* leaf extract as natural dye. Testing of textile encompasses broadly the physical, colorfastness properties and ecological compliance.

In the present study the effect of natural soap *Sapindues emarginatus* vahl. (reetha) used in the scouring of cotton was assessed for tearing strength, thickness and fabric count in terms of ends and pick / inch. Fastness properties were assessed finally after the complete dyeing .Dyed cotton was also assessed for count, thickness and tearing strength against natural and metal mordants used during the dyeing with natural dye.

MATERIALS AND METHOD

Materials: 50% grey cotton was used. Cotton being cellulosic fiber is biodegradable in nature and hence preferred safe route of using reetha for scouring. *Carissa carandas leaf* extract was used as a source of natural dye. Two natural mordants *Terminalia Chebula* Linn (harda fruits) and *Punica granatum* Linn (pomegranate rind) were used. Potash alum (alum) and Stannous chloride (Tin) were used as metal mordants

EXPERIMENTAL METHODS:

Scouring With *Sapindus emarginatus* Vahl (reetha):
Scouring of cotton was carried out in a bath containing 10% (reetha) powder (owf)and 2% Caustic soda (owf) for two hours. Temperature of the bath was kept at boiling keeping M:L as 1:30 with constant fabric liquor movement.

Scouring with Ezee (Synthetic Soap):
Scouring of cotton was carried out in a bath containing 2% caustic soda 5% ezee and 1% soda ash for 3 hours at boiling temperature keeping M:L as 1:30.

Aqueous Extraction of *Carissa carandas* leaves:
Dye extract was prepared with 50%dye material concentration (owf) keeping M:L ratio as 1:50. Extraction was carried out for two hours as optimum time revealed in previous studies. Temperature was kept at 90^0C maintaining the level of extract in the container throughout. The extract was then allowed to cool at room temperature and filtered to remove residual part to get clear solution. The solution was then transferred to open bath for exhaust dyeing.

Mordanting:
Mordanting of scoured cotton sample was carried out with 10% mordant (owf) . M: L ratio of mordanting bath was kept as 1:50. Initial temperature of the mordanting bath was 40^0C and it was slowly raised upto 90^0C. Mordanting was carried out for 45 minutes with constant fabric liquor movement. Mordanting bath was allowed to cool for 15 minutes at room temperature. Mordanting was carried out separately for each mordant and experimental sample.

Dyeing:
Mordanted sample was entered into the previously prepared dye bath. The dye bath was set with 1:50 M:L at 40^0C. Temperature was slowly raised up to 90^0C. Dyeing was carried for 60 min with continuous fabric liquor movement. The dye bath was allowed to cool for 15 mins. The dyed sample was removed, washed thoroughly and shade dried. The procedure was repeated for each experimental sample.

Assessment of Physical Properties:
Controlled, scoured and dyed cotton samples were assessed against ends and picks per inch, lengthwise shrinkage, thickness and tearing strength (ASTM stds).

Assessment of Fastness Properties
Wash fastness (ISO2) (IS:3361-1979)
Sunlight fastness (IS:686-1985)

RESULTS AND DISCUSSION

Table-1 reveals the significant increase in ends and pick/inch of cotton scoured with both *Sapindus emarginatus* Vahl. And Ezee where as cotton scoured with ezee showed more number of ends and picks/inch.

Table - 1 Effect Of Natural Soap *(Sapindus emarginatus* Vahl*).* and Synthetic soap (Ezee) on Physical Properties Of Cotton

Fabric Sample	Count		Thickness mm	Lengthwise shrinkage inch/yard	Tearing Strength	
	Ends/inch	Picks/inch			Warp	Weft
Gray cottn	82	72	.27	40	54.33	60.2
Cotton scoured with *Sapindus emarginatus* Vahl	92	76	.26	38	44.66	58
Cotton scoured with Ezee	102	80	.21	36.06	21.22	30.66

Table No. 2: Effect of Natural and Synthetic Mordants on Physical Properties of Cotton.

Mordants	Count				Thickness mm		Lengthwise Shrinkage inch/yard		Tearing Strength			
	***Sapanidus emarginatus* Vahl**		**Ezee**		**Sapanidus Vahl**	**Ezee**	**Sapanidus Vahl**	**Ezee**	***Sapanidus emarginatus* Vahl**		**Ezee**	
	Ends/ inch	Picks/ inch	Ends/ inch	Picks/ inch					Warp	Weft	Warp	Weft
Stanneous Chloride	100	74	120	90	.26	.22	38	36.8	70	61.33	35.66	41
Potash alum	106	82	110	96	.26	.21	38	36.8	77.33	45	44	65
Terminalia Chebula Linn	110	96	106	82	.27	.24	38	36.8	50.33	63.66	35.66	54.66
Punica garnatun Linn	106	84	110	86	.26	.21	36.8	36.8	45.66	37	55.33	49

Significant decrease in thickness was noted in the sample scoured with ezee. Compared to cotton scoured with *Sapindus emarginatus* Vahl.

Agrawal (2011) stated that Thickness of the control sample was observed not higher compared to desized, scoured and bio polished khadi. No significant difference was seen in lengthwise shrinkage when cotton scoured with *Sapindus emarginatus* Vahl was compared with that of cotton scoured with ezee.

Tearing strength of both the cotton samples scoured with *Sapindus emarginatus* Vahl and Ezee over control sample. It can be seen from the table that cotton scoured with *Sapindus emarginatus* Vahl (natural soap) showed significantly higher tearing strength in both warp and weft direction compared to cotton scoured with Ezee (synthetic soap)in both warp and weft direction. Agrawal (2011), resulted increase in tensile strength values of bio- polished (with cellulose enzyme) khadi fabric compared to bio desizing with Amylase enzyme and bio - scouring with pactinase enzyme 1 %(owf). Bio -desized and bio –scoured khadi showed increased tensile strength in weft direction and decrease in warp direction over the control sample.

Fabric Aesthetics:

Effect of scouring on fabric colour and lusture was evaluated visually by the panel of judges. Judges were of the opinion that colours of both

the cotton fabrics scoured with *Sapindus emarginatus* Vahl as natural soap and Ezee as synthetic soap cannot compared as reduced whiteness (bone white)may not be a disadvantage for manufacturer as well as consumer as seen in *Sapindus emarginatus* Vahl. scoured cotton.

Effect of Natural and Synthetic Mordants on Physical Properties of Cotton:

It is observed from the table that effect of natural as well as synthetic mordants showed significant results in terms of ends and pick/inch, thickness, lengthwise shrinkage and tearing strength over control samples.

Sapindus emarginatus Vahl scoured cotton mordanted with *Terminalia chebula* showed higher values of ends and picks/inch compared to other mordant. Contrary to this cotton scoured with Ezee mordanted with stannous chloride resulted in highest number of ends/inch. No significant difference was noted in control grey cotton and cotton scoured with *Sapindus emarginatus* Vahl and mordanated with synthetic and natural mordants but there is a slight increase in thickness when cotton was scoured with *Sapindus emarginatus* Vahl. and mordanted with *Terminalia chebula* Linn. Similarly significant increase in thickness was noted when cotton was scoured with synthetic soap and mordanted with natural mordant *terminalia chebule* Linn. No significant difference was seen in terms of other samples. *Punica granatum* Linn revealed good results. Compared to synthetic soap and mordants.

No significant difference was noted in terms of lengthwise shrinkage towards scoured and mordanted samples. Reddy (2011) has also reported that shrinkage of BTCA treated sample is significantly reduced in both warp and weft direction over control sample. Reddy (2011).

Table reveals the remarkable improvement in tearing strength for almost all the cotton samples mordanted with metal and natural mordants. Over the control and scoured cotton samples highest tering strength in warp direction has observed for alum mordanted sample. Siddiqui et.al. (2009) studied the effect of mordants on durability of cotton and silk fabrics dyed with Parijataka flower pigment where physical properties were found to be increased due to utilization of different mordants.

Maximum increase of tearing strength in weft direction is noted for *Terminalia chebula* mordanted sample. It is evident from the table-2 that the tearing strength in both warp and weft direction was more in samples scoured with *Sapindus emarginatus* Vahl as natural soap compared to samples with ezee as synthetic soap.

Salah et.al.(2013), reported the effect of various mordants on tensile properties of Egyptian cotton fabrics made from Giza 86, and Giza 90 dyed with natural colourant extracted from banana leaves. The addition of mordant increased the tensile strength of the both the cotton fabrics. Authors further stated that it is due to the metals with the free hydroxyl ions of

Table -3. Effect of scouring and Mordanting on Fastness Properties Of Dyed Cotton

Mordants	Sunlight Fastness		Wash Fastness			
	Scoured with *Sapindus emarginatus* vahl	Scoured with ezee	Scoured with *S. emarginatus* Vahl		Scoured with ezee	
	cc	cc	cc	cs	cc	Cs
Stannous chloride	4/5	4	4	4/5	3/4	4/5
Potash alum	4/5	4	4	4/5	3/4	4/5
Terminalia chebula Linn	4/5	4/5	4/5	4/5	3/4	4/5
Punica granatum Linn	4	4	4/5	4/5	4/5	4/5

cotton causing orientation of the cellulose chain. Reddy (2011) has treated the degummed tussar fabric with 1,2,3,4- butane tetra carboxylic acid (BTCA),3.3%.$NaH_2PO_2.H_2O$ and 0.5% non-ionic aqueous emulsion of polyethylene showed increase in tearing strength in warp and weft direction.

Table–3 reveals the data regarding colour fastness properties of Carissa dyed cotton scoured with *Sapanidus emarginatus* as natural soap and ezee as synthetic soap. Sunlight fastness of dyed cotton, scoured with natural soap has been improved and rated 4/5 as very good towards alum and stannual chloride and *Terminalia chebula* as natural mordant. Vankar et al. (2000) and Deshmukh et al (2014) stated that mordants provide improved was and light fastness.

No significant difference was noted in terms of metal and natural mordants in terms of wash fastness. But significant difference in wash fastness was noted where wash fastness of dyed cotton scoured with *Sapindus emarginatus* Vahl is compared to dyed cotton scoured with ezee which rated 3/4 as fairly good fastness.

CONCLUSION

From the results it can be concluded that scouring with *Sapindus emarginatus*Vahl as natural soap found more suitable compared to ezee as synthetic soap. Natural soap has improved physical properties compared to synthetic soap. Metal and Natural mordants both helps in improving physical properties. Scouring with *Sapindus emarginatus* Vahl as natural soap imparted better fastness properties compared to synthetic soap. Therefore present study suggests the safe route of using *saqindus emargiratus* vahl as natural soap for scouring.

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