INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN : 2277-7881
VOLUME 1, ISSUE 4, SEPT 2012

EXPERIMENTAL STUDY ON APPLICATION OF DIFFERENT SIZING AGENTS AND ITS IMPACT OF FABRIC PROPERTIES

Kusum Lata Joria
Deptt. Of Clothing & Textiles
The IISUniversity, Jaipur

Rena Mehta
Deptt. Of Clothing & Textiles
The IISUniversity, Jaipur

Introduction

Fabric finishes are wet or dry treatments that complete a textile. Sizing is a process used for the application of a film forming polymer to provide temporary protection to the warp yarns from abrasion and other types of stresses generated during the weaving machines in order to reduce the yarn breakage. Sizing is the most common finish applied on to a textile. Various sizing agent used are Poly vinyl alcohol, Carboxyl methyl cellulose, potato, sago, rice, corn, Starch is probably the commonest finishing agent for cotton goods and it may be applied as a stiffing binding agent alone or along with a little of softness .It may also be applied as a binding material for filling and weighing substance. Starches are used in different strength for different fabrics depending on the thickness of fabric and stiffness required for it. Maize, corn etc) pith of plant (sago) roots and tubers (tapioca, farina, potato, etc.) these are widely distributed throughout the vegetable kingdom and occurs in the form of granules in the seeds of cereals in bulks and tubers of plants and bark and pith of many trees. 50% of maize starch produced in India is raised in textile industry for various operation starching is very necessary for improving the physical properties (like stiffness, thickness etc.). (1)

Each variety of starch is recognized by the characteristic shape and size of its & granules together with stratification (concentric rings) when examined under a microscope.

Size of Starches

Starch	Size
Rice	3 – 10 µm
Corn	5 – 20 µm
Wheat	22 -36 µm
Cassava	5 -25 µm
Potato	15 -85 µm

Starch is insoluble in cold water but swells when kept suspended in water for a long time. Gelatinization take place only on heating when the granules swell considerably and burst out. Sizing consist of impregnating the textile material with some easily removed substance such as search or dextrin and in case of the more modern manmade fibers with synthetic products such as polyvinyl alcohol or polyacrylic acid.(2)

The properties of starch like Thickener, Film former, Sticking-adhesive/cohesive, Water binding capacity, Water retention & Flocculent are highly dependent on the origin and the chemical and physical modification of the polymer. Chemically starch is similar to cellulose. The glucose chain consists of *amylose* linear chain molecules and *amylopectin* branched chain molecules. The combination of amylose and amyl pectin are not soluble in water however if both are separate from each other, both are soluble. The amyl pectin is responsible for the paste forming property in starches. (3)

Various factors affecting the properties of starches are: Temperature, Time, Stirring, Ration of amylose and amylopectin. Starch granules when heated in water gradually absorb water and swell in size, causing the mixture to thicken. With continued heating however, the swollen granules fragment, the mixture becomes less thick, and the amylase and amyl pectin become soluble in the hot mixture. This process of granule swelling and fragmenting is called gelatinization (5).

Materials and Methods

Three types of starches mainly Sago, Rice and Corn were used as a sizing material. Starch solution was prepared and applied onto the fabric sample at various concentrations and temperature. The sized samples were subjected to the physical testing and wash fastness by subjecting the sized samples to two, four and six washes respectivly was carried out.

Preparation of the fabric: The fabric was washed so as to remove starch and other impurities in order to facilitate operation for succeeding processes. Soap was mixed in water according to material and liquor ratio i.e.1:20 in the container the fabric was kept for one night and then washed under running water.

Preparation of starch solution: - Starch flour was converted to a smooth paste by adding water , this paste was then poured in 500 ml of boiling water. This solution was continuously stirred until a transparent grey solution was obtained the starch thus prepared was called starch jelly (Same process used for corn, sago and rice)

Various concentrations used:

Rice: -	Rice Starch flour	-10gm ,15gm
	Water	-500ml
	Boiling	
Corn:-	Corn Starch flour	-10gm ,15gm
	Water	-500ml
	Boiling	
Sago: -	Sago Starch	-10gm, 15gm
	Water	-500ml
	Boiling	

Starch jelly and water were mixed in required concentration. The Solution was sized to 70°**C** and100°**C** respectively, as per the experiment washed fabric was immersed in the starch solution for few minutes till the fabric sample got saturated with starch. The sample was taken out and pressed between the palms so that excess of starch solution is squeezed out. The size sample is then dried in open air.

Sizing Recipe & process:-

Rice: - Starch jelly - 20ml ;Water - 100ml; Temperature - 70°**C**, 100°**C;** Time **:** 5 min.

Corn: -Starch jelly - 20ml; Water - 100ml; Temperature - 70°**C**, 100°**C;** Time : 5 min.

Sago:- Starch jelly - 20ml; Water - 100ml; Temperature - 70°**C**, 100°**C;** Time: 5 min.

The size solution was prepared and cooked. Fabric samples were sized with cooked size solution on laboratory model Paramount sizing Machine with 20% size jelly concentration for 5m/min sizing speed,90 daN squeezing load over warp sheet width of 12 inch.

Methods:

Fabric GSM: Determination of fabric weight in grams per square meter was done using GSM cutter. The sample was cut with the Paramount GSM cutter and Weighed to determine the weight.

Thickness test: Fabric samples were subjected to Shirley‘s thickness tester for determination of the variation in the thickness of the sized samples. Sized sample was

cut Sample were placed on the Anvil. Pressure foot was gently powered on the sample. Thickness in mm was measured after 30 sec.

Stiffness test; Stiffness of the sized sample was determined by cutting the sample of 2.5x15cm. Sized sample was placed in the Laboratory model of Paramount Stiffness Tester. The readings were taken

Tensile Strength: Sized Sample was cut 10x12(warp/weft) then the Samples were fit in Paramount Tensile Tester .The Load /Elongation curve was procured from the readings obtained from the tensile tester.

Wash Fastness : The sized sample was subjected to subsequent washes (2, 4 &6) after drying the samples were tested for stiffness in shriley's stiffness tester.

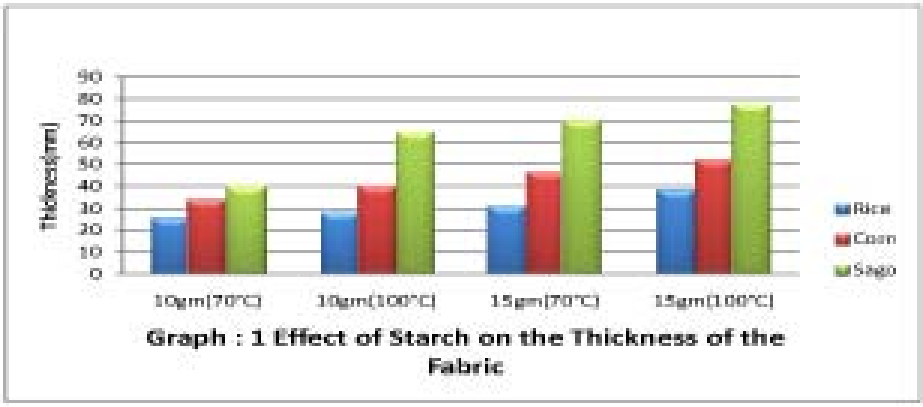
Results and Discussion:

Preliminary data of the control sample with a thread count of 160 X 90 indicated that weight per unit area of the sample was 0.94gsm,thickness being 20mm,with a width of the 48 inches, stiffness of warp yarns was 1.5 cm and 2.9cm for weft yarns

Table 1: Effect of Starch on the Thickness of the sized sample:

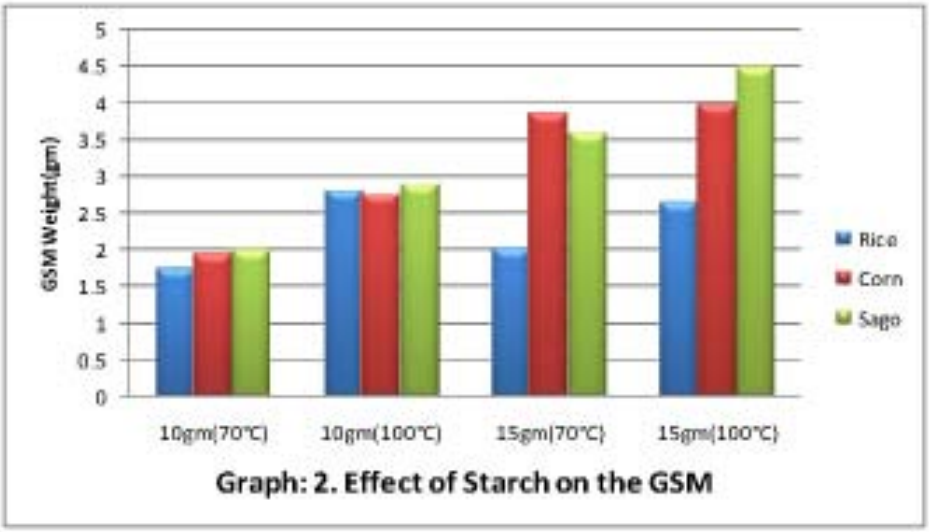
S/N	Starch	10gm Starch (70°C)	10gm Starch (100°C)	15gm starch (70°C)	15gm Starch (100°C)
1	Rice	26mm	28mm	31mm	38mm
2	Corn	34mm	40mm	46mm	52mm
3	Sago	40mm	65mm	70mm	78mm

Thickness of the sample varied in considerable amount with the increase of temperature. This could be due to more absorption of the starch with temperature and concentration because of increased kinetic energy of the particles that resulted in thick film formation on the fabric sample and also as the solution is in the granular stage at 100°**C** centigrate which gives maximum viscosity**.** To the starch solution which in turn resulted in thick layer formation on the sample.(Graph 1)



Graph : 1 Effect of Starch on the Thickness of the Fabric

Statastics of the weight of sample indicated that with the increase in concentration a major difference from 2.64gms to 4.5 gms respectively (Graph 2) was noted. Data also indicated that corn starch gives more weight gain at lower temperature as compared to the other as absorption of corn is more due to its waxy structure that does not retrograde easily, this is the reason it is used for commercial purpose(4).

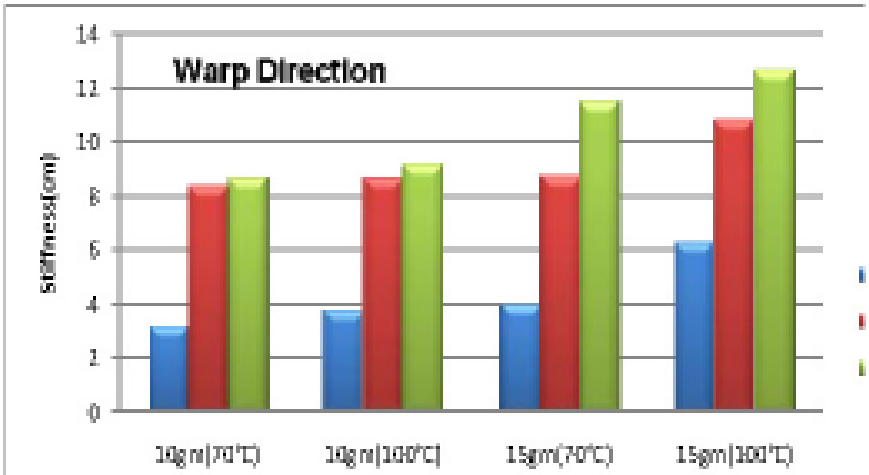


Graph: 2. Effect of Starch on the GSM

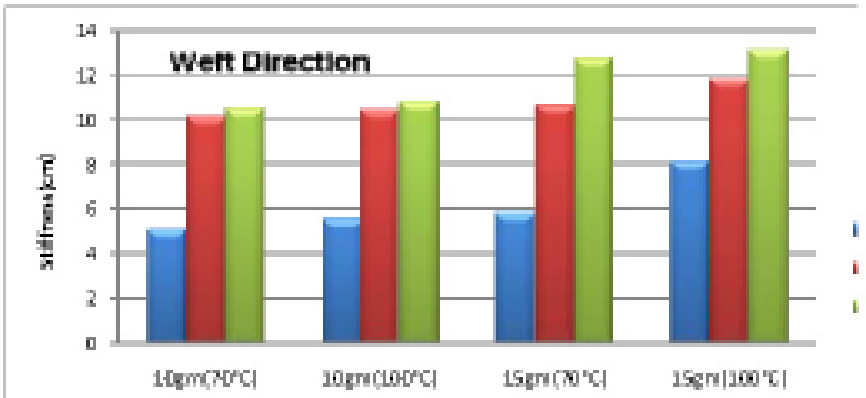
Results related to the variation in stiffness indicated that weft yarns were stiffer than the warp yarns at all concentrations and temperatures as indicated in Table 3. Sago has given maximum stiffness of 13.2cms at 15gm(100°**C**) and12.8cm at10gm(70°**C**).Stiffness considerably increased with the increased concentration of the starch. Wheras Stiffness of the control Sample of Warp(Graph 3) was 1.5cms and weft(Graph 4) was 2.9cms.

Table: 2 Effect of Starch on stiffness of the Fabric

S/N	Starch	10gm Starch 70 °C		10gm Starch 100°C		15gm Starch 70°C		15gm Starch 100°C	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
1	Rice	3.2 cm	5.1 cm	3.8 cm	5.6 cm	4 cm	5.9 cm	6.2 cm	8.2 cm
2	Corn	8.4 cm	10.2 cm	8.7 cm	10.5cm	8.8 cm	10.7cm	10.9 cm	11.9 cm
3	Sago	8.7 cm	10.6 cm	9.2 cm	10.9cm	11.5 cm	12.8cm	12.9 cm	13.2 cm



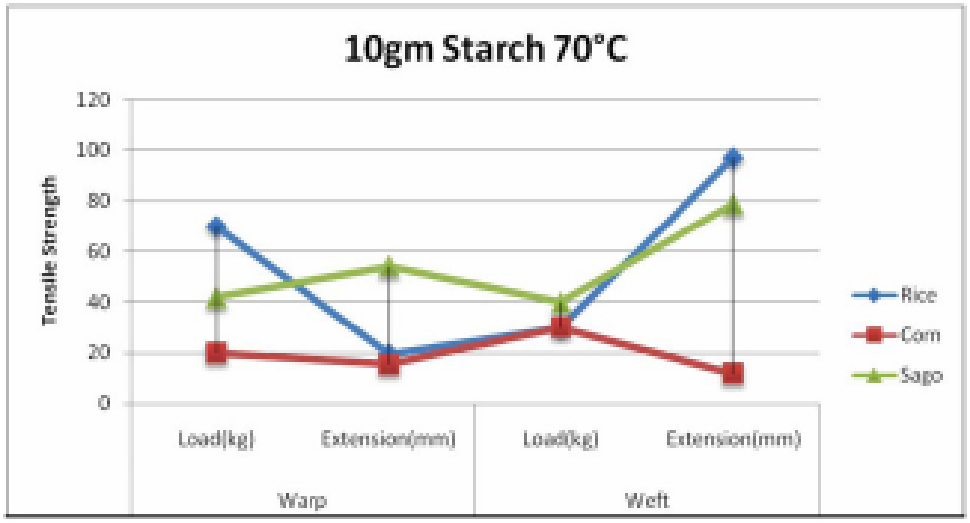
Graph: 3 Effect of Starch on stiffness of the Fabric



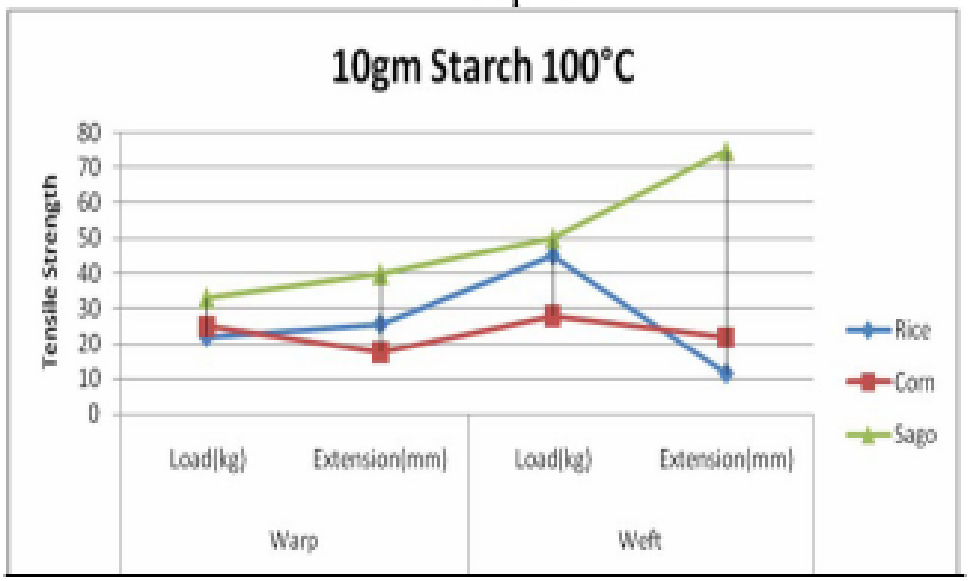
Graph:4. Effect of Starch on stiffness of the Fabric

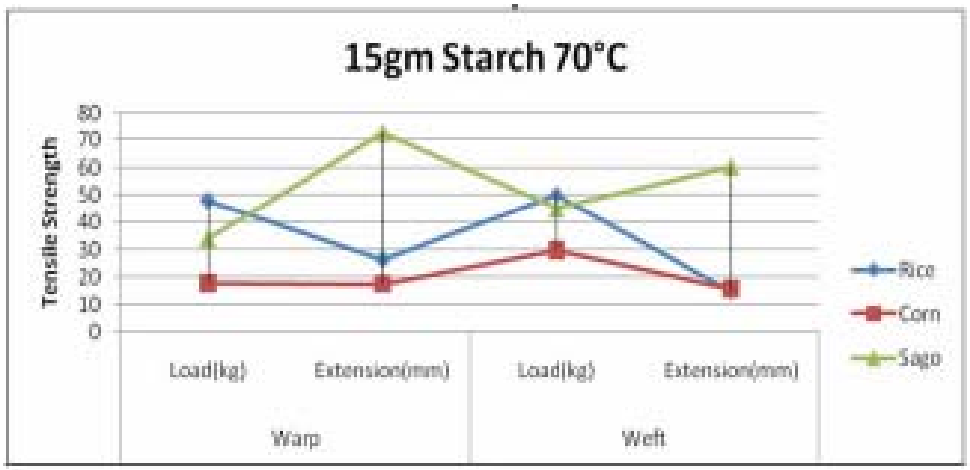
Statastics in graph 5 showed that with a load of 15kg extension was 8.5mm in warp which was less than weft with a load of 18kg and Extension 6.75mm.Application of any sizing agent leads to an increase in strength of the fabric. The breaking points of rice starch were found to be maximum at 55kg and corn being minimum at 20kgs near to sago at27kgs (100°**C** 15gm),the reason behind the variation is because the sample sized with rice was limp as compared to the other two and hence could take up more extension with increased load. On the contrary sago give a higher breaking point at 42gms as compared to the rice at lower concentration of 10gms owing to a lesser stifness at lower concentration.(Graph 5-a,b,c,d)

Graph 5: Effect of various starches on Tensile Strength of the fabric

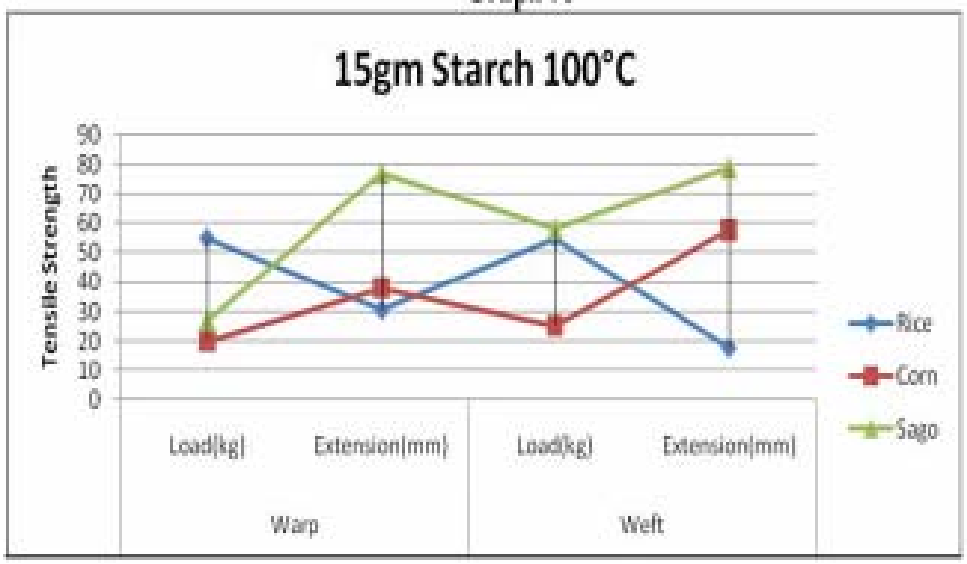


Graph 5a





Graph 5c



Graph 5d

Result of the effect of washing infered that after two washes sample sized with sago was Stiffer as compared to the other two (Rice , Corn, Sago)Respectively .

Table 3: Effect of Two Washes of the Sized fabric

S/N	Starch	10gm Starch (70°C)		10gm Starch (100°C)		15gm starch (70°C)		15gmStarch (100°C)	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
1	Rice	2.6	4.7	3	5	3.1	5.2	5.8	7.2
2	Corn	7.6	9.8	8	10	8.2	10.3	10.4	11.1
3	Sago	8.3	10.2	8.9	10.5	11.1	12.6	12.4	12.8

Whereas, a difference in the stiffness was found to be more stable than rice starch. Also, weft yran were stiffer than warp yran in all the three washes Gaph..

Table 4: Effect of Four Washes of the Sized Fabric

S/N	Starch	10gm Starch (70°C)		10gm Starch (100°C)		15gm starch (70°C)		15gmStarch (100°C)	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
1	Rice	2.2	4.5	2.1	4.6	2.8	4.7	5.4	6.7
2	Corn	1.8	3.9	1.9	4.3	2	1	5	6.2
3	Sago	1.6	3.2	1.7	2.9	1.9	3.8	4.3	5.8

Table 5: Effect of Six Wash of the Sized Fabric

S/N	Starch	10gm Starch (70°C)		10gm Starch (100°C)		15gm starch (70°C)		15gmStarch (100°C)	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
1	Rice	1.5	3.9	1.7	4	2.1	4.1	5	6.1
2	Corn	1.6	2.9	1.7	4	1.9	3.8	4.7	5.9
3	Sago	1.5	2.9	1.5	3	1.6	3.4	3.9	5.2

Conclusion

Application of any sizing agent leads to an increase in stiffness, strength & weight if the fabric. Result of present study swot up at the conclusion that sago is an optimum starch that can be use commercial purposes

References:

1. Butnaru R., Muresanu A and Mitu S. (1986) May; Cellulose Chemistry and Technology 20/3 ,349-355.
2. Khukan Ava rani & Gowel Jiju , (1998) Effect of various starch on cotton and silk fabric Asian Journal 45, Pages 76-85.
3. Adamec, S.Kubicek,A.(1986) Effect of the rheological properties of starches on their sizing capacity 41/8. 269-277.
4. Goyal S.G ,Kandoparker V.G, .(1989)Preparation of Low viscosity starch by Biological Method, Indian textiles Journal 42:76-77.
5. Mukerjee A.k .(1981) The mechanical properties of the size yarns 38, 73-70.