
ORGANIC COTTON
KNITTED FABRIC
VS.
REGULAR COTTON
KNITTED FABRIC
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Organic Cotton Knitted Fabric vs. Regular Cotton Knitted Fabric

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Performance & Comparative Study of Characteristics of Organic Cotton Knitted Fabric with Regular Cotton Knitted Fabric

Abstract

The organic cotton which is produced without any chemical fertilizers and pesticides are playing vital role in creating harmless environment. An Investigation of the properties of weft knitted fabrics produced from organically made cotton vis-à-vis regular cotton knitted fabric is reported. The yarn is made with organically produced cotton and regular cotton and the fabric was knitted using single jersey machines. The fabrics were subsequently dyed using natural dyes. The naturally dyed knitted fabrics were examined for shrinkage, bursting strength, abrasion resistance, colour fastness properties. The result show that the knitted fabrics produced from organically grown cotton is superior in performance in comparing with fabrics produced from regular cotton.

1. Introduction

Cotton is the back bone of the world's textile trade. Since centuries the usage of cotton has been used for apparel purposes because of its well known advantages viz, ability to take up a wide range of dyestuff, low cost of production and comfort during wear. Cotton grown without the use of any synthetic chemicals i.e., pesticides, plant, growth regulators, defoliants and fertilizers is considered "organic" cotton, according to Doug Murray, Ph.D., a professor of sociology at Colorado state university. The most hazardous available pesticides are used on cotton, of the available today during his study on pesticide used on cotton overseas. In general, organic cotton is grown using methods and materials that have low impact on the environment with the organic production systems replenishing and maintaining soil fertility, reducing of the use of synthetic pesticides, fertilizers and building a biologically diverse agricultural system. The effects of this overuse of chemicals on the environment and human health are alarming. For example, pesticide and fertilizers use on cotton has been linked to ground and surface water contamination, and even the pollution of drinking water. Organic cotton has given a better result for environment problems. Environmental concerns are also increasing organic cotton production provides an alternative to grow cotton without chemicals. Leading global brands and private labels are increasing their emphasis on eco-friendly textiles, including organic cotton products and India needs to make the best out of this opportunity says Pillip Jiwrajka. The environmental impact of the textile industry has become an important issue for consumers. The textile manufacturing process in characterized by the high consumption of resources like water, fuel and a variety of chemicals in a long process sequence that generates a significant amount of waste. When considering the environmental performance of fibers then the general consumer assumption is that 'natural' fibers are more environmentally friendly than manmade or synthetic fibers. Organic cotton production is also a consumer driven initiative. There are many harmful chemicals that people do not know about. Twelve of

these chemicals are known as persistent organic pollutants or pops, which are the most hazardous of all man-made products or wastes that cause deaths, birth defects and diseases among humans and animals.

1.1 Organic cotton

The organic system of cotton production promotes enhanced biological activity encourages sustainability and commands proactive management of production, affirms R.Senthilkumar (2006). There is no conflict of interest between the conventional and organic cotton and both need to co-exist in a consumer oriented society said J.N. Singh (2007). According to Swezey and Goldman (1996), organic cotton yields did not differ significantly from conventional production yield in (ICAC Recorder) 1996. The most hazardous available pesticides are used on cotton of the available today, says Doug Murray (2007). Most consumers the word 'organic' is primarily a maker a word that symbolizes a life style that they want to be part of says Laurie Demeritt (2006).

1.2 Quality attributes of organic and conventional cottons

Limited studies by NITRA have shown that organic cotton fibers have better physical properties, than conventional cottons in terms of length, bundle strength, length uniformity, and maturity. Breaking elongation is also higher for organic cotton by as much as 20% ash and wax content in organic cotton are lower and absorbency better as compared to conventional cotton. Organic cottons shows better durability and color retention. The presence of heavy metals like cobalt, iron copper, lead and calcium is reported to be lower in organic cotton.

1.3 Technical Aspects of Organic cotton

Cotton grown without the use of any synthetically compounded chemicals and fertilizers is considered 'organic' cotton. Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore maintain and enhance ecological harmony. Organic cotton evokes images of white, fluffy purity and many people think of cotton as being a natural, pure fabric. Cotton is a wonderfully versatile and globally important fiber that is used for a vast variety of fiber and food products, making it one of the most widely traded commodities on earth versatility, softeners, breath-ability, absorbency, year-round comfort, performance and durability are just a few of the qualities that have earned cotton it's popular status.

2. Methodology

The regular cotton knitted fabric and organic cotton knitted fabrics are prepared for dyeing process with the following sequences.

Desizing ⟶ Scouring ⟶ Bleaching

After the fabrics are prepared the fabrics are dyed with the following natural dye materials

Table 1: Materials and Dyes used

Common Name	Botanical Name	Parts Used	Material Used for Dyeing
Annatto	Bixa orellana linn	Seed	Cotton & organic cotton
Berberine	Berberis aristata	Root	Cotton & organic cotton
Catchu	Acacia catchu	Root	Cotton & organic cotton
Buck thrown	-	Bark	Cotton & organic cotton

2.1 Dyeing procedure for Annatto

Annatto is mixed with oil and water and soaked for overnight. Then it is crushed well to remove the colorant from the seeds. The solution along with seed is boiled for half an hour. The solution is filtered. The residue is again mixed with water to remove all the dye. Again it filtered. The solution is mixed with water of M.L.R 1:20. The solution is heated at temperature 80°c – 90°c. The material is immersed in the dye solution and heated for 1 hour. pH is checked every half an hour. After the process is over the material is taken out and washed in cold water.

Table 2: Dyeing Recipe for Annotto

Cotton	15g	Organic	15g
Annotto	15g	Annotto	15g
MLR	1:20	MLR	1:20
Temp	80°c-90°c	Temp	80°c-90°c
Time	1 Hour	Time	1 Hour

2.2 Dyeing procedure for Berberine

Beriberine powder is mixed with water and soaped for overnight. Then it is crushed well to remove the colorant from the powder. The solution along with powder is boiled for half an hour. The solution is filtered. The residue is again mixed with water to remove all the dye. Again it filtered. The solution is mixed with water of M.L.R 1:20. The solution is heated at temperature 80°c – 90°c. The material is immersed in the dye solution and heated for 1 hour. pH is checked every half an hour. After the process is over the material is taken out and washed in cold water.

Table 3: Dyeing Recipe for Berberine

Cotton	15g	Organic	15g
Berberine	15g	Berberine	15g
MLR	1:20	MLR	1:20
Temp	80°c-90°c	Temp	80°c-90°c
Time	1 Hour	Time	1 Hour

2.3 Dyeing procedure for Catchu

Catchu is mixed with water and soaked for overnight. Then it is crushed well to remove the colorant from the catchu. The solution along with seed is boiled for half an hour. The solution is filtered. The residue is again mixed with water to remove all the dye. Again it filtered. The solution is mixed with water of M.L.R 1:20. The solution is heated

at temperature 80°c – 90°c. The material is immersed in the dye solution and heated for 1 hour. pH is checked every half an hour. After the process is over the material is taken out and washed in cold water.

Table 4: Dyeing Recipe for Berberine

Cotton	15g	Organic	15g
Catchu	15g	Catchu	15g
MLR	1:20	MLR	1:20
Temp	80°c-90°c	Temp	80°c-90°c
Time	1 Hour	Time	1 Hour

2.4 Dyeing procedure for Buck thrown

Buck thrown bark is mixed with water and soaked for overnight. Then it is crushed well to remove the colorant from the barks. The solution along with seed is boiled for half an hour. The solution is filtered. The residue is again mixed with water to remove all the dye. Again it filtered. The solution is mixed with water of M.L.R 1:20. The solution is heated at temperature 80°c – 90°c. The material is immersed in the dye solution and heated for 1 hour. pH is checked every half an hour. After the process is over the material is taken out and washed in cold water.

Table 5: Dyeing Recipe for Buckthrown

Cotton	15g	Organic	15g
Buck thrown	15g	Buck thrown	15g
MLR	1:20	MLR	1:20
Temp	80°c-90°c	Temp	80°c-90°c
Time	1 Hour	Time	1 Hour

3. Evaluation Results and Discussions of the dyed fabrics

The cotton and organic cotton dyed samples were evaluated in comparison with the original samples by both visually and laboratory tests. The laboratory test samples were cut according to the specification from relative portion of all the original materials and washed materials for the following laboratory test

3.1 Abrasion Resistance

Wear is generally considered to be net result of a number of causes which reduces the serviceability of textile materials. Abrasion which is one aspect of the wear in caused by rubbing away of the component fibers and yarns of the fabric, says Sundaram (1979). According to ASTM standards (1983), abrasion is the wearing off of any part of a material by rubbing against another surface. The Eureka Martindale abrasion resistance tester plate was used to determine the abrasion resistance of the samples. The samples were cut from different places of the same material at random

From the result most of the samples have shown good abrasion resistance. Among the original samples cotton and organic cotton shows increase in the mean value. In the

case of dyed samples shows increase in weight. Hence it could be concluded that among all the cotton dyed & organic cotton dyed samples shows increase in abrasion resistance.

Table 6: Fabric Abrasion Resistance

Samples	Mean Resistance (mgs)	Gain or Loss over original	Percentage of Gain or Loss
Cotton	0.1	-	-
Organic Cotton	0.2	-	-
Cotton dyed with Annatto	0.09	-.01	10
Organic cotton dyed with Annatto	0.17	-0.003	15
Cotton dyed with Berberine	0.08	-0.002	20
Organic cotton dyed with Berberine	0.18	-0.002	10
Cotton dyed with Catchu	0.07	-0.003	30
Organic cotton dyed with Catchu	0.21	0.01	10
Cotton dyed with Buck thrown	0.08	-0.02	20
Organic cotton dyed with Buck thrown	0.18	-0.02	10

3.2 Fabric Bursting

Lawson (1982) reported that bursting strength is the measure of resistance to textile fabric to bursting. The difference between the total pressure required for rupturing the specimen and the pressure required to inflate the diaphragm is reported as bursting strength.

Table 7: Fabric Abrasion Resistance

Samples	Mean in Kg Pa	Gain or Loss over original	Percentage of Gain or Loss
Cotton	534.8	-	-
Organic Cotton	541.4	-	-
Cotton dyed with Annatto	530.6	4.2	0.7
Organic cotton dyed with Annatto	536.5	4.9	0.9
Cotton dyed with Berberine	531.3	3.5	0.6
Organic cotton dyed with Berberine	538.9	2.5	0.4
Cotton dyed with Catchu	531.6	3.2	0.6
Organic cotton dyed with Catchu	536.3	5.1	0.94
Cotton dyed with Buck thrown	533.3	1.5	0. 2
Organic cotton dyed with Buck thrown	537.8	3.6	0.6

From the above table most of the cotton and organic samples bursting strength were good strength. The dyed organic cotton sample has increased in strength compared to dyed cotton fabrics.

3.3 Colour Fastness to Sunlight

A test piece of the textile material id exposed to daylight along with eight standard patterns. It is evaluated for light fastness by comparing its change is color with that of the standard patterns. Samples of test piece and patterns are of 1x6 cm size. Place an opaque cover across the middle third of the test piece and the standard patterns. Place the assembly in the exposure rack expose it every day from the sunrise to the sunset, until sufficient fading has occurred for a good comparison to be made with the standards. After exposure remove the covers and compare the change in color of the exposed portion of the test piece with the standards patterns.

Table 8: Colour Fastness to Light

Samples	Colour Fastness to Light		
	Up to 2 days	Up to 5 days	Up to 8 days
Cotton dyed with Annatto	4/5	4/5	4
Organic cotton dyed with Annatto	4/5	4/5	4
Cotton dyed with Berberine	4/5	4	3 / 4
Organic cotton dyed with Berberine	4/5	4	3 / 4
Cotton dyed with Catchu	5	4/5	4/5
Organic cotton dyed with Catchu	5	4/5	4/5
Cotton dyed with Buck thrown	5	4	3 / 4
Organic cotton dyed with Buck thrown	5	4	3 / 4

3.4 Colour Fastness to Washing

A fabric that retains its color during care and use is said color fast state Poul ET AL (1993). The importance of color fastness depends upon the use of the fabric. For testing of fabric is 687 E (1979) was selected. A specimen measuring 2x4 inch of the material to be tested in cut out. Each sample was placed between the undyed cotton samples which have been desized well. The 3 pieces are held together by stitching on all four sides. Soap solution of about 5 gpl was prepared. Each of the samples was soaked in the soap solution separately for above ½ an hour. After that, the test samples were removed rinsed in cold water thoroughly squeezed well and dried. The color change and staining of the sample were assessed in compression with the grey scale.

Table 9: Colour Fastness to Washing

Samples	Colour Fastness to Washing	
	Colour Change	Staining
Cotton dyed with Annatto	4/5	4/5
Organic cotton dyed with Annatto	4/5	4/5
Cotton dyed with Berberine	4/5	4/5
Organic cotton dyed with Berberine	4/5	4/5
Cotton dyed with Catchu	4/5	4/5
Organic cotton dyed with Catchu	4	4
Cotton dyed with Buck thrown	4/5	4/5
Organic cotton dyed with Buck thrown	4/5	4/5

3.5 Colour Fastness to Rubbing

For testing of fabric is 766 method was selected. A wet fabric will crock more easily than the dry one because the moisture present assists is removing dye, states Pizzuto (1995). Sasmire crock meter was cut to a size of 10"x 8" and mounted on a flat base. A white material was mounted is to the rubbing finger with a ring. Each sample was given ten rubs based on the standardization. The color transfer from the dyed sample to the white material was assessed using grey scale. A damp white material was used for wet crocking. The procedure adopted was same as that of dry crocking.

Table 10: Colour Fastness to Rubbing

Samples	Colour Fastness to Rubbing			
	Dry		Wet	
	Colour Change	Staining	Colour Change	Staining
Cotton dyed with Annatto	4/5	5	4	4/5
Organic cotton dyed with Annatto	4/5	5	4/5	5
Cotton dyed with Berberine	5	5	4/5	4/5
Organic cotton dyed with Berberine	5	5	4/5	5
Cotton dyed with Catchu	4/5	4/5	4	4/5
Organic cotton dyed with Catchu	4/5	4/5	4/5	5
Cotton dyed with Buckthrown	5	5	5	5
Organic cotton dyed with Buck thrown	5	5	5	5

The results show that the colour fastness properties such as light fastness, washing fastness and rubbing fastness are good for the knitted organic cotton fabric dyed with natural dyes as compared to ordinary cotton knitted fabrics dyed with natural dyes.

3.6 Heavy Metal Content

Heavy metals such as copper, nickel, zinc, cobalt and iron contents are keenly checked and plotted in the table.

Table 11: Heavy Metal Content

Metals	Ordinary Cotton(ppm)	Organic Cotton(ppm)
Copper	1.08	0.92
Nickel	0	0
Zinc	4.32	3.55
Cobalt	0	0
Iron	3.96	3.22

The results show that the organic cotton dyed fabrics having less amount of metal contents as compared to ordinary cotton.

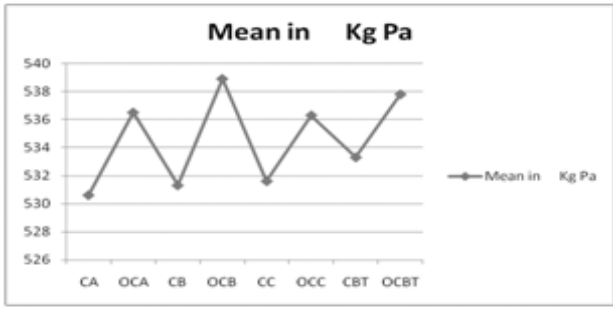

Fig.1 Bursting Strength

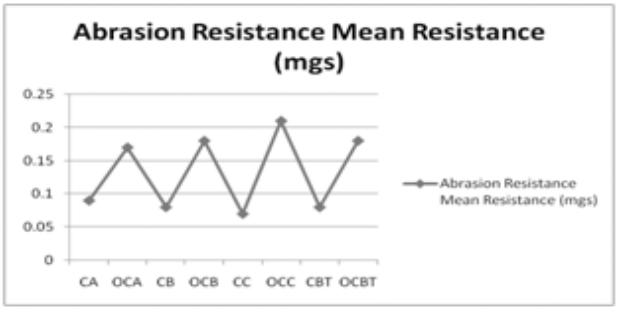

Fig.2 Abrasion Resistance

4. Conclusion

Textiles have such an important bearing on our daily lives that everyone needs to know something about them. From earliest times, people have used textile of various types of covering, warmth, personal adornment and even to display personal wealth. The environmental impact of the textile industry has become an important issue for consumers. The textile manufacturing process in characterized by the high consumption of resources like water, fuel and a variety of chemicals in a long process sequence that generates a significant amount of waste. When considering the environmental performance of fibers then the general consumer assumption is that 'natural' fibers are more environmentally friendly than manmade or synthetic fibers. From the study, it may be concluded that the selected material cotton and organic cottons are highly suitable for natural dyes. The extracted dyes produce different colors and shades. Compared to cotton, organic cotton with natural dyes are safe and eco-friendly. Therefore, their use will definitely minimize the health hazards caused and by the use of synthetic dyes. The comparison of cotton and organic cotton samples the properties like durability, strength and absorbency is much better than cotton.

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