Journal of Polymer and Biopolymer Physics Chemistry, 2014, Vol. 2, No. 3, 44-49
Available online at http://pubs.sciepub.com/jpbpc/2/3/1

DOI:10.12691/jpbpc-2-3-1

Comparatively Study of Natural and Polymeric Cotton

Karthikeyan M. R[1], Omprakash Sahu[2,*]

[1]Department of Textile Engineering, KIOT, Wollo University, South Wollo, Ethiopia
[2]Department of Chemical Engineering, KIOT, Wollo University, Kombolcha, Ethiopia
*Corresponding author: ops0121@gmail.com

Received June 17, 2014; Revised June 28, 2014; Accepted July 02, 2014

Abstract 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.

Keywords: *abrasion, bursting, dyes, fitness, light*

Cite This Article: Karthikeyan M. R, and Omprakash Sahu, "Comparatively Study of Natural and Polymeric Cotton." *Journal of Polymer and Biopolymer Physics Chemistry*, vol. 2, no. 3 (2014): 44-49. doi: 10.12691/jpbpc-2-3-1.

1. Introduction

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. In recent years, the textile industry had undergone modernization [1]. In addition to the conventional fibers (cotton, synthetics and wool) variety of fibers and blends have been introduced. New finishes have been developed to add new and interesting characteristics to fibers, yarns and fabrics. The latest development includes new machineries that process more fabric per unit time and conserve water, varied types of dyes has also been introduced [2]. Cotton is the world major textile fiber. It is one of the oldest and most versatile of all fibers and is able to contribute all of its good properties when blended with other fabrics [3]. Some of their basic characteristics differ, the better known kinds and type of cotton used in the United States are upland, American Pima, Egyptian and Asiatic cotton says MC. Graw hill. 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. The most hazardous available pesticides are used on cotton, of the available today during his study on pesticide used on cotton overseas [4].

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 [5]. 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. So organic cotton is gives a better result for environment problems [6]. 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. 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 [7]. 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. However this is a misleading and often inaccurate assumption [8]. When handled responsibly then the processing and production of manmade fibers compare favorably with 'natural' fibers in terms of environmental impact. All types of fiber have both upside and downsides in terms of their environmental performance. Organic cotton production is also a consumer driven initiative [9,10,11]. 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. Colors and dyes play an important role in the cycle of human beings. The colorful garments are

reflection of the culture. The growth of fashion has reached the peak in this fast growing civilization.

Thus the present investigation aim at developing an eco friendly natural cotton fabric dyed with natural dyes for textile application To dye the regular cotton and organic cotton materials with natural dyes, analyze the performance qualities of the knitted fabrics and evaluate the performance of the dyed knitted samples.

2. Material and Methods

2.1. Material

2.1.1. Cotton

Presently cotton is the world's most used fiber. Every part of the cotton plant is useful. The fiber is the most important part of the plant, because it's used is making cotton cloth. Cotton is the number of fiber used for apparel in US. In 1994 63% of cotton was used for apparel 29% for home furnishing 8% used for industrial type products and exportation. Cotton is one of the strongest cellulose fibers and it has excellent wicking, wetting and water absorption and retention properties. It is ideally suited for different end uses [12].

2.1.2. 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 [13].

2.2. Methods

2.2.1. Preparation of Fabric

The preparatory test for cotton material is scouring and bleaching. This treatment is given for removal of starch, natural coloring matters and other impurities. The required amount of water is heated till 95°C. The material is immersed for 1 hour, after 1 hour the material is taken out and washed with cold water. Then the material is dried. After Scouring the material is taken for bleaching. Bleaching is the oldest, the easiest, and the cheapest and perhaps the best method of bleaching cotton with oxygen becomes colorless. The oxygen from the air and grams liberated by the sunlight and in-conjunction with moisture is the active bleaching agent.

2.2.2. Dyeing

For the experiment 5 colors of natural dyes in various parts of the plants were selected. The plants and the parts we used to dye the cotton and organic cotton fabric are listed below.

Table 1. Dye Particulars

S.No	Common Name	Botanical Name	Parts Used	Material Used for Dyeing
1	Annatto	Bixa orellana linn	Seed	Cotton & organic cotton
2	Berberine	Berberis aristata	Root	Cotton & organic cotton
3	Catchu	Acacia catchu	Wood	Cotton & organic cotton
4	Buck thrown	-	Bark	Cotton & organic cotton
5	Chevallikodi	-	Root	Cotton & organic cotton

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 [14]. After the process is over the material is taken out and washed in cold water. For the experiment 12 samples are make which are mention below in Table 2.

Table 2. Nomenclature of the samples

S.No	Sample	Name
1.	C	Cotton
2.	OC	Organic cotton
3.	CB_1	Cotton dyed with Berberine
4.	OCB_1	Organic cotton dyed with Berberine
5.	CA_1	Cotton dyed with Annatto
6.	OCA_1	Organic cotton dyed with Annatto
7.	CC_1	Cotton dyed with Catchu
8.	OCC_1	Organic cotton dyed with Catchu
9.	CBT_1	Cotton dyed with Buck thrown
10.	$OCBT_1$	Organic cotton dyed with Buck thrown
11.	CCK_1	Cotton dyed with Chevallikodi root
12	$OCCK_1$	Organic cotton dyed with Chevallikodi root

2.3. Performance Test

2.3.1. Evaluations

The cotton and organic cotton dyed samples were evaluated in comparison with the original samples by both visually and laboratory tests. The tested samples were evaluated visually using a panel of hundred post graduate students specializing in the field of costume design and fashion as judges for evaluating the samples. General appearance, brilliance of color, evenness, texture and order were the major aspect taken in to consideration for visual inspection [15].

2.3.2. 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. The fabric was examined for weight, thickness, abrasion resistance and bursting test [16].

2.3.3. Color Fastness Test

A fabric that retains its color during care and use is said color fast state [17]. The importance of color fastness depends upon the use of the fabric. The samples were examine for washing rubbing and sunlight test.

3. Result and Discussion

3.1. Visual Evaluation

The visual evaluation was carried out for all 12 samples and examine for general appearance, brilliance of color,

texture, evenness and odor. The visual evaluations were summarized in Table 3.

From the Table 3 it is clear that the general appearance of cotton and organic cotton, scoured and bleached samples are taken. C_1 was rated as good by 38% of judges, followed by OC_1 which has rated as good by 45% of judges. General appearance of cotton sample CCK_1 was ranked first by 42% judges and followed by CA_1 and CC_1 which was rated as good by 40% of judges. In case of organic cotton samples $OCCK_1$ was rated first by 48% of judges and followed by OCA_1 and OCC_1 which was rated as good by 46% and 45% of judges. Brilliance of color in cotton CCK_1 was ranked first by 43% of judges and followed by CB_1 and CC_1 which was rated as good by 41% and 38% of judges. In the case of organic cotton samples $OCCK_1$ was rated first by 48% of judges and followed by OCB_1 and OCC_1 which was rated good as by 45% and 43% of judges. Evenness of cotton sample CCK_1 was rated first by 45% of judges and followed by CC_1 and CA_1 which was rated as good by 43% and 41% of judges. In the case of organic cotton samples $OCCK_1$ was rated first by 49% of judges and followed by OCC_1 and OCB_1 which was rated as good by 45% and 43% of judges.

Table 3. Visual evaluation of cotton and organic cotton dyed samples

S.N0	Samples	General appearance			Brilliance of color			Evenness			Texture			Odour		
		G	F	P	B	M	D	G	F	P	G	F	P	G	F	P
1	C_1	38	12	-	35	15	-	40	10	-	38	12	-	46	4	-
2	OC_1	45	5	-	42	18	-	45	5	-	45	5	-	48	2	-
3	CA_1	40	10	-	36	14	-	41	9	-	43	7	-	45	5	-
4	OCA_1	46	4	-	41	9	-	43	7	-	47	3	-	47	3	-
5	CB_1	36	14	-	38	12	-	42	8	-	41	9	-	46	4	-
6	OCB_1	40	10	-	43	7	-	45	5	-	45	5	-	48	2	-
7	CBT_1	37	13	-	37	13	-	41	9	-	42	8	-	45	5	-
8	$OCBT_1$	41	9	-	42	8	-	43	7	-	47	3	-	47	3	-
9	CC_1	40	10	-	42	9	-	43	7	-	41	9	-	41	9	-
10	OCC_1	45	5	-	45	5	-	45	5	-	46	4	-	43	7	-
11	CCK_1	42	8	-	43	7	-	45	5	-	43	7	-	45	5	-
12	$OCCK_1$	48	2	-	48	2	-	49	1	-	45	5	-	49	1	-

Note- G-Good, F-Fair, P-Poor, B-Bright, M-Medium, D-Dull

Texture of cotton sample CC_1 was ranked first by 43% of judges and followed by CC_1 and CBT_1 which was rated as good by 42% and 41% of judges. In the case of organic cotton samples $OCCK_1$ was rated first by 45% of judges and followed by OCC_1 and $OCBT_1$ which was rated as good by 43% and 41% of judges. Odour of cotton sample CC_1 was ranked first by 48% of judges and followed by CA_1 and CB_1 which was rated as good by 45% and 43% of judges. In the case of organic cotton samples $OCCK_1$ was ranked first by 49% of judges and followed by OCB_1 and $OCBT_1$ which was rated as good by 48% and 47% of judges.

3.2. Labotary Fitness Test

3.2.1. Fabric Weight

The fabric weight of test was examined for all samples, which is presented in Figure 1. Among these dyed samples weight is normally high compared than undyed samples. Hence it could be concluded that among all the cotton and organic cotton samples while dyed with natural dyes, basically the amount of weight is increased after dyeing.

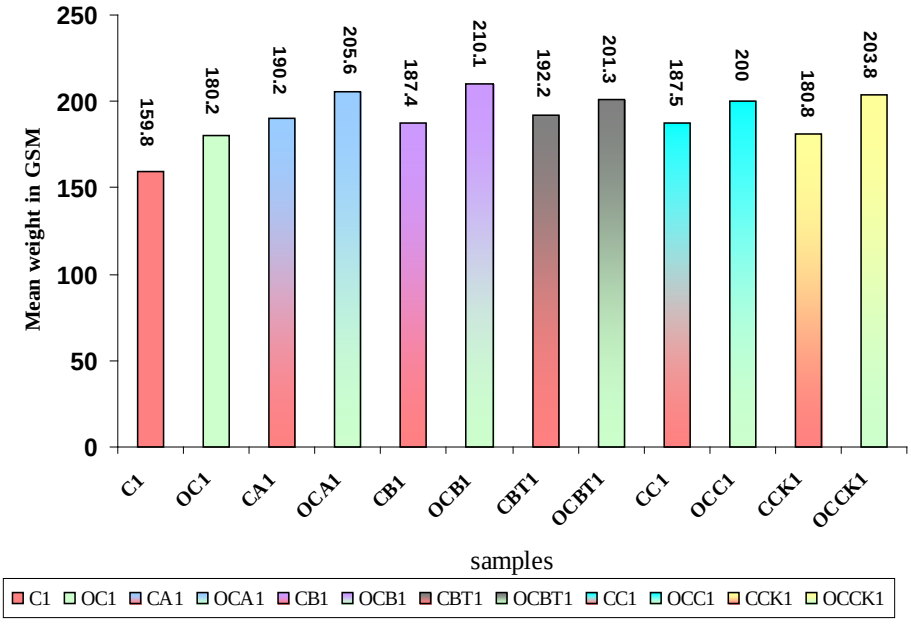

Figure 1. Fabric weight fitness test for different sample

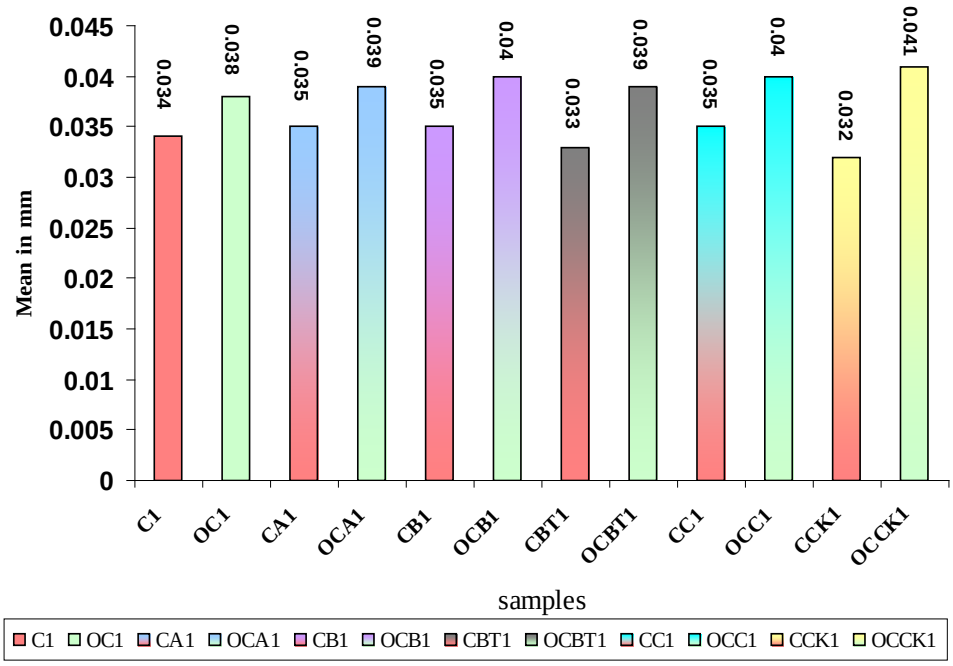

Figure 2. Fabric thickness fitness test for different samples

3.2.2. Fabric Thickness

The fabric thickness test was carried out for all the samples, which presented in Figure 2. The greater the mean value, the greater is the fabric thickness of the samples. Among these dyed samples thickness is normally high compared than undyed samples. Hence it could be concluded that among all the cotton and organic cotton samples while dyed with natural dyes, basically the amount of thickness is increased after dyeing.

3.2.3. Fabric Abrasion Resistance

The abrasion resistance fitness test was carried out for all the samples, which is shown in Figure 3. From the Figure it was found that 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 and organic cotton dyed samples shows increase in abrasion resistance

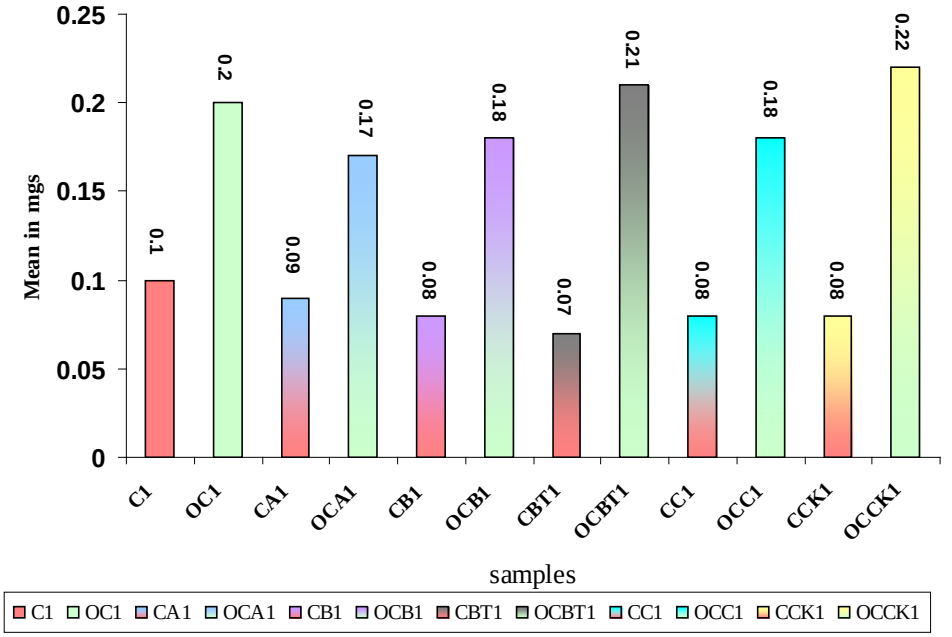

Figure 3. Fabric abrasion resistance fitness test for different samples

3.2.4. Bursting Strength

The warp strength fitness test was carried out for all the samples, which is presented in Figure 4. From result it was found that the cotton and organic samples were good strength in warp. The dyed organic cotton sample is maximum increased in strength compared to dyed cotton fabrics.

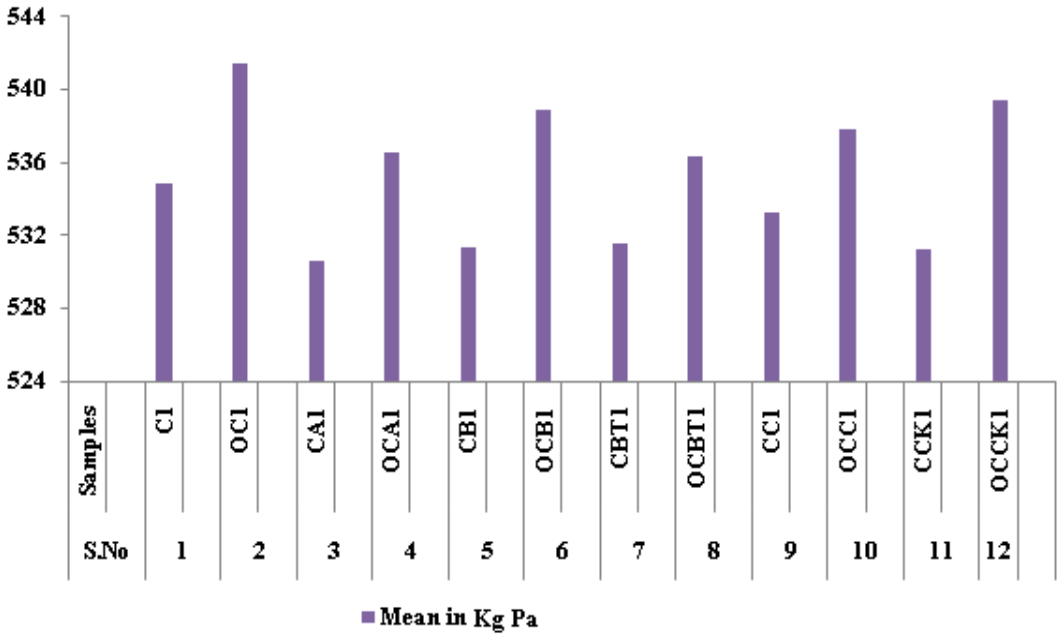

Figure 4. Fabric warp strength fitness test for different samples

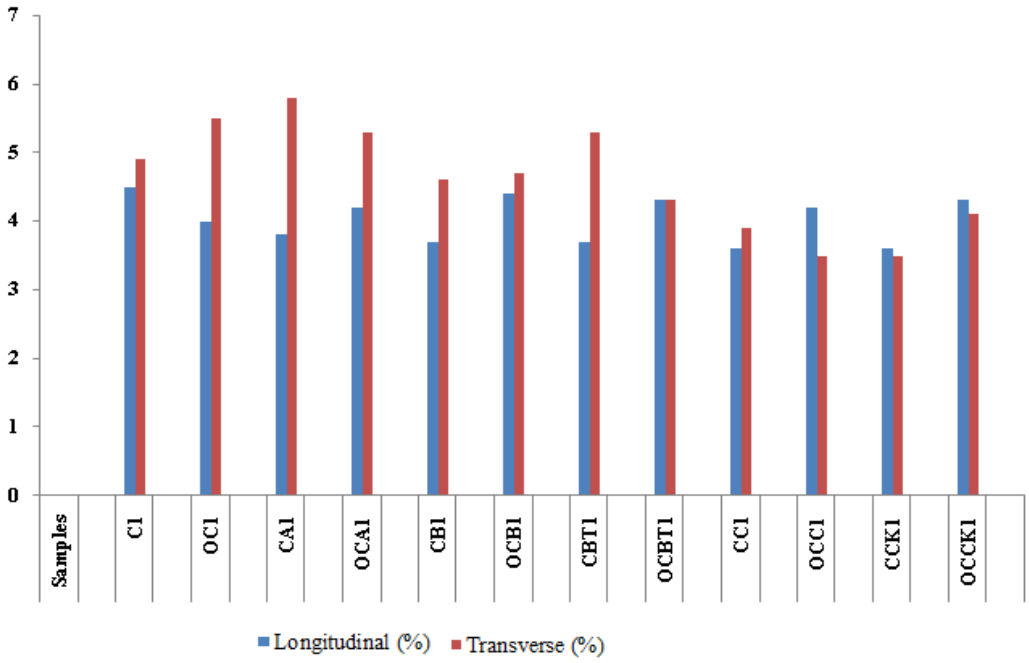

Figure 5. Fabric shrinkage fitness test for different samples

3.2.5. Shrinkage

The shrinkage fitness test was carried out for all the sample, which is presented in Figure 5. From the results it was found that the fabric shrinkage in Longitudinal (%) and Transverse (%) of knitted fabric are very less.

3.3. Color Fastness Test

The color fastness test light, washing and rubbing was carried out for all the sample, which summarized in Table 4. From the table it was observed that in color fastness to washing $OCCK_1$, $OCBT_1$, OCC_1, OCB_1, OCA_1 are excellent and very good colorfastness in organic cotton and then CA_1, CB_1, CBT_1, CCK_1 are rated as very good and good colorfastness in cotton. In color fastness to light CA_1, CB_1, CC_1, CBT_1, CCK_1 are rated as excellent and very good up to 2 days and then OCA_1, OCB_1, OCC_1, $OCBT_1$, $OCCK_1$ are rated as excellent and very good in organic cotton. Fastness up to 8 days means CA_1, CCK_1 are rated as very good and good in cotton and then OCA_1, and CCK_1 are rated as very good and good is organic cotton. In dry crocking all the samples had excellent fastness properties to color change and in staining CA_1, CB_1, CBT_1, CCK_1 are rated as excellent and very good in cotton and then OCA_1, $OCBT_1$, $OCCK_1$ are rated as excellent and good in organic cotton samples. In wet crocking all the samples had very good fastness properties to color change and in staining. CB_1, CBT_1, CCK_1 are rated as excellent and good in cotton and then OCA_1, OCB_1, OCC_1, $OCBT_1$, $OCCK_1$ are rated as excellent and good in organic cotton samples.

Table 4. Color fitness test for fabric

S.No	Sample	Colorfastness to light			Colorfastness to washing		Colorfastness to rubbing			
							Dry		Wet	
		Up to 2 days	Up to 5 days	Up to 8 days	Color change	Staining	Color change	Staining	Color change	Staining
1	CA1	4/5	4/5	4	4/5	4/5	4/5	5	4	4/5
2	OCA1	4/5	4/5	4	4/5	4/5	4/5	5	4/5	5
3	CB1	4/5	4	3/4	4/5	4/5	5	5	4/5	4/5
4	OCB1	4/5	4	3/4	4/5	4/5	5	5	4/5	5
5	CBT1	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4	4/5
6	OCBT1	4/5	4/5	4/5	4	4	4/5	4/5	4/5	5
7	CC1	5	4	3/4	4/5	4/5	5	5	5	5
8	OCC1	5	4	3/4	4/5	4/5	5	5	5	5
9	CCK1	5	4/5	4/5	4/5	4/5	5	5	4/5	4/5
10	OCCK1	5	4/5	4/5	5	5	5	5	4/5	4/5

Note- 1-Very poor, 2- Poor, 3- Moderate, 3/4 - Fair, 4- Good, 5- Excellent

4. Conclusion

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.

Reference

[1] AATCC, (1995), 'Technical manual of the American Association of Textile Chemist and Colorist', Col 70, American associations of Textile Chemists and Colorists, Canada. P. 23.

[2] Bhavasar. A.M, (2004),'Dyeing and Finishing of Cotton', Man Made Textile in India Journal, L. Simson publications, pp. 580.

[3] Chemical finishing of textiles (2004), edited by S.D. Wolfgang, Wood Head Publishing.

[4] Wickens hetty, 'Natural Dye for Spinners and Weavers', BT Batsford Limited, London.

[5] Priyank Dasgupta Brahma, 'Cotton Organic Orientations', Modern Textile Journal, Oct-Nov. 2007, pp. 19-23.

[6] Natural dyes February 2008, 'Colourage' – Gahlot, Mumbai-79.

[7] Environment production –April 2006, 'Colourage', pp. 52-54.

[8] Organic cotton – July 2006, 'Asian Textile Journal', pp. 75-79.

[9] Ravichandran. P, (2002), Colourage, Vol – XLIX. No. 11, The Future of Cotton, p. 1.

[10] Kaplan. N. S (2001), Textile Fibers, Abshishek Publication, Chandigar, pp. 203.

[11] Mary D. Boundrea and Frenderick A. Beleand (2006), the Journal of Environmental Science and Health, Part C, pp. 103-154.

[12] Mishra. S. P (2000), A Text Book of Fiber Science and Technology, New Age International Publishers, pp. 2.

[13] Natural Colored Cotton – July 2006, 'Colourage', pp. 57.

[14] Globalize Organic Cotton – November 2006, 'Apparel Online', pp. 16-30.

[15] Environment production – November 2006, 'Colourage', pp. 38-42.

[16] Iyer. N. D, (2001), 'Cotton the King of Fibers', Colourage, May, Colourage publications, pp. 75-76.

[17] Teli. M. D, Paul Roshan, Pardeshi. P.P, (2001) Natural Dyes, Classification Chemistry and Extraction Methods, Colourage, April 2001, 51.