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A COMPARISON OF PHYSICAL PROPERTIES ON SCOURED AND BABOOL DYED KHADI COTTON FABRIC USING ALUM AS A MORDANT

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ABSTRACT:

As dyed khadi cotton fabric has more acceptance than plain khadi cotton fabric and scoured khadi cotton fabric. Application of natural dye is always beneficial as synthetic dyes are more harmful to skin. So, in this study babool is used as a natural dye and alum as a mordant. Physical properties were changed when babool was used as a dye material and those changes in physical properties were tested and concluded in this study. Comparison of physical properties between scoured khadi cotton fabric and dyed khadi cotton fabric were shown in this research study.

These comparative effects of natural dyeing using babool and alum as a mordant on the physical properties of scoured khadi cotton fabric is the aim of this study. As synthetic dyes show environmental and dermatological hazardous effect their natural alternatives are gaining popularity. This study involved dyeing scoured khadi cotton fabric with babool bark extract using alum as a mordant. This experiment analyzed main physical properties, those are tensile strength, elongation, tearing strength, bending length and crease recovery. Result of this experimental work shown different physical properties with increased, decreased and stabled effects. In this way physical properties of scoured khadi cotton fabric and babool dyed khadi cotton fabric compared in this research study.

Keywords: *Khadi cotton fabric, Babool dye, Alum, physical properties.*

INTRODUCTION :

The name "Khadi," which comes from the word "khaddar," refers to a hand-spun and woven natural fibre textile that was first employed by Mahatma Gandhi in 1918 during the Indian subcontinent's freedom struggle. The phrase is used in Bangladesh, Pakistan, and India. In 1917–18, the Sabarmati Ashram produced the first piece of the hand-woven fabric. Gandhi called it 'khadi' because of the coarseness of the fabric. Cotton is typically spun by hand and woven into the fabric. But it might also comprise wool or silk, which are all spun into yarn on a Charkha, a type of spinning wheel. This fabric is warm in the winter and cool in the summer. Khadi/khaddar is occasionally starched to give it a firmer feel and to enhance its appearance.

Khadi became a key component and symbol of the Swadeshi movement in the 1920s when Mahatma Gandhi started encouraging its spinning for rural self-employment and independence (as opposed to mill-made).

Colour substance derived from natural sources are known as natural dyes. Up until the middle of the nineteenth century, natural dyes were utilized to dyeing and printing many kinds of fabrics. The introduction of synthetic dyes, which were affordable and had superior fastness qualities, led to a decrease in the usage of natural dyes. Natural dyes are becoming more popular, nevertheless, as a result of stricter environmental regulations, global environmental concerns, and rising consumer awareness of the harmful effects of synthetic dyes.

Although plants are the primary source of natural dyes, these dyes are essentially components of natural resources and are often categorized as plant, animal, mineral, and microbial dyes according to their place of origin.

Because they are biodegradable and renewable, natural dyes are sustainable.

Natural dyes can be made from roots, leaves, fruits, flowers, and bark. Each component can produce a different colour; for example, sappan-wood tree pods produce red, bark produces brown, and roots produce yellow. Dye can be made from a variety of plant by products.

The babool tree, also known as Acacia Nilotica, is a medium sized tree with golden yellow flowers and long white thorns. The bark of the tree is rough and is dark brown, wood reddish brown, hard and strong, useful for agriculture and much other purpose. The bark of the tree gives light brown colour which in combination with different mordants, gives different shades. Babool is suitable for Khadi cotton fabrics. It produces black, brown and khaki shades. Considering the toxic and carcinogenic effects of synthetic dyes, eco-friendly natural dye Babool, were selected and used for the study. (Mrs. V. Rajeswari, 2020).

In order to set (i.e., bind) dyes on textiles, a chemical known as a mordant or dye fixative forms a coordination complex with the dye, which subsequently adheres to the fabric (or tissue). It can be used to enhance stains in cell or tissue preparations or to dye textiles. Directs have generally replaced mordants in industry, however they are still used, particularly by small batch dyers. (Wikipedia).

The most often used mordant is alum. There are two kinds of this naturally occurring metallic mordant: aluminum potassium sulfate and aluminum ammonia sulfate. Potassium aluminum sulfate is inexpensive, accessible, and secure. Colour is unaffected. It enhances and intensifies the finished color. Textiles with more alum seem harsh and sticky. Cream of tartar, which aids in evenness and somewhat brightens, is typically added with it. (Prakash)

MATERIALS AND METHODS :

Material

Fabric

100% pure Khadi Cotton fabric was selected.

Metal Mordant: Alum (Aluminium sulphate)

Natural Dye: Babool (Acacia Nilotica)

Chemicals: Sodium chloride (NaCl) and Sodium Carbonate

Method

The dyeing of khadi cotton fabric was basically done in four stages, pre-treatment, extraction of dyes from root powder, mordanting and dyeing. The entire process of dyeing was done through control method.

Preparation of raw Material

Scouring of Khadi cotton fabric

The starch present in khadi cotton fabric was eliminated by scouring. Fabric to be scoured was pre-weighed. Ratio of material to liquor 1:20 Fabric was dipped normal water for 30 minutes. Then heated the water and salt was added and thoroughly mixed. After adding the soaked cloth, the temperature was maintained at 80°C for approximately 30 minutes while being agitated. After giving the material a thorough water treatment, it was allowed to air dry at room temperature.

Mordanting

Mordanting of the fabric was performed using alum 15% of weight of fabric. Material to liquor ratio 1:20 was taken. Mordant bath was maintained at 40°C temp and then added scoured fabric. Temperature was maintained at 80° C with constantly stirring for about 30 minutes. Then fabric taken out from dye and fabric was dried without washing.

Extraction of Dye

Used aqueous extraction method. Concentration of babool bark powder 30% of the weight of the fabric. Babool bark powder mixed with filter water and kept the mixture for an hour. Dye material to liquor ratio 1:30 and temperature 65° C for extraction of dye. Temperature was maintained at 65° C with continuous stirring for about 60 minutes. Throughout the process

extraction was carried out to get optimum colour of the solution. Solution was filtered to get clear extraction. Some drops of sodium carbonate were added to maintained pH value. pH value was 5.

Dyeing

Scoured khadi cotton fabric was dyeing with extract using material to liquor ratio was 1:30. Some drops of sodium carbonate for pH value. maintained pH value 5. Dye bath was at sa temperature 40° C and salt was added 10 gm per liter, after adding mordanted fabric. Then temperature was maintained at 60° C with continuous stirring for about 30 minutes. Fabric was taken out from the dye bath and dipped in regular water and then washed gently in non-ionic soap solution. Then dyed fabric was dried at normal room temperature.

RESULTS AND DISCUSSION :

Results of Fabric Tests

Elongation

IS 1969:1985 test method was taken for assessment of elongation of scoured khadi cotton fabric. As sample was dyed with madder using alum as a mordant it shown changes in their physical properties as per graph, I show that elongation of sample before dye i.e. scoured khadi cotton fabric was 10.0% as warp and 8.2% as weft. But when the same sample was dyed with babool using alum as a mordant their warp become 9.8% and weft become 5.8%.

Tensile Strength

IS 1969-1989 test method was taken for assessment of tensile strength in kg scoured and dyed khadi cotton fabric. When applied tensile strength test on same scoured khadi cotton fabric, as per graph II tensile strength of warp was 78.89 kg and tensile strength of weft was 56.46 kg. Then after application of dye tensile strength of same dyed sample become 67.16 kg on warp and 49.97 kg on weft.

Bending Length

IS 6490:1971 test method was selected for assessment of bending length in cm for scoured khadi cotton fabric and dyed khadi cotton fabric. Graph III shows that bending length of scoured khadi cotton fabric for warp was 1.36 cm and for weft was 1.45 cm. when it was dyed with babool using alum as a mordant its bending length for warp become 1.43 cm and for weft become 1.41 cm.

Tearing Strength

IS 6489:1993 test method for assessment of tearing strength was taken for scoured and dyed khadi cotton fabric. As per graph IV tearing strength of scoured khadi cotton fabric was 3942.40 gm for its warp and 3532.80 gm for its weft. When same sample dyed with babool using alum as a mordant its tearing strength become 3174.4 gm for warp and 2841.6 gm for weft.

Crease Recovery

IS 4681:1981 test method for assessment of crease recovery was selected for scoured and dyed khadi cotton fabric. As per graph V it shows that crease recovery of scoured khadi cotton fabric was 56.40° for warp and 54.00° for weft. When the same scoured fabric was dyed with babool using alum as a mordant its crease recovery become 60.8° for warp and 57.0° for weft.

CONCLUSION:

Different physical properties were tested on scoured khadi cotton fabric and babool dyed khadi cotton fabric. Combinedly result of all tests show different way of variation.

Elongation of dyed khadi cotton fabric was reduced when it dyed with babool and used alum as mordant. Tensile strength is also an important physical property due to dyeing of scoured khadi cotton fabric it shows reduction in tensile strength. Tearing strength of the fabric was observed in grams. Results of tearing strength test shows it decreased in tearing strength as compared plain khadi cotton fabric

with dyed khadi cotton fabric. Bending length of both the samples were tested it shown increase in bending length as compared warp of plain khadi cotton fabric with warp of dyed khadi cotton fabric. But bending length of weft of plain khadi cotton was decreased when it dyed. Crease recovery of both fabrics was tested with specific tests to observe its change. It shows that crease recovery angle of plain khadi cotton fabric was increased when it dyed.

REFERENCES :

Author Prakash, book title- Textile colouration and finishes.
https://ebooks.inflibnet.ac.in/hsp09/

Abdu Zubairu, Yusuf Madu Mshelia (2015), Effects of Selected Mordants on the Application of Natural Dye from Onion Skin (Allium cepa). Department of Chemical Engineering, University of Maiduguri, Borno State, Nigeria, Science and Technology 2015, 5(2): 26-32 DOI: 10.5923/j.scit.20150502.02

Dhunki, 2020. Studied at National Institute of Fashion Technology. https://www.quora.com/What-are-the-properties-of-Khadi-cloth

Mazharul Islam Kiron (2022), Textile learner, one stop solution for textile, Natural Dyes: Properties, Classification, Production, Advantages and Disadvantages.
https://textilelearner.net/natural-dyes-properties-types-production/

Mrs. V. Rajeswari, (February 2020), Volume 5. Application of Natural Dye from Babool Bark on Cotton Fabric using Mordent. International Journal of Scientific Development and Research (IJSDR).

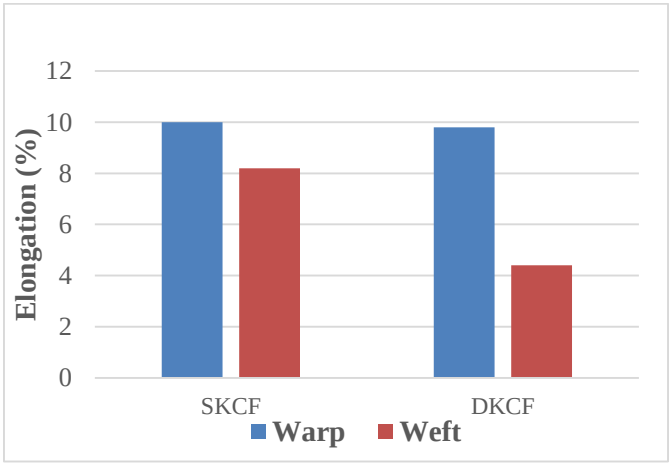
Needhi Dhoker, (15 Nov. 2018). Things To Know About Khadi Fabric.

S. Karpagam Chinnammal, Natural Mordants. Textile colouration and Finishes https://ebooks.inflibnet.ac.in/hsp09/chapter/natural-mordants/

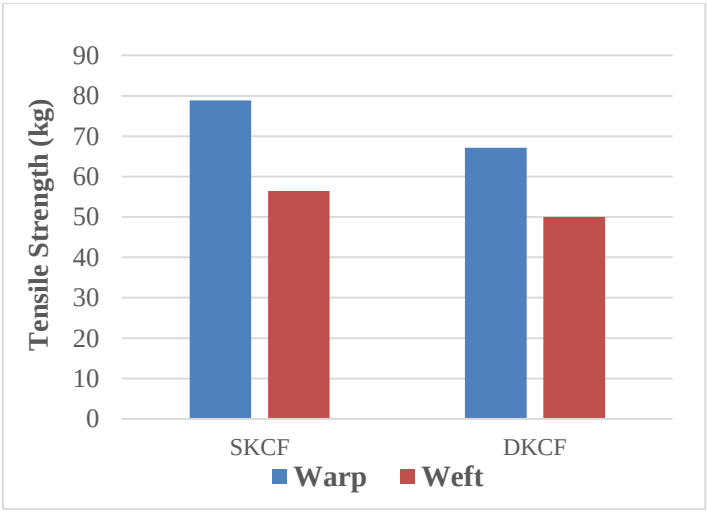
Sujata Saxena and A.S.M. Raja. Natural Dyes: Sources, Chemistry, Application and Sustainability Issues. Central Institute for Research Cotton Technology, Mumbai, India.

Wikipedia
https://en.wikipedia.org/wiki/Main_Page

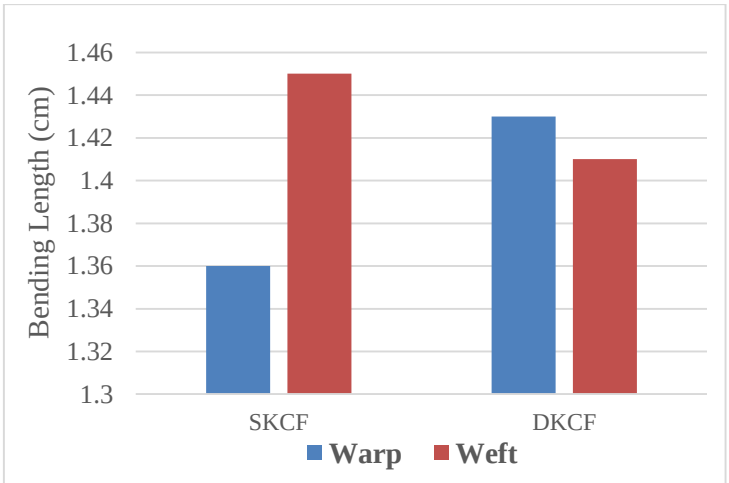
Wikipedia
https://en.wikipedia.org/wiki/Khadi#mw-head



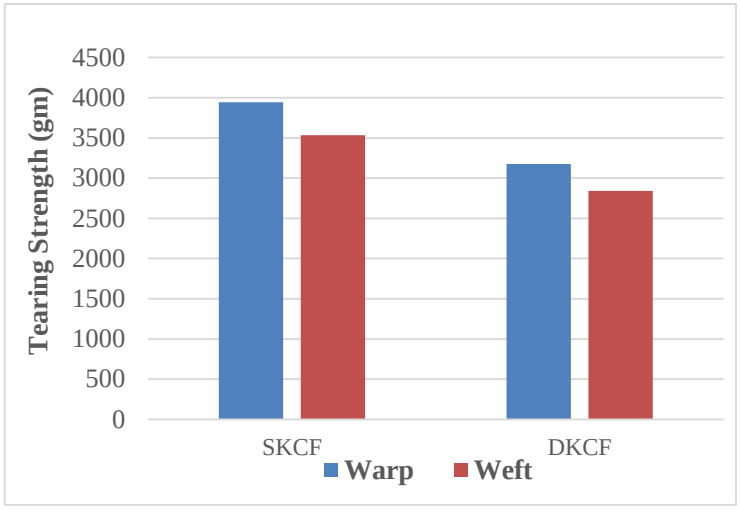
GRAPH I Elongation



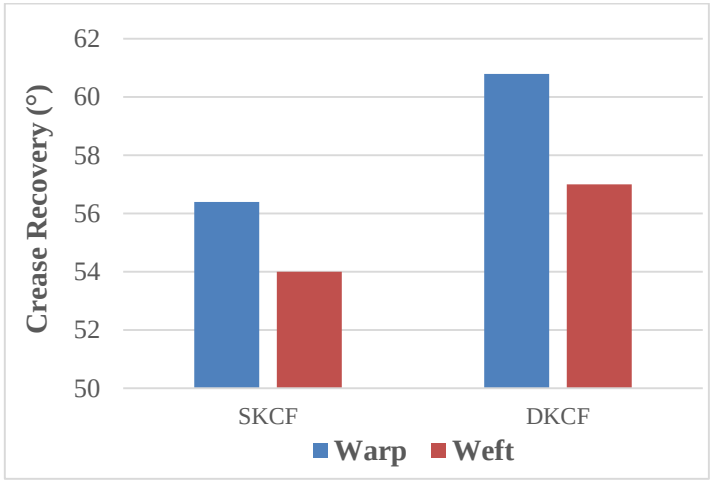
GRAPH II Tensile Strength



GRAPH III Bending Length



GRAPH IV Tearing Strength



GRAPH V Crease Recovery