DEVELOPMENT OF NEW VEGETABLE DYES FOR *Kalamkari* PAINTING AND TO ASSESS THEIR COLOUR FASTNESS PROPERTY

THESIS SUBMITTED TO THE
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(TEXTILES AND CLOTHING)

BY

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CERTIFICATE

Kumari S.Udayini has satisfactorily prosecuted the course of research and the thesis entitled **DEVELOPMENT OF NEW VEGETABLE DYE FOR KALAMKARI PAINTING AND TO ASSESS THEIR COLOUR FASTNESS PROPERTY."** -Submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part there of has not been previously submitted by her for a degree of any university.

DATE : 16/4/88

DR.(MRS) MARY JACOB.

MAJOR ADVISOR.

CERTIFICATE

This is to Certify that the thesis entitled, **"DEVELOPMENT OF NEW VEGETABLE DYES FOR KALAMKARI PAINTING AND TO ASSESS THEIR COLOUR FASTNESS PROPERTY."** -Submitted in partial fulfilment of the requirements for the degree of **"Master of Science in Home Science "** of the Andhra Pradesh Agricultural University, Hyderabad, is a record of the bonafide research work carried out by Kumari S.Udayini under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.

NO part of the thesis has been submitted for any other degree or diploma has been published. Published part has been fully acknowledged. All the assistance and help received during the course of the investigation has been duly acknowledged by her.

(DR.(MRS) MARY JACOB.)

Chairman of the Advisory Committee

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ABSTRACT

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The present study was undertaken with the objectives of extracting four new vegetable dyes which are not being used for Kalamkari painting and to assess their colour fastness to washing, sunlight, perspiration, crocking and pressing.

Keeping in view of the existing vegetable dyes that are used for Kalamkari, orange, blue, garnet and lavender colours were selected. The four colours namely orange from Bixa orellana, blue from Indigofera tinctoria, garnet and lavender

from Caesalpinia sappan were extracted by series of experiments. The extracted dye was applied to desized and bleached cotton material and suitable after treatments were given to fix the dye. The colour fastness property of the extracted dyes to washing, sunlight, perspiration, crocking and pressing were assessed.

From the findings of colour fastness tests with regard to overall efficiency it was found that the blue had the best colour fastness followed by orange, garnet and lavender. Blue colour showed fair resistance to washing, sunlight, crocking, perspiration and pressing. Orange ranked second. Though it had poor fastness to sunlight it can be used as drying is usually done under shade. Garnet and lavender colours had similar colour fastness. As they showed poor resistance perspiration they can be used only for wall panels.

CHAPTER - I

INTRODUCTION

Indian art is intimately tied with the centuries old religion, literacy and mythological traditions. Painting on textiles is an art for which Indian textiles have been chiefly famed abroad. In painting of cotton, the dyes and mordants are applied freely by hand with a brush. Thus every painting has a character of an individual drawing with a human and sensous touch. One of the famous such hand paintings is the Kalamkari painting. Baker (1970)describes Kalamkari, " As examples of decorative art, some of these printed calicos are unsurpassed in design; they reveal an art which has reached such a pitch of perfection that it presupposes long centuries of apprenticeship and practice".

Kalamkari art is as old as India's heritage. Emberumal (1983) winner of master craftsmen award of the All India Crafts Board, expressed that "Kalamkari was the name given to handpainted dyed fabrics unsurpassed for attractiveness of design and richness or colour, these were actually an extension of fresco or mural tradition". "Kalamkari" is made up of two Telugu words. Kalam meaning pen and kari meaning work. Kalamkari art has always been a cottage industry. Kalamkari fabrics of Andhra Pradesh from Sri Kalahasthi (Chittoor District) and Masulipatnam (Krishna District) are considered as one of the most popular art fabrics of India.

Kalamkari industry in Masulipatnam and Srikalahasti are known as Addakkam and Rathapani respectively. Initially the Kalamkari painting of Masulipatnam and Srikalahasti were entirely painted with Kalam (pen), but now at Masulipatnam wooden blocks are used for the printing outlines. The design on the Masulipatnam Kalamkari fabric is block printed and then the colours are painted with Kalam, whereas in the case of the Kalahasti product the entire work including the outline is done with the Kalam. The painting of dyes and mordants completely with a Kalam , gives each design an individuality of character, while printing of colours using a block gives the Masulipatnam Kalamkari a mechanically repetitive designs. So the products of Kalahasti are referred to as Kalamkari painted goods while that of Masulipatnam refers to as Kalamkari printing.

The art of Kalamkari in Kalahasti and Masulipatnam though arising from a common foundation, differs greatly with regard to the idealism and philosophy. Kalahasti being under Hindu rule and piligrim center, the Kalamkari artist developed sacred connotation and the art is considered as an act of devotion. So the themes adopted for the designs are from the epics and puranas. The following are some of the themes - Dhruvavijayam, Sitarama Kalayanam, Mahabharata etc., Masulipatnam on the other hand had the intluence of Muslim ruled state of Golconda, hence predominates in the usage of Islamic Ornamentation.

These art arose out of the need of trade with other nations hence it was not religion, but rather the tastes and demands of foreign and local consumers influence the themes. The common motifs of Kalamkari printing are tree of life, Buddha, birds, horses etc., All the natural forms are reduced to stylised and geometric designs. Some of the fine varieties of Kalamkari are so perfect that at a distance of few feet, they can be distinguished only with great difficulty from very fine Kashmir embroidered shawls. Havell (1971) described about the designs of Kalamkari as scenes from Hindu epics like Ramayana, Mahabharata and others are exact reproductions with richness of architectural frame work and elaboration of Jewellery. But apart from their interest, the wonderful effect of the arrangement of colour gives them an artistic value of high order.

With regard to dyes and colours, both places claim the use of vegetable dyes that are famed for their deep rich shades. The art of using pigments of ornament fabrics has an ancient origin. When natural dyes are used there is limitation in variety of colour and brightness. Black, red, yellow, blue and green are the colours used for making Kalamkari paintings. Each colour is used according to its significance. Black is the major colour used for the strong outlines, producing a bold and striking effect, red is the colour for joy, passion and happiness, strength and virility. Green stands for youth and life, yellow is identified with cheerfulness, intellectualism and life givings of the Sun.

Kalamkari art is becoming increasingly popular today. Kalamkari textiles include bedspreads, wall hangings, table cloths, curtains, dress materials and many other forms ranging from small designs to curtains portraying an entire mythology are available. Most of the Kalamkari fabrics are being exported to foreign countries like U.K., U.S.A., France and Germany. Inspite of the heavy demand for Kalamkari fabrics in abroad and in India only five common colours are used. Not much of research work has been done on natural dyes and hence colours are limited in number for Kalamkari. Kalamkari fabrics can be made more interesting by minimising the monotony of using same old colours. At present instead of indigo blue, laundry blue is used at higher concentrations. Therefore, the study was undertaken to make some more colours like orange, blue, garnet and lavender to already existing colour scheme in Kalamkari painting. The experts and artists involved in this art besides the consumers are of the opinion that any addition to the existing colours is always accepted with great interest.

Colour fastness of textile material is of considerable importance to the consumers. The colour fastness depends not only on the nature and depth of the shade of dyestuff used but also upon the nature of dye and method of dyeing. Hence, it is also proposed to assess the colour fastness characteristics of the developed dyes.

This study was therefore undertaken with the following specific objectives:-

1. To extract four new vegetable dyes which are not being used for Kalamkari painting at present.

2. To assess the colour fastness property of the extracted dyes to washing, sunlight, crocking, pressing and perspiration.

LIMITATIONS OF THE STUDY :

The study is limited to only four colours namely orange, blue, garnet and lavender due to paucity of time.

CHAPTER - 2

REVIEW OF LITERATURE

Review of literature gives an idea about the work done related to the present area of investigation and provides a frame of reference for theoritical insight. Not much of research literature is available in Kalamkari field, but a few articles were published regarding processing of fabric for Kalamkari, dyes and motifs used. The available literature collected from different sources are presented under the following sections for clarity.

2.1 Origin of natural dyes.

2.2 Origin of Kalamkari art.

2.3 Kalamkari centers

2.4 Kalamkari technique

2.4.1 Fabrics used

2.4.2 Equipment and raw materials

2.4.3 Bleaching

2.4.4 Designs and motifs

2.4.5 Colouring process

2.5 Studies on colour fastness property.

2.1 ORIGIN OF NATURAL DYES :-

The knowledge and use of colour began with the dawn of civilisation. In the beginning man utilised the colours that he found in the earth. Long before the birth of textile industry,

man decorated the skins of animals and barks of trees with various natural dyestuff and pigments that were available (Dutta, 1953). The art of using pigments to ornament fabric has an ancient origin. The discovery of a fragment of madder dyed fabric at Mahenjo-daro stuck to a silver vase shows that vegetable dyes were known in India 5000 year ago (Jayakar, 1979).

2.2 ORIGIN OF KALAMKARI ART :-

Like many of the decorative arts, textile ornamentation is a branch of the creative arts which embraces any method of applying colour or design to a woven fabric (kafka, 1959). The Kalamkari industry is one of the most ancient industries of India. It was reported that dyed sheets of Kalamkari were traded from Ist century A.D. (Thomas, 1983). Kalamkari is world famous and is greatly appreciated by foreigners, even before the Christian era. The tradition of cloth painting flourished throughout India from the 14th Century long before chemical colours and dyes were discovered (Marg).

2.3 KALAMKARI CENTRES :-

Kalamkari, the art of painting on Cottons using the indigeneous pen or Kalam is practised over a wider areas like Portugal, England, Persia and Dutch (Varadarajan, 1979). Kalamkari, a kind of picturisation on cloth is done in many parts of India, but the best known are in Rajasthan, Gujarat, Orissa

and West Bengal besides Andhra Pradesh. Kalahasti and Masulipatnam of Andhra Pradesh are noted for Kalamkari paintings (Chattopadhyay, 1985).

2.4 KALAMKARI TECHNIQUE :-

2.4.1 *FABRICS USED* :-

For Kalamkari painting, thick unbleached cotton cloth of about $25^{S'}$ count of the required size is used (Census of India, 1961). According to Gurappa Chetty who is a National Award Winner in the field of Kalamkari, silk can also be used for painting.

2.4.2 EQUIPMENT AND RAW MATERIALS :-

The sketches are drawn on the cloth guided by imagination, knowledge of epics and artistic instinct (Indian Kalamkari, 1971) The preliminary outlines are sketched with charred tamarind twigs (Joshi, 1983). The Kalam or brush is of wooden piece with a ball of cotton or jute tied at one end, for the absorption of dye. In early times, the designs were entirely painted with brushes or Kalams but later on, brushes were substituted by block printing to compete with machine printed fabrics of late nineteenth and twentieth centuries (Marg, 1980). Today the best quality Kalamkari is a product of the careful blending of block printing and hand painting, a process both complicated and laborious (Pal, 1978).

Most of the natural dyes will not give a fast colour unless a mordant is used. Usually alum (Aluminium Sulphate) is used to fix some of the dyes. When used in large quantities it tends to brighten up the colours (Brand, 1907). Chrome (Bichromate of Pottassium), iron (Ferrous Sulphate) and copper compounds such as sulphate and nitrate can also be used as mordants (Mullins, 1974). The dyes used in Kalamkari follow mostly the old tradition of extracting colours from plants, roots, trees and similar natural sources, as also from minerals like iron, coal and compounds like alum (Marg, 1980). Myrobalans, jaggery, madder and turmeric are commonly used as indigeneous dyes. Myrobalan (Terminaliachebula) gives a very light yellow colour when used by itself. This helps in developing and stabilising the black dye and serves as a back ground (Joshi, 1983). Black dye or Kasam is a mixture of molasses and iron fillings (Chattopadhyay, 1985). When the Kasam is applied on plain cloth without myrobalan base, the black colouring does not develop (Census of India, 1961). The bark or root of Rubia cardifolia (Manjistha) produces a deep red dye. The strongest pigment is just under the rind, and the fresh is twice as potent in colour as the dried. The important chemicals in madder are alizarin and purpurin (Brown, 1983). Turmeric is the tuber of the Curcuma tintoria and is a commonly used dye. It gives a brilliant yellow colour when dyed (Robinson, 1969). Mango bark (Manifera indica) or Pomegranate rind (Punica granata) is also used as a substitute for turmeric (Lintault, 1982).

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2.4.4 DESIGNS AND MOTIFS :-

The themes adopted for the designs are from the epics and puranas. There is no standard book of designs or scenes from which the artist craftsman can copy out the panels. The panels usually have attractive, purely decorative borders within which the scenes are painted. The court scenes and marraige pandals in particular are embellished with beautiful line drawing in the borders. The motifs are both religious and secular (Census of India, 1961).

2.4.5 COLOURING PROCESS :-

For the completion of Kalamkari fabrics, nearly two months will be taken as the cloth has to undergo thirteen stages of preparation. The bleached cloth is soaked in milk to prevent Kasam or black dye used for outlines from spreading. Fabric treated with myrobalan serves as ground for black colour (Joshi, 1983). The outline of the design is finished with black colour by using the reed pen (Lewis, 1953). Wherever red is needed, a solution of alum is applied with Kalam and is allowed to dry in the sun. The cloth is boiled in the solution of madder and surudu bark for half an hour. The areas that are painted with alum turn dark red (Lintault, 1982). Then the green colour is applied. The combination of blue and yellow colours turns to green. Blue dyeing was originally done in batik style with

indigo. Because of complicated process Kalamkari makers today prefer to use chemical dye applied with the Kalam (Lintault, 1982).

2.5 STUDIES ON COLOUR FASTNESS PROPERTY :-

Iravathy (1964) compared the dyeing qualities of indigeneous dyes like Catechue (Acacia catechue), Turmeric (Curcuma tinctoria) Safflower (Carthamus tinctorius) and Mehndi (Lawsonia nermis) with synthetic vat and direct dyes by producing corresponding colours. It was reported that catechu when subjected to washing test was inferior in quality to vat dyes but superior to direct dyes. Turmeric colour showed a slight decrease in colour change than those dyed with direct dye. It was found that indigeneous safflower dye when compared to vat and direct pink dyes had the least efficiency for dyeing. The study on the natural sources revealed that fabric dyed in mehndi extracts had good colour fastness.

Molly Simon (1966) studied the effect of shoeflower (Hibiscus rosasinensis), Turmeric (Curcuma tinctoria) and Catechu (Acacia catechu) with different mordants like alum, chromium and ferrous sulphate for printing on cotton and silk. When the specimens were subjected to laundering at 70 °C, cotton was found to have less colour change but silk showed less colour transfer with alum mordant. It was reported that for dry crocking on printed specimen, both the fabrics were equally good but for wet

crocking catechu with chromium mordant showed very slight decrease in colour change and colour transfer. Results of acid perspiration test proved that cotton was rated as best fabric for colour change and silk for colour transfer. It was reported that in alkaline perspiration treatment, colour transference on silk was less but colour change in both the fabrics were minimum.

Sheila Subramaniam (1974) found the effect of synthetic direct dyes for Kalamkari work on silk and cotton in comparison with four traditional colours such as black (iron and jaggery), red (madder), yellow (turmeric) and blue (indigo). The colour fastness test to laundering, sunlight, perspiration, crocking and pressing were conducted. The natural indigeneous dyes were found to be more colourfast than direct dyes with the exception of turmeric. It was reported that both direct and natural dyes did not exhibit any colour change when subjected to laundering test. When subjected to laundering and perspiration tests, it was reported that except black and blue vegetable colours all the other colours have shown colour transfer to white material. It was indicated that though the Kalamkari dyes did not have as bright shades as the direct dyes, they are proved to be superior in colour fastness to almost all the tests such as laundering, sunlight, pressing etc. The study concluded that direct dyes are suited for application to the Kalamkari technique as they can be directly applied to the fabric and need no elaborate preparation of cloth. The only draw back is that when materials are direct

dyed, they are not fast to laundering and pressing, which can be overcome by using special finishes like chroming and topping.

Sarada Devi (1981) compared the Kalamkari work done on cotton and silk. The effectiveness of black, red and yellow vegetable dyes used for Kalamkari were tested for their colour fastness to sunlight and laundering. It was reported that pure vegetable hues cannot be obtained like the red in reddish brown hue, the black in very deep grey with the exception of yellow. It was proved that black and red colours were fast when subjected to colour fastness tests to washing and sunlight. The study revealed that vegetable dyed samples were resistant to bleeding both on cotton and silk. It was reported that though the vegetable dyed samples have not got bright appearance, they proved to be superior in colour fastness to washing in low and high temperature and also to sunlight exposure. The study concluded that both cotton and silk Kalamkari works were good even after exposure to hot sun and laundering.

Vasugi (1984) investigated the dyeing behaviour and fastness properties of natural red alizarin dye. The visual inspection tests proved that the evenness of dye on both cotton and silk, had excellent rating. It was found that compared to silk, cotton has shown excellent rating. It was reported that general appearance of Alizarin red on cotton was better than that of silk fabrics. The results of the sunlight test proved that

silk showed excellent rating than cotton which showed very good resistance to sunlight. It was observed that both cotton and silk dyed samples had good resistance to laundering. The study concluded that both the cotton and silk vegetable dyed fabrics showed negligeable rate of colour change and transfer to dry crocking, where as for wet crocking colour change and colour transfer was noticable.

CHAPTER - 3

MATERIALS AND METHODS

The experimental procedure of this study consists of the following steps :

3.1 Selection of fabric.

3.1.1 Preparation of the fabric.

3.2 Selection of the dyes.

3.3 Standardisation of the dyes preparations.

3.3.1 Preparation of orange dye.

3.3.2 Preparation of indigo blue dye.

3.3.3 Preparation of garnet dye.

3.3.4 Preparation of lavender dye.

3.4 Application of the dye.

3.5 Colour fastness tests.

3.5.1 Colour fastness to washing.

3.5.2 Colour fastness to sunlight.

3.5.3 Colour fastness to crocking.

3.5.4 Colour fastness to perspiration

3.5.5 Colour fastness to pressing.

3.6 Statistical Analysis of the data.

3.1 Selection of fabric.

Five meters of gray cloth which is commonly used for Kalamkari was selected for this study.

3.1.1 PREPARATION OF THE FABRIC :-

The fabric was desized by boiling in water for ten minutes and then bleached by steeping overnight in cowdung solution at the ratio of 1:4 (1 part of cowdung in 4 parts of water). Then the fabric was rinsed thoroughly and exposed to sunlight. The fabric was moistened occassionally to prevent thorough drying. This process was repeated for two days and then the cloth was washed and dried. The bleached material was steeped in buffalo milk for ten minutes to prevent spreading of the dye while dyeing. The material was then dried thoroughly without rinsing.

3.2 SELECTION OF DYES :-

The four colours which can be extracted from vegetable sources but are not being used for Kalamkari work were selected, namely orange, blue, garnet and lavender.

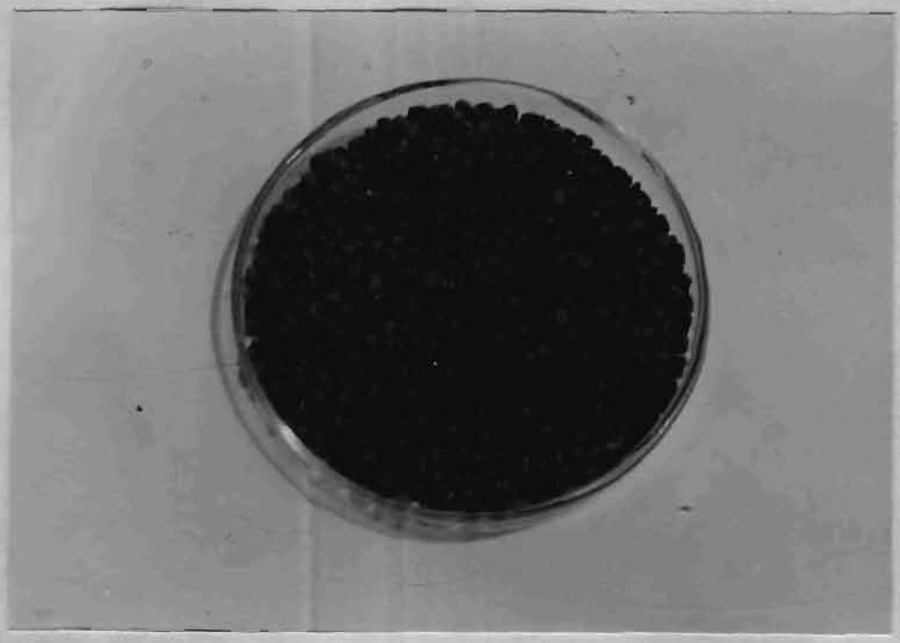
3.3 STANDARDISATION OF THE DYE PREPARATION :-

The selected colour preparation were standardised by series of preliminary tests until uniformly desired quality colour was obtained. The details of the ingredients, proportions used and method of preparation are given below.

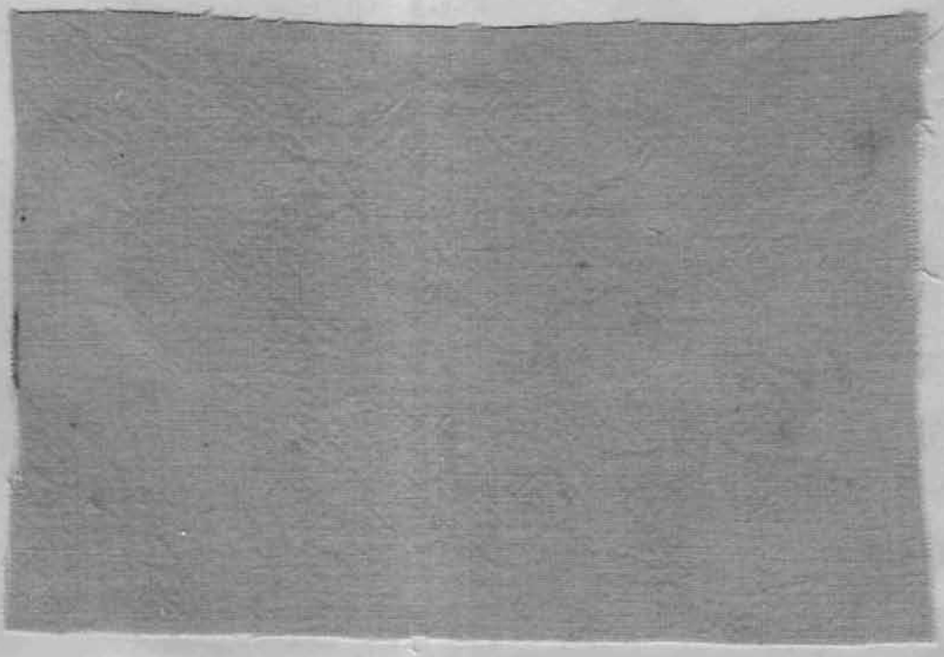
3.3.1 PREPARATION OF ORANGE DYE :-

The orange red seeds of Bixa orellana (Annatto)was used as raw material for orange colour.

Fig : 1 Photograph of Bixa orellana.



1.1 Sample of orange dyed fabric.



Bixa orellana Linn seeds (Annatto) was procured from Forest Department Government of Andhra Pradesh, Hyderabad. The seeds were cleaned by removing extraneous matter.

INGREDIENTS :

Annatto seeds	-	20 grams
Washing soda	-	5 grams
Water	-	500 C.C.

Annatto seeds were soaked in 500 C.C. of water for four hours and boiled with washing soda until the extract was reduced to half the amount. Washing soda was added to dissolve the dye in water.

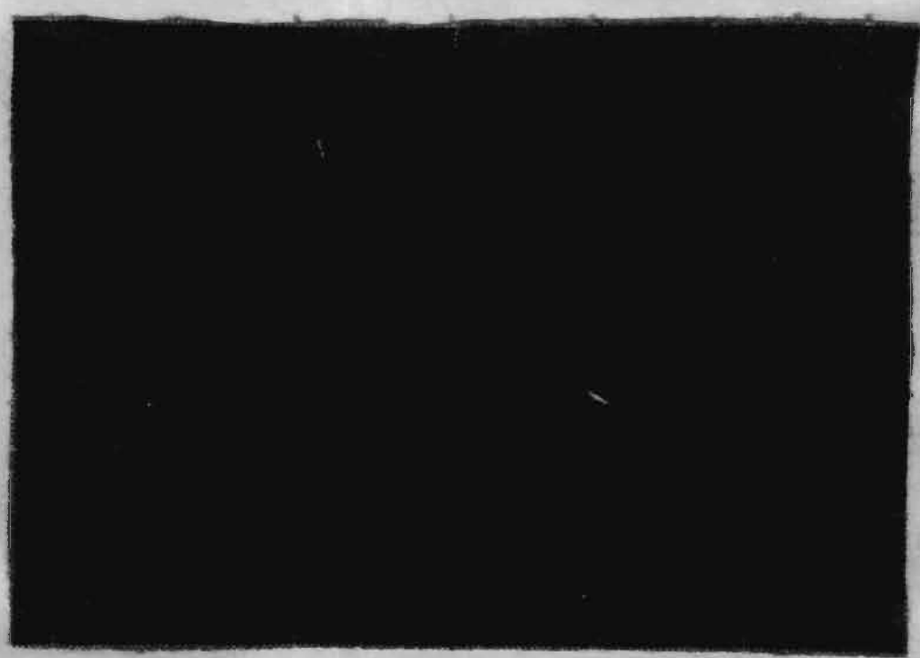
3.3.2 PREPARATION OF INDIGO BLUE DYE :-

Indigo is cultivated in Cuddapah, Kurnool and Guntur districts of Andhra Pradesh. The green leaves of Indigofera tinctoria (Nili) are the source of vegetable blue dye. The indigo cake was obtained from the manufacturers of Indigo in Devunicuddapah and then made into powder.

INGREDIENTS :

Indigo blue	-	5 grams
Sodium Hydrosulphite	-	2 grams
Caustic soda	-	2 grams
Water	-	250 C.C.

2.1 Sample of blue dyed fabric.



Caustic soda was dissolved in 20 C.C. of water. Dye powder was added to caustic soda solution. Caustic soda was used to dissolve indigo blue as it is insoluble in water. Sodium hydrosulphite was added to the dye solution just before application of dye as it acts as a reducing agent. The solution at this stage is yellow green in colour.

3.3.3 PREPARATION OF GARNET COLOUR :-

The orange red heart wood of Caesalpinia sappan (Patang) was used as raw material for garnet colour.

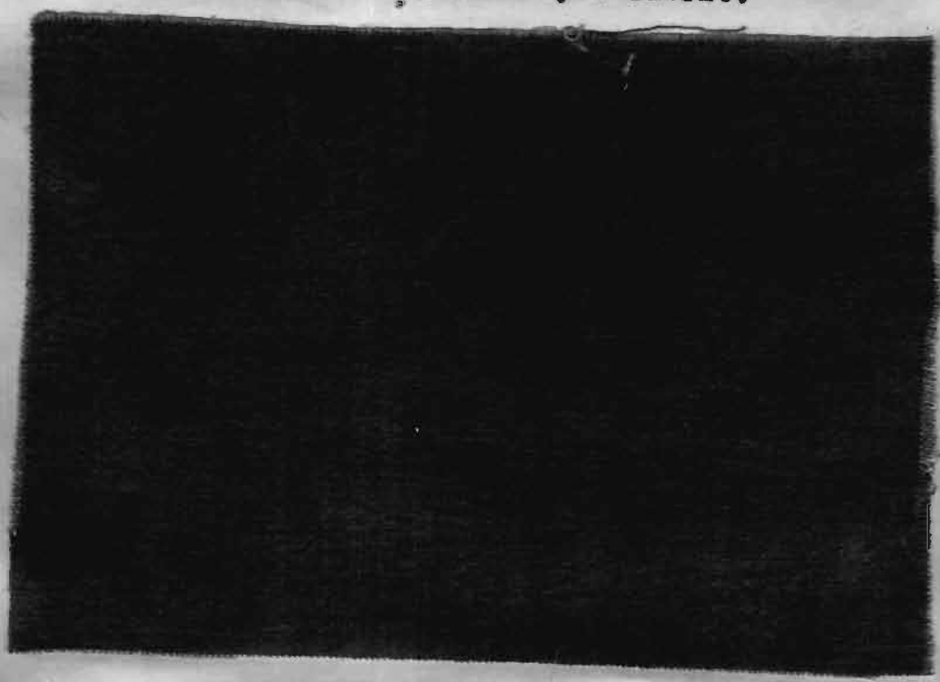
Caesalpinia sappan linn is mostly used for ayurvedic purpose, therefore, the wood was collected from ayurvedic stores. The wood was made into chips for the extraction of the dye.

INGREDIENTS :

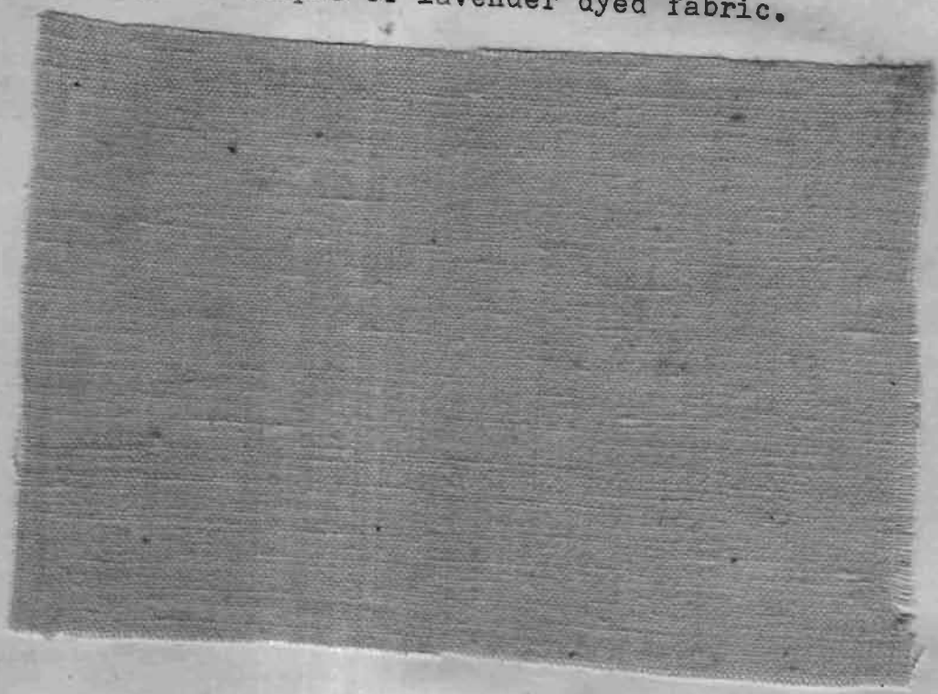
Wood chips	-	30 grams
Copper sulphate	-	7.5 grams
Washing soda	-	7.5 grams
Water	-	600 C.C.

The wood chips were soaked for three hours in 600 C.C. of water. The solution along with wood chips and washing soda was boiled until the quantity of water got reduced to half the amount. Washing soda was added to enhance extraction of the dye. Coppersulphate as an oxidising agent was added while the solution was still hot.

3.1 Sample of garnet dyed fabric.



3.2 Sample of lavender dyed fabric.



3.3.4 PREPARATION OF LAVENDER COLOUR :-

The orange red heart wood of caesalpinia sappan (Patang) was used as raw material for lavender colour.

The ingredients used for lavender colour is same as that of garnet (3.3.3) except the addition of aluminium acetate, but the proportions taken are different as shown below.

INGREDIENTS :

Wood Chips	-	20 grams
Copper sulphate	-	5 grams
Washing soda	-	2 grams
Aluminium acetate	-	2 grams
Water	-	500 C.C.

The wood chips along with washing soda were boiled in 500 C.C. of water for one hour. After one hour the extract was measured and made upto 250 C.C. by adding required amount of water. Washing soda was added to the liquor to enhance the extraction of dye. Coppersulphate as oxidising agent, Aluminium acetate as mordant were added when the solution was still hot.

3.4 APPLICATION OF DYE :-

Each colour was applied with brush to one meter of prepared fabric. (3.1.1) Dye application was repeated twice with an interval of one day to ensure even and thorough drying. After drying the material was washed in 0.2 percent detergent solution

and the fabric was rinsed thoroughly and dried in shade.

3.4.1 AFTER TREATMENT FOR ALL COLOURS :-

After 24 hours of dye application and drying, the material was soaked in 5 percent alum solution. (30 grams of alum in 750 C.C. of water) for 5 minutes. Alum acts as mordant and helps in fixation of the dye.

3.5 COLOUR FASTNESS TESTS :-

Laboratory tests were conducted to test the colour fastness property of prepared vegetable dyed fabric such as orange, blue, garnet and lavender.

3.5.1 COLOUR FASTNESS TO WASHING :-

Colour fastness test to washing was conducted following BIS test procedure IS 687 - 1979. A composite specimen of 10cms x 4cms was prepared as per the standard procedure. The test solution was prepared by dissolving 5 grams of soap in one litre of distilled water. The test specimens were placed in jars of launder-o-meter with test solutions preheated to 40^{o} c. The tank of the launder-o-meter was filled with water upto the required level and thermometer was adjusted to 40 ± 2^{o} C. After the set temperature was attained, the stainless steel jars containing the samples were clamped in the rotar with the help of holders and the rotar was worked for 30 minutes. Then the samples were

removed from the stainless steel jars and rinsed in water for 10 minutes. The samples were dried at temperature not exceeding 60^{o} C. The samples were evaluated by five judges for colour change and for degree of staining of two adjacent fabrics using geometric grey scales following BIS test procedure IS 768 - 1956 for colour change and IS 769 - 1956 for colour staining.

3.5.2 COLOUR FASTNESS TO SUNLIGHT :-

The test procedure was carried out as per BIS test IS 686 - 1957. Five samples of size 1cm x 6cms each were placed on a card board and an opaque cover was fixed in such a way that one half of the total length of each test piece was covered. Exposure to sunlight was carried out between 8 A.M. and 4 P.M. in a sunlight cabinet. According to Lyle (1977) most of the apparel fabrics are tested for periods ranging to 40 standard fading hours. Hence the five samples were exposed to sunlight for 8, 16, 24, 32 and 40 hours. The samples were evaluated by five judges for colour fastness to light by comparing the changes in colour of the exposed portion of the test pieces with that of original samples using geometric grey scales following BIS test procedure IS 768 - 1956.

3.5.3 COLOURFASTNESS TO CROCKING :-

The test was carried out on a Eureka wear tester based on Martindale principle which provides similar rubbing conditions as

that of Crock-o-meter (Martindale working manual). Crocking test was conducted when the sample was dry.

The abradant of the wear tester was replaced by the coloured test sample of exposure size of 10.5 cms. The undyed bleached sample was cut to 3 cms diameter corresponding to the template size and was fixed in the holder to rub against the test specimen and the counter was set to 100 revolutions. Then the bleached white sample was assessed for transference of colour by five judges using a geometric grey scale following BIS test procedure IS 769 - 1956.

2.5.4 COLOUR FASTNESS TO PERSPIRATION :-

The colour fastness to acidic and alkaline perspiration was carried out by following BIS test Number IS 971 - 1956.

ACIDIC TEST SOLUTION :

The test solution was prepared by dissolving 2.65 grams of sodium chloride and 0.75 grams of urea per litre of water and pH was adjusted to 5.6 by addition of acetic acid.

ALKALINE TEST SOLUTION :

The test solution was prepared by dissolving 3 grams of sodium chloride per litre of water and pH was adjusted to 7.2 with the addition of sodium bicarbonate.

5 cms x 4 cms test specimen was placed between two undyed fabrics of size 5 cms x 5 cms and stitched together to form a composite specimen. The composite specimen was steeped thoroughly in the test solution using liquor to specimen ratio of 50 : 1 (ml:gms) and was kept at room temperature for 30 minutes. Then the specimen was placed between two acyrilic seperators under the pressure of 4.5 kgs for 10 minutes in the perspir-o-meter. The entire apparatus was placed in the oven for 4 hours at 37±2 °C. At the end of 4 hours the specimen was removed and dried at temperature not exceeding 60 °C.

The samples were evaluated for colour change and for colour staining using the geometric grey scales according to BIS test procedure IS 768, 769 - 1956 respectively.

3.5.5 COLOUR FASTNESS TO PRESSING :-

Dry and Damp pressing tests were carried out as per BIS test Number IS 689 - 1956.

(a) DRY PRESSING :

The test specimen of size 10 cms x 4 cms was placed on the dry, undyed bleached cotton material of size 14 cms x 4 cms. Iron heated to temperature set for cotton was placed on top of the sample for 15 seconds. The sample was then evaluated for the colour change and staining of undyed cloth with the help of geometric grey scale immediately after testing and after 4 hours following BIS test procedure IS 768, 769 - 1956 respectively.

(b) DAMP PRESSING :

The test specimen of size 10cms x 4cms was placed between bottom dry undyed cloth and top wet undyed cloth of size 14cms x 4cms. Iron was heated to temperature set for cotton and pressed for 15 seconds without any additional pressure. The sample was evaluated for change in colour and degree of staining of adjacent fabrics with the help of grey scales immediately and after 4 hours of pressing following BIS test procedure IS 768, 769 - 1956 respectively.

3.6 STATISTICAL ANALYSIS OF THE DATA :-

The statistical analysis of the data was done under the following heads.

(1) To find out degree of agreement between the judges.
(2) To compare within the colours.
(3) To compare between the colours.

To study the degree of agreement between the judges analysis of variance was used.

Null hypothesis - There is no significant difference between the judges with respect to the degree of agreement.

G is grand total.

n = total number of observations.

Total sum of squares = (T.S.S)

$$(Y_1^2 + Y_2^2 + Y_3^2 \ldots\ldots Y_n^2) - C.F.$$

$Y_1, Y_2, Y_3 \ldots\ldots Y_n$ = each individual item.

C.F. = Correction factor.

Treatment sum of squares - (Tr.S.S.)

$$1/r \ (T_1^2 + T_2^2 + T_3^2 \ldots\ldots T_n^2) - C.F.$$

T_1, T_2, T_3 are treatment sum

r = replicas in each treatment.

Error sum of squares - (E.S.S)

Total sum of squares - Treatment sum of squares

ANOVA TABLE

Source	Degrees of freedom	Sum of squares	Mean Sum of squares	F cal value	F tab value
Between Treatment	(t-1)	Tr.S.S	$\frac{\text{Tr.S.S.}}{t-1} = \text{Tr.M.S.}$	$\frac{\text{Tr.M.S.}}{\text{E.M.S.}}$	
Within Treatment	(N-t)	E.S.S	$\frac{\text{E.S.S}}{(N-t)} = \text{E.M.S.}$		
Total	(N-1)				

CONCLUSION :- If 'F' calculated value is greater than or equal to 'F' tabulated value with (t-1) and (N-t) degrees of freedom at required level of significance, null hypothesis is rejected other wise it is accepted.

If the null hypothesis is rejected critical difference (C.D.) is calculated by using the formula.

$$C.D. = t\,(N-t) \sqrt{\frac{2 \times E.M.S}{r}}$$

t (N-t) = t tabulated value at error degrees of freedom.

E.M.S = Error mean of sum.

r = Number of replicas.

For comparison within the colours three tests were used.

(1) Mean of scores were used for washing, pressing an crocking.

The formula in terms of symbol is

$$\bar{X} = \frac{\Sigma X}{N}$$

Where

$\bar{X}$ = The arithmetic mean

Σ = The sum of

X = Individual item

N = The number of items.

(2) Paired 't' test was used to compare the immediate rating with after 4 hours rating in pressing test.

Null Hypothesis

$$\mu_1 = \mu_2$$

$$t = \frac{\bar{d}}{\sqrt{\frac{sd^2}{n}}}$$

Where $d = x_1 - x_2$

$\bar{d}$ = mean of d

$$sd^2 = \frac{1}{n-1}\left(\Sigma d^2 - \frac{(\Sigma d)^2}{n}\right)$$

n = number of observations.

CONCLUSION :- If 't' calculated value is equal to or greater than 't' tabulated value with (n-1) degrees of freedom at required level of significance null hypothesis is rejected other wise it is accepted.

(3) The significant difference in colour change between the hours of exposure to sunlight was tested by using analysis of variance.

For comparison between the colours - orange, blue, garnet and lavender analysis of variance was used.

CHAPTER - 4

RESULTS AND DISCUSSION

The four extracted dyes for Kalamkari namely orange, blue, garnet and lavender were tested for their colour fastness to washing, sunlight, crocking, perspiration and pressing.

One way analysis of variance was used to evaluate the degree of agreement between the five judges and it was found that there was no significant difference among the judges with regard to their evaluation at one percent level

The data from the evaluation of five judges is presented and discussed under the following sections.

4.1 Assessment of Colour fastness property.

4.1.1 Colour fastness to Washing.

4.1.2 Colour fastness to Sunlight.

4.1.3 Colour fastness to Crocking.

4.1.4 Colour fastness to Perspiration.

4.1.5 Colour fastness to Pressing.

4.1.6 Assessment of over all efficiency of developed colours.

4.1 ASSESSMENT OF COLOUR FASTNESS PROPERTY :-

4.1.1 COLOUR FASTNESS TO WASHING :

The data pertaining to colour change and colour staining on wool and cotton is presented in the following table

TABLE - 1

COLOUR FASTNESS TO WASHING.

PROPERTY	VALUES IN RATING			
	ORANGE	BLUE	GARNET	LAVENDER
Colour change	2.38	2.24	Changed in hue	2.75
Colour Staining				
a) Wool	4.29	2.4	3.15	3.29
b) Cotton	4.04	3.35	3.19	2.42

Means underscored by same line are not statistically significant at one percent level.

As indicated in table 1, considerable change in colour had taken place in orange by washing. The fair colour fastness property of orange for washing may be due to insolubility of bixin in water. With regard to colour staining, orange colour had shown minimum staining on adjacent cotton and wool fabrics. The staining of wool was comparatively less than that of cotton in case of orange colour.

The wash fastness of blue was fairly good with 2.24 rating. This may be due to excellent wash fastness property of vat dye. In blue colour the staining on wool was more than that

of cotton. So it was evident that wool had greater affinity for blue colour.

The garnet colour had changed to brown by washing. The change in hue may be due to oxidation of dye in hot water. The garnet colour which had turned brown by subjecting to washing test number : 1 at 40 °C as per BIS specifications was found to be colour fast to laundering at room temperature. Since all the coloured fabrics are recommended to wash at room temperature even the garnet colour can be used. The colour staining on wool and cotton was almost equal.

As seen from the above table, lavender colour showed noticeable change in washing. With regard to colour staining visible and marked staining was found on wool and cotton respectively.

As orange, blue and lavender colours had shown fair resistance to washing at 40 °C and garnet at room temperature all the four colours can be used for Kalamkari fabrics.

One way analysis of variance was used to find whether there is any significant difference between the colours. As the garnet colour had changed its hue, it was excluded and other three colours namely orange, blue and lavender were compared.

TABLE - 2

ANALYSIS OF VARIANCE FOR WASHING TEST TO COLOUR CHANGE

Sources	d.f	s.s	m.s.s	F (cal)
Between Colours	2	0.717	0.3585	2.852 Ns.
Within Colours	12	1.507	0.1287	
Total	14			

NS Not significant

The one way analysis of variance table shows that there is no significant difference between the three colours. From the data presented in table 1 it can be observed that all three colours namely orange, blue and lavender were equally good. Inspite of the raw material being the same for garnet and lavender, wash fastness exhiblted by lavender colour can be attibuted to aluminium acetate which was used as a mordant.

The analysis of variance tables with regard to colour staining on wool and cotton fabrics ar presented in table 3 and 4.

TABLE - 3

ANALYSIS OF VARIANCE FOR WASHING TEST TO COLOUR STAINING ON WOOL

Sources	d.f	s.s	m.s.s	F(cal)
Between colours	3	8.62	2.873	85.25 * *
Within colours	16	0.54	0.0337	
Total	19			

* * significant at one percent level

Critical difference (C.D.) = 0.246

TABLE - 4

ANALYSIS OF VARIANCE FOR WASHING TEST TO COLOUR STAINING ON COTTON

Sources	d.f	s.s	m.s.s	F(cal)
Between colours	3	9.632	3.210	10.993 * *
Within colours	16	4.675	0.292	
Total	19			

* * Significant at one percent level.

C.D. = 0.725

From the table 3 and 4 it is evident that there was significant difference between four colours with respect to colour staining on wool and cotton respectively. Referring to table 1 it can be noticed that there was little difference between garnet and lavender. Hence it can be concluded that there was no significant difference between garnet and lavender with regard to colour staining on wool and cotton. Similarity between garnet and lavender may be perhaps due to use of same raw material for both. With respect to colour staining on cotton, there was also no significant difference between orange and blue.

4.1.2 COLOUR FASTNESS TO SUNLIGHT :

The results obtained for sunlight test were tested by one way analysis of variance. Analysis of variance tables for colour change on exposure to sunlight for orange, blue, garnet and lavender age given in tables 5, 6, 7 and 8 respectively.

TABLE - 5

ANALYSIS OF VARIANCE FOR COLOUR CHANGE OF ORANGE TO SUNLIGHT

Source	d.f	s.s	m.s.s	F(cal)
Between hours of exposure	5	38.5	7.7	32.45 * *
Within hours of exposure	24	5.7	0.2375	
Total	29			

* * Significant at one percent level.

5. A EFFECT OF SUNLIGHT ON ORANGE COLOUR

C.D. Value	Mean of 8 hours of exposure	Mean of 16 hours of exposure	Mean of 24 hours of exposure	Mean of 32 hours of exposure	Mean of 40 hours of exposure
0.634	2.7	2.[illegible]	2.1	1.8	1.6

Means under scored by the same line are not significant at 5 percent level.

As indicated in table 5 there was significant difference in colour change between different hours of exposure to sunlight As seen from table 5 A it was evident that orange colour had undergone noticeable change during first 8 hours of exposure to sunlight. After initial 8 hours of exposure the change in colour of orange was found to be gradual and the difference between every eight hours was 0.3 and less. Significant difference was seen between 8 and 24 hours of exposure, 16 and 40 hours of exposure to sunlight.

The orange colour had exhibited poor colour fastness sunlight. As colour fastness to sunlight is an important criteria to be considered for textiles in domestic use, orange colour is limited only for wall panels

TABLE - 6

ANALYSIS OF VARIANCE FOR COLOUR CHANGE OF BLUE COLOUR ON EXPOSURE TO SUNLIGHT

Sources	d.f	s.s	m.s.s	F(cal)
Between hours of exposure	5	16.142	3.228	12.709 * *
Within hours of exposure	24	6.098	0.254	
Total	29			

* * Significant at one percent level.

6. A EFFECT OF SUNLIGHT ON BLUE COLOUR

C.D. Value	Mean of 8 hours of exposure	Mean of 16 hours of exposure	Mean of 24 hours of exposure	Mean of 32 hours of exposure	Mean of 40 hours of exposure
0.566	4.7	4.3	3.5	3.2	3

Means underscored by same line are not statistically significant at 5 percent level.

From the above table it can be noticed that there was significant difference in colour change between different hours of exposure to sunlight. Between 8 and 40 hours of exposure to sunlight, the change in colour was gradual, ranging from

negligeable change to significant change. Maximum change in colour had taken place between 16 to 24 hours of exposure to sunlight. As there was no significant difference between 24 hours and 40 hours of exposure, it was clear that after 24 hours of exposure to sunlight the degradation in colour was reduced markedly. It can be concluded that blue colour had good resistance to sunlight. Since the blue colour exhibited good resistance to sunlight, it is recommended for all variety of Kalamkari fabrics.

TABLE - 7

ANALYSIS OF VARIANCE FOR COLOUR CHANGE OF GARNET ON EXPOSURE TO SUNLIGHT

Sources	d.f	s.s	m.s.s	F(cal)
Between hours of exposure	5	21.77	4.354	12.91 **
Within hours of exposure	24	8.1	0.337	
Total	29			

** Significant at one percent level.

7. A EFFECT OF SUNLIGHT ON GARNET COLOUR.

C.D. Value	Mean of 8 hours of exposure	Mean of 16 hours of exposure	Mean of 24 hours of exposure	Mean of 32 hours of exposure	Mean of 40 hours of exposure
0.756	4.6	3.8	3.5	2.9	2.6

Means under scored by the same line are not statistically significant at 5 percent level.

From the statistical analysis it was found that there was significant difference between different hours of exposure to sunlight for colour change with regard to garnet. The colour change between 8 hours and 40 hours of exposure to sunlight ranged from negligeable change to marked change. From the table 7.A it was evident that maximum change in colour had occured between 8 and 16 hours of exposure and minimum between 32 and 40 hours of exposure. In general, it can be concluded that garnet colour had fair resistance even after 40 hours of exposure to sunlight. The good colour fastness to sunlight exhibited by garnet may be attributed to addition of copper sulphate in the dye bath, as copper sulphate is used as an after treatment to improve light fastness of direct dyes.

TABLE - 8

ANALYSIS OF VARIANCE FOR COLOUR CHANGE OF LAVENDER ON EXPOSURE TO SUNLIGHT

Source	d.f	s.s	m.s.s	F(cal)
Between hours of exposure	5	16.375	3.275	21.252 * *
Within hours of exposure	24	3.7	0.1541	
Total	29			

* * Significant at one percent level.

8. A EFFECT OF SUNLIGHT ON LAVENDER COLOUR

C.D. value	Mean of 8 hours of exposure	Mean of 16 hours of exposure	Mean of 24 hours of exposure	Mean of 32 hours of exposure	Mean of 40 hours of exposure
0.511	4.6	3.8	3.6	3.2	3.2

Means under scored by same line are not statistically. significant at 5 p[illegible]cent level.

From the analysis of variance table for colour change of lavender, it was seen that there was significant difference between different hours of exposure to sunlight. From the

table 8.A it was clear that colour change was minimum at 8 hours, slightly changed at 16 and 24 hours of exposure, noticeable change at 32 hours and 40 hours of exposure to sunlight. As the maximum difference of 0.80 was noted between means of 8 hours and 16 hours of exposure to sunlight, it was evident that greater change in colour had occured between this period. There was no change between 32 hours and 40 hours of exposure to sunlight. The good colour fastness property of lavender may be due to use copper sulphate which is used for after treatment to improve light fastness property of direct dyes.

The following table gives the difference between the four colours orange, blue, garnet and lavender on exposing to sunlight.

TABLE - 9

ANALYSIS OF VARIANCE FOR COMPARISON BETWEEN COLOURS ON EXPOSURE TO SUNLIGHT.

Sources	d.f	s.s	m.s.s	F(cal)
Between colours	3	229.64	76.54	7.341 * *
Within Colours	16	166.8	10.425	
Total	19			

* * Significant at one percent level.

9. A COMPARISON BETWEEN COLOURS AFTER EXPOSING TO SUNLIGHT.

C.D.Value	Lavender	Blue	Garnet	Orange
4.32	19.1	18.5	17.1	10.6

Means under scored by same line are not statistically significant at 5 percent level.

From the statistical analysis it was found that there was significant difference between four colours after exposing to sunlight for 40 hours. From the table 9.A it was indicated that there was significant difference between orange and other three colours namely blue, lavender and garnet. It was evident that orange cannot be compared with the other three colours with respect to fastness to sunlight. With regard to blue, lavender and garnet colour, there was not much difference in mean scores. Out of the four colours, lavender was more resistant to sunlight followed by blue, garnet and orange.

4.1.3 COLOUR FASTNESS TO CROCKING :

The mean data for colour fastness to crocking is presented in table 10.

TABLE - 10

EFFECT OF CROCKING

C.D. Value	Lavender	Orange	Blue	Garnet
0.259	4.54	4.18	3.18	3.16

Means under scored by same line are not statistically significant at 5 percent level.

As shown in table 10 lavender and orange have excellent fastness to crocking. The colour transference of lavender on to the white material may be due to the loss of superfluous dye. However blue and garnet colours were resistant to crocking with the mean ranks of 3.18 and 3.16 respectively indicating good colour fastness to crocking.

As all the four colours namely orange, blue, garnet an lavender had shown good resistance to crocking, all these colours can be used for Kalamkari work.

TABLE - 11

ANALYSIS OF VARIANCE FOR COMPARISON BETWEEN COLOURS FOR FASTNESS TO CROCKING

Source	d.f	s.s	m.s.s	F(cal)
Between colours	3	7.97	2.65	
Within Colours	16	0.56	0.035	75.71 * *

* * Significant at one percent level.

4.1.4 COLOUR FASTNESS TO PERSPIRATION :

The data pertaining to acidic perspiration and alkaline perspiration are presented in the table 12 and 13 respectively.

TABLE - 12

EFFECT OF ACID PERSPIRATION

PROPERTY	COLOUR			
	ORANGE	BLUE	GARNET	LAVENDER
Colour Change	3.2	4.35	1.4	0
Colour staining				
(a) Wool	4.2	4.65	2.7	4.3
(b) Cotton	4.55	3.9	4.3	4.2

As seen from the table 12 orange colour showed noticeable change in colour but the staining on wool and cotton was negligeable. With regard to orange the staining on wool was more than that of cotton.

Blue colour sample showed minimum colour change, with the rating of 4.35. with respect to colour staining significant difference was observed between wool and cotton. The colour staining was less on wool than on cotton.

Major colour change was seen in garnet with 1.4 mean rating representing poor colour fastness. The colour staining was more on wool than on cotton. The lavender colour showed

complete colour loss. Inspite of complete colour loss, staining on wool and cotton was negligeable.

However it was found that for colour change blue colour was more resistant to acidic perspiration followed by orange, garnet and lavender. With respect to staining on wool blue ranked first followed by lavender, orange and garnet. With regard to staining on cotton orange ranked first followed by garnet, lavender and blue.

TABLE - 13

EFFECT OF ALKALINE PERSPIRATION

PROPERTY	Values in rating			
	ORANGE	BLUE	GARNET	LAVENDER
Colour change	2.4	4.35	1.4	0
colour staining				
(a) Wool	4.3	3.9	4.35	4.5
(b) Cotton	4.3	4.65	2.7	4.8

Orange colour on subjecting to alkaline perspiration test showed noticeable colour change with mean rating of 2.4. Inspite of major change in colour slight staining was seen on cotton and wool. It was interesting to note that colour discharged from the test sample did not show any affinity to cotton and wool.

Blue colour showed minimum colour change with the rating of 4.35 indicating good resistance to alkaline perspiration. The staining was more on wool than on cotton.

Garnet exhibited fair colour change with the rating of 1.4. With respect to colour staining significant difference was noted between staining on wool and cotton, with maximum staining on cotton and minimum on wool.

Lavender had lost its colour completely indicating poor colour fastness to alkaline perspiration. Inspite of complete colour loss, no staining was seen on adjacent fabrics namely wool and cotton.

Bixin and brasilien the colour components of orange, garnet and lavender are readily soluble in alkaline solution. The colour loss of orange, garnet and lavender can probably be attributed to the solubility of bixin and brasilien in alkaline solution.

With respect of colour change as indicated in table 13 blue colour was more colour fast to alkaline perspiration. There was marked difference between the four colours with blue ranking first, followed by orange, garnet and lavender. With regard to colour staining on wool not much difference was seen between all the colours, lavender ranking first followed by garnet, orange an blue. With respect to staining on cotton lavender was placed first followed by blue, orange and garnet.

Since blue and orange colours are fast to both acid and alkaline perspiration, these can be used for all Kalamkari work. The other two colours namely garnet and lavender can be used for wall panels, bedsheets and they are less resistant to perspiration.

4.1.5 COLOUR FASTNESS TO PRESSING :

The following table 14 shows the difference between immediate pressing and 4 hours after dry pressing. For this purpose paired 't' test was used.

TABLE - 14

EFFECT OF DRY PRESSING ON COLOUR CHANGE AND COLOUR STAINING

COLOURS	't' Calculated Value	
	Colour change	Colour staining
Orange	Ns 1	Ns 1
Blue	Ns 0	Ns 0
Garnet	Ns 0	Ns 0
Lavender	Change in hue	Ns 1

Ns = Not Significant

From the statistical analysis it was found that there was no significant difference in colour change and colour staining between immediate and after 4 hours of dry pressing with regard to orange, blue and garnet. In case of lavender, on pressing the changes in hue remained as such. The change in hue of lavender

may be due to volatalisation of the dye. It can be concluded that orange, blue and garnet can be used for all varieties of Kalamkari fabrics for which constant pressing is needed. Even if there is no staining on cotton, lavender is not recommended as there was change in hue.

TABLE - 15

COMPARISON BETWEEN COLOURS FOR DRY PRESSING.

PROPERTY	Values in rating			
	Orange	Blue	Garnet	Lavender
Colour change				
(a) Immediate	4.8	5	5	Change in hue
(b) After 4 hours of pressing	5	5	5	
Colour staining				
(a) Immediate	4.8	5	5	4.8
(b) After 4 hours of pressing	5	5	5	4.9

The findings with regard to comparison between four colours for dry pressing showed that there was no significant difference in colour change in orange, blue and garnet. Hence it can be concluded that effect of dry pressing was minimum on all the colours with the exception of lavender. Though there was no significant difference in staining among the four colours, small

degree of staining was seen in lavender even after 4 hours of dry pressing.

The values of paired 't' test regarding the effect of damp pressing on colour change and colour staining are presented in table 16.

TABLE - 16

EFFECT OF DAMP PRESSING ON COLOUR CHANGE AND COLOUR STAINING

Colours	't' Calculated value	
	Colour Change	Colour staining
Orange	Ns 1.891	Ns 0
Blue	Ns 0	Ns 0
Garnet	Ns 1.639	Ns 1.304
Lavender	Hue changed	Ns 1.639

Ns = Not Significant.

The context of the table revealed that there was no significant difference in colour change and colour staining between immediate and after four hours of damp pressing with orange, blue and garnet, where as for lavender even with damp pressing the hue was completely changed.

TABLE - 17

COMPARISON BETWEEN COLOURS FOR DAMP PRESSING

PROPERTY	Values in rating			
	ORANGE	BLUE	GARNET	LAVENDER
Colour change				
(1) Immediate	4.3	5	4.8 Change in hue	
(2) After 4 Hours of pressing	5	5	5	
Colour Staining				
(1) Immediate	5	5	4.3	4.7
(2) After 4 Hours of pressing	5	5	4.9	4.9

As indicated in table 17, blue colour was found to have excellent colour fastness to damp pressing. The Orange and garnet colours showed noticeable change in colour immediately after damp pressing, but they regained its original colour after 4 hours of pressing. With respect to lavender, the hue had changed to pinkish purple in both cases of immediate and after 4 hours of damp pressing. With regard to colour staining no staining was observed in orange and blue. Noticeable staining was seen in garnet and lavender but staining had reduced its intensity after 4 hours. Blue colour was ranked first followed by garnet, orange and lavender for colour fastness to damp pressing.

4.1.6 ASSESSMENT OF OVERALL EFFICIENCY OF FOUR COLOURS

One way analysis was used to compare the colours for overall efficiency.

TABLE - 18

ANALYSIS OF VARIANCE - COMPARISON BETWEEN COLOURS FOR OVERALL EFFICIENCY TO COLOUR FASTNESS

Sources	d.f	s.s	m.s.s	F(cal)
Between Colours	3	2008.71	669.57	69.75 * *
Within Colours	16	153.63	9.60	
Total	19			

* * Significant at one percent level.

18. A OVERALL EFFICIENCY OF COLOUR FASTNESS OF FOUR COLOURS

C.D. Value	Blue	Orange	Garnet	Lavender
4.3	96.434	87.342	82.080	68.642

From the above tables it is concluded that there was significant difference between all the colours in over all efficiency with blue ranking first followed by orange, garnet and lavender.

CHAPTER - 5

SUMMARY AND CONCLUSION.

The Kalamkari industry is the most ancient industry in India. South India, especially Masulipatnam and Srikalahasti of Andhra Pradesh are famous for Kalamkari art. The Kalamkari is made up of two words Kalam meaning pen and Kari meaning work. At Kalahasti complete work is done with kalam only but at Masulipatnam wooden blocks are used for painting the outlines.

The colours used in Kalamkari are from natural sources. When natural dyes are used there is limitation in variety of colour and brightness. Hence this study was under taken with the following objectives.

1. To develop four new vegetable dyes which are not being used for Kalamkari painting at present.
2. To assess the colour fastness property of the developed dyes to Washing, Sunlight, Perspiration, Crocking, and Pressing.

For the present study orange, blue, garnet and lavender colours were selected. The four colours namely orange from Bixa orellana, blue from Indigofera tinctoria, garnet and lavender from Caesalpinia sappan were developed by series of experiments. The developed colours were applied to the bleached material with a brush. The coloured materials were treated with alum as a mordant. The colour fastness property of the developed dyes to

washing, sunlight, perspiration, crocking and pressing were assessed.

The important findings of the present study are as follows:

1. The results of washing test laundered at 40 °C showed fair resistance to colour change with orange, blue, and lavender where as garnet colour was found to have better wash fastness when laundered only at room temperature. The colour transference on wool was more than that of cotton with exception of blue and garnet. With respect to colour transference on wool, orange was found to be superior followed by lavender, garnet and blue. However with regard to colour transference on cotton, orange was ranked better followed by blue, garnet and lavender.

2. When the specimens were subjected to sunlight test blue, garnet and lavender colours showed good fastness to sunlight where as orange was found to be fairly resistant. When four colours were compared it was found that lavender was resistant to sunlight followed by blue, garnet and orange.

3. Acid perspiration test proved that blue had good resistance to colour change. Blue and orange have shown very little colour transference on cotton and wool respectively.

4. From the colour resistance to alkaline perspiration test it is found that blue had better resistance to colour change.

Inspite of complete colour loss with respect to colour transference on wool and cotton, lavender was found to be equally good.

5. With regard to colour fastness to crocking lavender ranked first followed by orange, blue and garnet.

6. The findings of dry and damp pressing showed that all the colours had negligeable rate of colour change and colour transference, with th exception of lavender in which the hue was changed.

7. Regarding the overall efficiency of four colours, blue was ranked first followed by orange, garnet and lavender.

To conclude the blue colour ranked first in overall efficiency with fair resistance to washing, sunlight, crocking, perspiration and pressing. Hence it can be widely used for all Kalamkari work. Though orange ranked second in overall efficiency with reference to colour fastness, it had poor fastness to sunlight. Since the coloured fabrics are expected to dry under shade, orange colour can also be used for kalamkari work. Garnet and lavender colours had almost similar colour fastness characteristics with the exception of pressing in which lavender had changed its hue. Since lavender and garnet had poor resistence to perspiration these colours can be used for Kalamkari wall panels.

IMPLICATIONS OF THE STUDY :

As the raw materials used for preparing this colours are easily available and the method of preparation is simple, these colours can be easily developed by the Kalamkari artists. The weaver's service center can assist the artists in developing the above developed dyes. With the addition of four new colours, the colour range is increased there by adding variety and interest to existing Kalamkari fabrics.

SUGGESTIONS FOR FURTHER STUDY :

1. As the Kalamkari is done on both cotton and silk fabrics the developed dyes namely orange, blue, garnet and lavender can be tried on silk also.

2. Some more colours can be developed and tested for its colour fastness property.

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