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Dyeing of soya material using natural extracts

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Abstract
Dyeing is the process of colouring the textile material. The paper concerns with dyeing of soya material using natural extracts. The dyeing is done for soya cotton blended fabric and checked for the properties. The natural dye selected for the study is Indian madder which is commonly known as madder with 6 per cent of dye concentration. The natural mordant is lime bark with 2 percent concentration for the study. Lime bark is used as mordant as it contains 90 percent natural tannin. Lime bark is an extract of a plant. The paper also aims at the comparison of grey and dyed fabrics. Further the samples were tested for the following and evaluated as per the Fabric stiffness, Tensile strength and elongation, Crease recovery and Air permeability.

Keywords: dyeing, mordant, lime bark, soya fabric

Introduction
Dyeing is a process of colouring textile materials by immersing them in an aqueous solution of dye liquor. The theory of dyeing is the interaction between dye, fabric, water and dye auxiliary.

Cotton
Cotton is the most important of the vegetable fibres belongs to the family Malvaceae (mallow family). It is creamy colour and easily spun and cultivated in temperature climate with well-distributed rainfall. All western U.S cotton and as much as one-third of southern cotton, however, is grown under irrigation. Cotton is classified in the division Magnoliophyta, class Magnolioside, and order Malvales, family Malvaceae. Cotton was first spun by machinery in England in 1703.cotton is a part of our daily lives. All parts of the cotton plant are useful.
Coton linder also are incorporated into high quality paper products and processed into batting for padding mattresses, furniture and automobile cushions. Cotton has the good characteristics of comfortable soft hand**,** good absorbency**,** colour retention**,** prints well**,** machine-washable**,** dry-cleanable**,** good strength**,** drape well and easy to handle and sew.

Soya Bean
Soya bean protein fibre is a new green textile fibre, and it possesses the superiorities of many natural fibre and synthesized ones. Soya bean fibre inexpensive in price. The production of soya bean protein fibre will not bring pollution to the environment. It consists of about 40% protein and 21% oil expressed and there are over 2500 varieties in cultivation, producing beans of many sizes, shapes and colours.
Soya bean functions are such as antibiosis function, bacteriostasis function, far infrared function, negative oxyanion function and anti-ultraviolet radiation function. Its plant is of 1.25 m of height and have spare or dense branches, depending on cultivars growing conditions. The embryo contains two pieces of cotyledons that function as food reserve structures. The seed coat is marketed with a helium or seed scar that varies in shape from linear to oval. That coat protects the embryo from fungi and bacterial infection before and planting. The embryo has three other parts; radical, hypocotyls and epicotyls. The radical and hypocotyls, together known as embryonic axis, or germ, are located under the seed coat at one end of the helium, just below the micro Pyle, which is a tiny hole formed by the integuments during seed development. Soya bean functional fibre has good affinity to human body's skin and possesses many kind of amino acid, which make it, has good health protection effects. Soya bean functional fibre filled up the vacancy in textile material development of our country as a big textile expressed producing country.
Soya bean protein is an advanced textile fibre. The microscopic appearance shows a skin core structure. The skin layer is irregular, close with lower degree of orientation along the fibre axis and with moisture bsorbing grooves. The micro porous structure of soya bean fibre makes it air and moisture permeable. The 20 amino acids present in it are healthy and nutritional to human skin. Soya bean protein fibre is a healthy, comfortable and environment friendly textile fibre.
The followings are the four health protective functions of soya:

- Negative ox anion function
- Four infrareds function
- Anti- ultraviolet function
- Anti- bacterial function

Functions of Soya Fabric Are

- Press comfortable function
- Touch comfortable function
- Quick wet permeability and moisture transmission function

100% Soya Bean Protein Fibre Fabric
The colour of the 100% soya bean protein fibre fabric is natural and pure with abundant fluff on the surface without pilling. It exhibits excellent hand, drape and softness.

Soyabean Protein Blended Fabric with Cashmere
Soya bean protein stable has abundant fluffs similar to the feelings of cashmere.

Soya Bean Protein Fibre Fabric Blended with Mercerised Wool
Because of its less shrinkage, it is easier to wash and preserve which is suitable for wool sweater, interlock underwear and blanket.

Soyabean Protein Fibre Fabric Blended With Silk
It also has a good draping along with lustre and elegance of silk, which is suitable for printing silk, weaving underwear, sleepwear, shirts and evening dress.

Soya Bean Protein Fibre Blended Fabric with Combed Cotton
It is suitable to use as T-shirts, infants wear as it is soft hand, towel and beddings and also to use as underwear for men and women for its better moisture absorption and ventilation**.**

Soya Bean Protein Fibre Fabric Blended with Elastic Fibre
Addition of a small parts of elastic fibre gives more elasticity to the fabrics which gives easy washing and caring.

Soya Bean Protein Fibre Fabric Blended With Polyester Another Synthetic Fibre:
It is Suitable for fashion apparels, underwear, shirt and sportswear for spring and summer season.

Objectives
- To study soya blended cotton yarn.
- To convert the soya blended cotton yarn into material by using suitable fabric construction technique.
- To dye the bleached soya blended material using natural dyes.
- To study about comparison details of grey and dyed fabric.
- To modify and construct the same into an apparel.

Methodology
Character and Performance of Soya Blend
Weaving fabric from pure soybean protein fibre or with a little spandex/lycra/cotton added to, has a soft and comfortable handle and is used for underwear, T- shirt, casual wear, sportswear, Women's fashion wear, which is fashionable.

Natural Dyes
There are three differen types of natural dyes namely
a) Vegetable dyes
b) Animal dyes
c) Mineral dyes
The natural dye chosen for the study is vegetable dye.

Vegetable dyes
The dyes extracted from the leaves, barks, pods, flower, fruits and some trees are called as Vegetable dyes. The soya fibre which is extracted from the leaves of soya seed is eco-friendly and it is also a fully bio- degradable natural fibre. Hence the soya yarn of 40's count was selected by investigator for the study. After weaving process, the natural dye Indian madder which is commonly known as madder was selected for the study with 6 per cent of dye concentration. The natural mordant used was lime bark with 2 per cent concentration for the study.

Selection of Yarn
The soya fibre was extracted from the leaves of soya. Soya seed is eco-friendly and it is fully bio-degradable natural fibre. The fine texture of the soya fibre takes dyes easily and offers largest range of dye colours. Hence the soya yarn of 40's count was selected by investigator for the study.

Conversion of Yarn into Fabric
The soya yarn is converted into fabric using weaving technique. Weaving is a textile production method in which two distinct sets of yarns are interlaced at right angles to form a fabric or cloth. The way the warp and filling threads interlace with each other is called the weave. Then the fabric is bleached and dyed.

Selection of Natural Dye
The natural dye selected for the study is Indian madder [PLATE1] which is commonly known as madder with 6 per cent of dye concentration.

Selecrtion of Mordant
The investigator selected the natural mordant lime bark [PLATE 2] with 2 per cent concentration for the study. Lime bark is used as mordant as it contains 90 per cent natural tannin. It is an extract of a plant

Dyeing Process
In the dyeing process for 5 kg soya fabric 270g of lime bark natural mordant, mixed with 16.5 litter of water. boil that for about 40 minutes and maintain the temperature of 100 c. After desired time filter that solution with a muslin cloth. Taking into the fabric for the process of pre-mordanting process. The fabric stirred the fabric into the solution continuously. Maintaining the temperature of 60 c. After desired time thoroughly rinsed in soft water and dried under shade.

Preparation of Dye Solution
The dye solution of Indian madder dye powder was taken based on the weight of the material. Mixed soft water in M:L ratio, and maintain the temperature of 100c and bring the M:L ratio to 1:20 to form a thick viscous dye solution. After the desired process it was filtered with the muslin cloth.

Dyeing the Pre-Mordanted Soya Fabric
Fabric was steeped into the dye bath containing the Indian madder dye solution. Stirred continuously to avoid patchy dyeing. Maintaining temperature of 50 c to 55 c. After 15 minutes, a pinch of glober salt was added to the dye solution. After the desired time thoroughly rinsed to soft water to remove the excess dye stuff and the fabric was dried under shade.

Colour Fastness Tests

The dyed soya fabric was futher tested for colour fastness

a) Colour fastness to sunlight
b) Colour fastness to washing
c) Colour fastness to dry crocking
d) Colour fastness to wet crocking
e) Colour fastness to perspiration

a) Colour Fastness to Sunlight

To measure the colour fastness of soya blended fabric AATCC 16E standard is followed. This is an accelerated test method for testing of light fastness. There are different options in this method which are A, B, C, D, E, F, G, H, I, J. These options differ from each other on the basis of light source, panel temperature and humidity. Generally AATCC 16E method is widely used for testing purpose. In this method a test specimen is exposed under the condition specified in various test methods for 20hours, 40 hours or 60 hours and the factors affecting light fastness. Grading of light fastness in this method is given on the basis of grey scale with rating of 1-5. One being poor and the five being the best. Rating 3 is normally acceptable for most of the requirements.

b) Colour Fastness to Washing

The method followed is ISO 105 C06/C08, AATCC: 61.the sample is collected from bulk and conditioned for 04.30 to 06 hours. Then specimens are made of 04 cm*10 cm in size, following the specimen is sewed with multi-fibre fabric of same size at corner. Finally the specimen is immersed into the solution of 4gm/litre ECE detergent & 1 gm/litre sodium perborate, (If required SKFL use 0.15 gm/litre TAED) at temperature of 60^{O}C/ 40^{O}C for 30 minutes. Then the specimen is washed in hot water, squeezed with cold water and dried in air not exceeding 60^{O}C. The stitching is then broken out except on one of the shorter end and measured the staining and color change by grey scale & make a test report.

c) Colour Fastness To Dry Crocking

A crock test is used to determine the amount of color that may be transferred from a sample fabric to another fabric by rubbing. The test method adopted here is AATC 8 test method. There are two types of crocking namely:

1. Dry crocking
2. Wet crocking

i) Dry Crocking

Strip of fabric 9”” x 3”” was taken and secured into fabric holder so there was a pull and the technical face is facing down. The holder was loaded into the crockmeter so the technical face is facing upwards. White test cloth was mounted and loaded into machine. The lid is lowered and the start button is pushed to begin the cycle. Machine will rub across the fabric 10 complete turns. The white test cloth was removed and evaluated as directed.

ii) Wet Crocking

The wet white test cloth was mounted into the holder same as in the dry test.

The lid was closed and the machine was run to 10 complete turns. The wet white test cloth was removed and evaluated as directed.

d) Colour Fastness to Perspiration

Color fading and alteration can be caused by the reaction between dyes on garments and the constituents of human perspiration, such as skin waste. It varies for different individuals and conditions. Methods for testing fastness levels of dyed materials against perspiration have been established by ISO, AATCC and various other standards. The standard procedure of ISO 105-E04 was adopted.Both acid and alkaline perspiration are tested. The dyed soya blend material showed excellent colour fastness to both acid and alkaline perspiration test.

Evaluation

Objective based approaches relates outcomes to pre-specified allowing judgement to be made about their level of attainment unfortunately, the objectives are often not proven to be objectives are often not to proven to be important or they focus on outcomes too narrow to provide the basis for determining the value of an objectives.

- Fabric weight
- Fabric stiffness
- Tensile strength and elongation
- Crease recovery
- Air permeability

Result and discussion

Fabric weight

Table 1

Soya material	Mean weight (g/cm2)	Sd	Cv%
Grey	0.3940	0.0041	1.10130
Dyed	0.3134	0.0028	0.7007

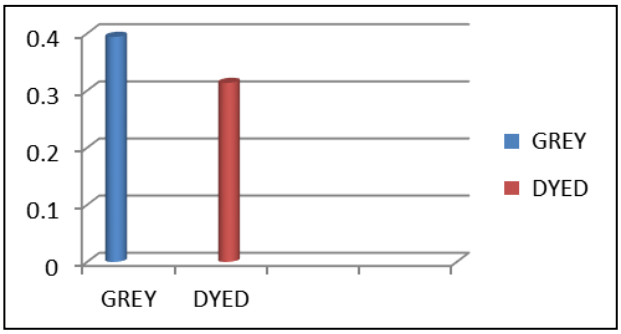

Fig 1

From the above table 1 and figure 1, it was found that the weight of dyed soya material has been decreased than grey material.

Fabric Stiffness - Warp

Table 2

Soya Material	Mean Weight (G/Cm2)	SD	CV%
Grey	3.1100	0.2923	8.8848
Dyed	2.0067	0.3028	14.082

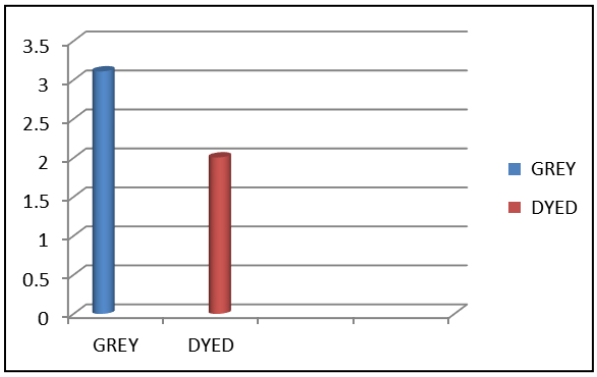

Fig 2

From the above table 2 and figure 2, it was found that the fabric stiffness in warp of dyed soya material has been decreased than grey material.

Fabric Stiffness – Weft

Table 3

Soya Material	Mean weight (g/cm2)	SD	CV%
GREY	4.100	0.2751	7.1079
DYED	3.8500	0.3028	9.6116

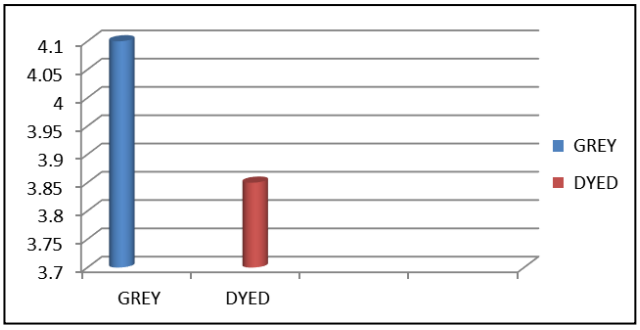

Fig 3

From the above table 3 and figure 3, it was found that the CV% of fabric stiffness in weft of dyed soya material has been decreased than grey material.

Tensile Strength – Warp

Table 4

Soya Material	Mean warp strength (kg/cm2)	SD	CV%
GREY	58.9890	4.4987	5.7872
DYED	36.8760	0.5567	4.8100

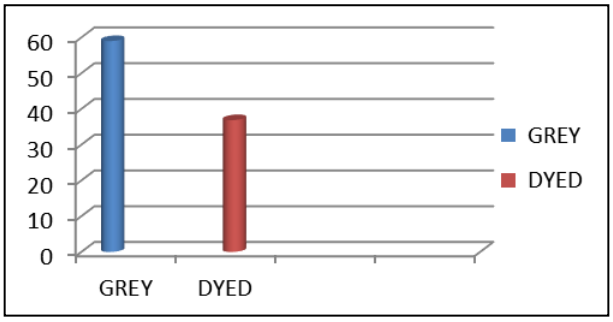

Fig 4

From the above table 4 and figure 4, it was found that the tensile strength in warp of dyed soya material has been decreased than grey material.

Tensile Strength – Weft

Table 5

Soya Material	Mean weft strength (kg/cm2)	SD	CV%
GREY	80.9760	4.0170	4.6279
DYED	38.2870	2.3676	5.4706

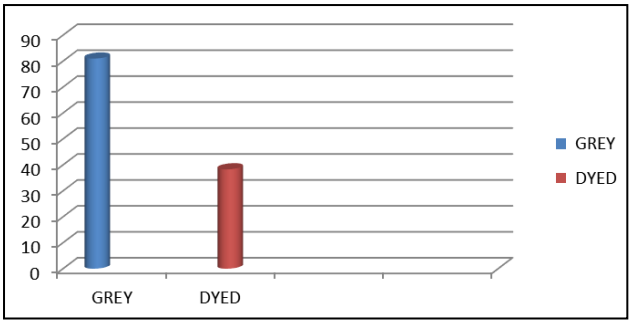

Fig 5

From the above table 5 and figure 5, it was found that the tensile strength in weft of dyed soya material has been decreased than grey material.

Tensile Elongation-Warp

Table 6

Soya Material	Mean warp elongation(cm)	SD	CV%
GREY	12.4598	0.2071	1.4452
DYED	9.7654	0.8313	8.0440

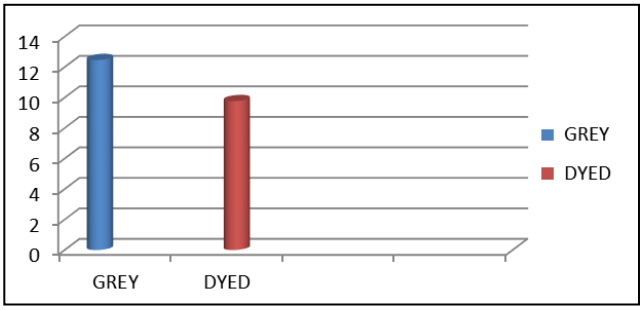

Fig 6

From the above table 6 and figure 6, it was found that the tensile elongation in warp of dyed soya material has been decreased than grey material.

Tensile Elongation-Weft

Table 7

Soya Material	Mean weft elongation(cm)	SD	CV%
GREY	4.5676	0.1006	2.8166
DYED	8.7654	0.6868	6.9023

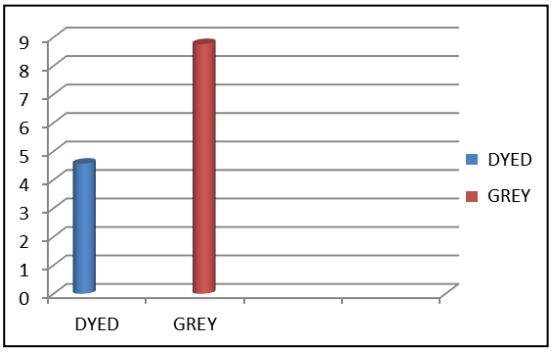

Fig 7

From the above table 7 and figure 7, it was found that the tensile elongation in weft of dyed soya material has been decreased than grey material

Crease Recovery-Warp

Table 8

Soya Material	Mean warp crease recovery(degrees)	SD	CV%
GREY	48.5767	3.440	6.8118
DYED	59.0098	3.0277	4.9230

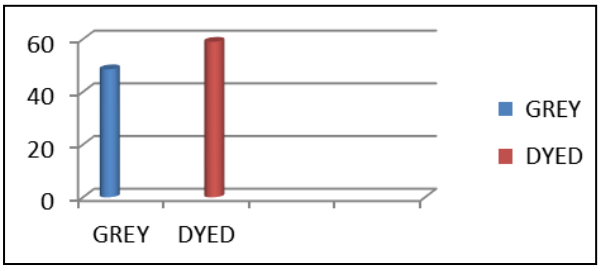

Fig 8

From the above table 8 and figure 8, it was found that the crease recovery- warp of dyed soya material has been increased than grey material

Crease Recovery- Weft

Table 9

Soya Material	Mean weft crease recovery (degrees)	SD	CV%
GREY	55.9082	3.6780	5.765
DYED	47.5000	3.4567	5.9087

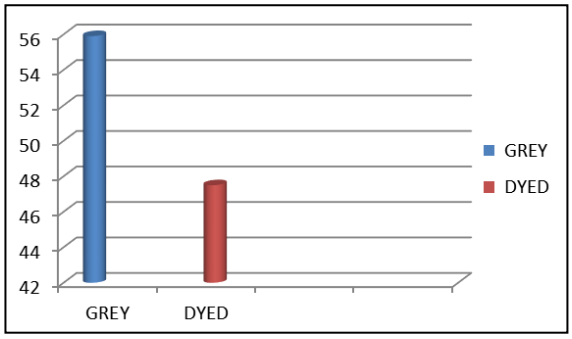

Fig 9

From the above table 9 and figure 9, it was found that the crease recovery in weft of dyed soya material has been increased than grey material

Air Permeability

Table 10

Soya Material	Mean air Permeability (cc/cm2/sec)	SD	CV%
GREY	202.5409	10.7295	4.9974
DYED	172.6308	6.7503	3.7151

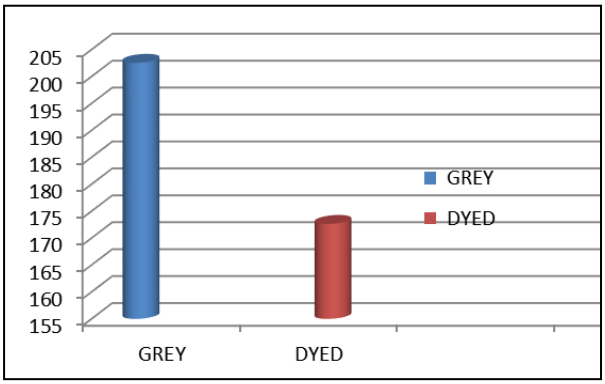

Fig 10

From the above table 10 and figure 10, it was found that the air permeability of dyed soya material has been increased than grey material

Drapability

Table 11

Soya Material	Mean Drape (percent)	SD	CV%
GREY	94.5674	0.3896	0.4065
DYED	87.5432	0.0948	0.1045

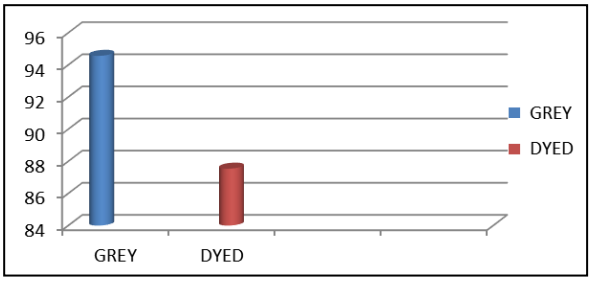

Fig 11

From the above table 11 and figure 11, it was found that the drapability of dyed soya material has been decreased than grey material.

Abrasion Resistance

Table 12

Soya Material	Mean abrasion (gm)	SD	CV%
GREY	2.876	0.1564	5.3272
DYED	3.9000	0.1754	3.5073

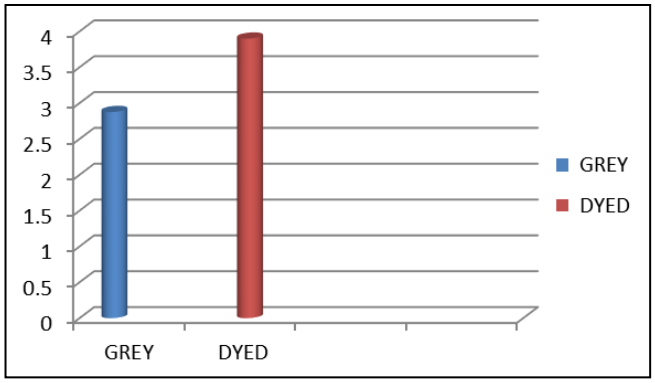

Fig 12

From the above table 12 and figure 12, it was found that the abrasion resistance of dyed soya material has been increased than grey material

Sinking Test

Table 13

Soya Material	Mean sinking (sec)	SD	CV%
GREY	11.0000	3.8960	25.8925
DYED	33.0000	5.5430	14.7783

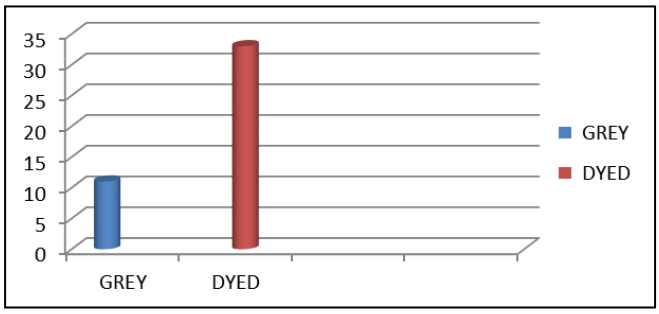

Fig 13

From the above table 13 and figure 13, it was found that the sinking test of dyed soya material has been increased than grey material

Capillary Rise Test

Table 14

Soya Material	Mean Capillary Rise (sec)	SD	CV%
GREY	82.6000	7.1678	7.6778
DYED	165.5000	6.6374	3.5626

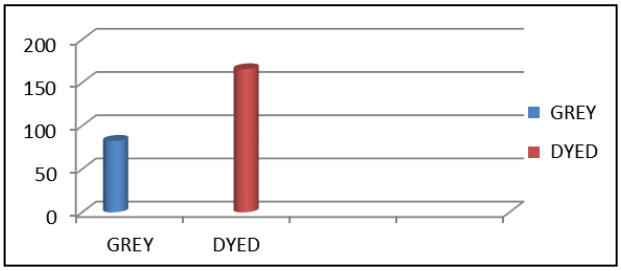

Fig 14

From the above table 14 and figure 14, it was found that the capillary test of dyed soya material has been decreased than grey material

Warp Shrinkage

Table 15

Soya Material	Mean warp shrinkage (per cent)	SD	CV%
GREY	10.564	0.3091	2.2418
DYED	11.987	0.2449	1.9129

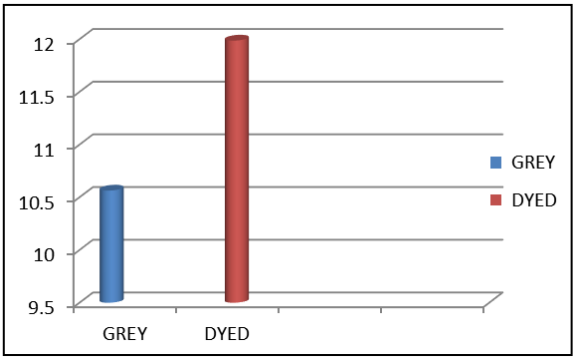

Fig 15

From the above table 15 and figure 15, it was found that the warp shrinkage of dyed soya material has been decreased than grey material

Weft Shrinkage

Table 16

Soya Material	Mean weft shrinkage (per cent)	SD	CV%
GREY	14.9876	0.2516	1.7321
DYED	12.8760	0.2234	1.4181

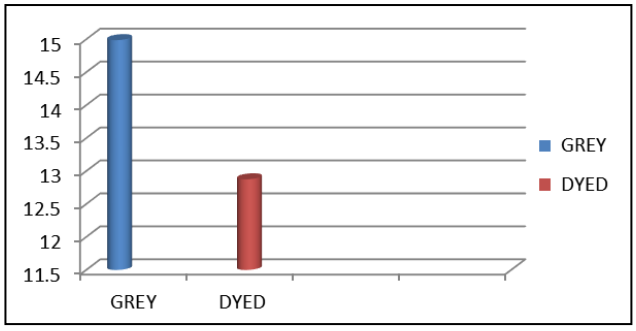

Fig 16

From the above table 16 and figure 16, it was found that the weft shrinkage of dyed soya material has been increased than grey material

Summary and Conclusion

Soya bean protein fibre is the only botanic protein fibre in the world, a newly born guard to mankind's skin. The fee such as softness, comfort and smoothness would have never been felt before it is feeling like "skin on skin". It is an active fibre, a new green textile fibre, and it possesses the superiorities of many natural fibre and synthesized ones. Dyeing with natural dyes is traditional craft of India. The menacling back drop of impending ecological disaster and toxic disease of synthetic dyes has prompted researches to look for eco-friendly, bio-degradable, non-toxic natural dyes.

- Soya blended cotton yarn was converted into material by fabric construction technique.
- Soya blended cotton material was dyed using natural dyes.
- Grey and dyed fabric were analysed and compared
- An apparel was constructed

Findings of the Study

- From the above table 1 and figure 1, it was found that the drapability of grey material is higher than dyed soya material.
- From the above table 2 and figure 2, it was found that the abrasion resistance of dyed soya material is higher than grey material**.**
- From the above table 3 and figure 3, it was found that the sinking test of dyed soya material is greater than grey material.
- From the above table 4 and figure 4, it was found that the capillary test of dyed soya material is higher than grey material
- From the above table 5 and figure 5, it was found that the warp shrinkage of dyed soya material has been increased than grey material
- From the above table 6 and figure 6, it was found that the weft shrinkage of dyed soya material has been decreased than grey material

Soya bean protein fibre is a healthy, comfortable and environment friendly textile fibre says. We can feel its smoothness at that of a child's skin. Its moisture absorption capacity is similar to cotton and moisture transmission is better than cotton. SPF can be blended with other common fibres like cashmere, wool, combed cotton, elastic fibre, polyester and synthetic fibres. Soya protein fibre not only has excellent optic effect but outstanding features in wearing.

Knitting fabric of soya bean fibre has soft. The original colour of soya bean protein is light yellow like that of tussah silk. Also fabric of soya bean protein fibre has outstanding anti- crease, easy – wash and fast- wash property. The count of protein in the fibre is up to 45 % soya bean protein contains 18 kind of active materials which are necessary to human body. SPF has breaking strength higher than that of wool, cotton and easy. Its boiling water shrinkage is low and its has outstanding anti-crease, easy – wash and fast – dry property. The fibre strength strength decreases greatly and the colour becomes pale yellow at 160 c. at 110 c, the fabric handle becomes harsh. It can be dyed with acid dye, cationic dyes, metal complex dyes, reactive dyes and vat dyes. The weaved garments made from SPF has strong UV absorption (195-380 mm) almost 100% and hence can effectively prevent the incidence skin cancer. Promoting blood circulation and strengthening immunity. Soya bean functional fibre has not only the superiorities of the natural fibre but also the physical properties of synthetic ones.

People can improve the small environments around himself at any time, more benefit to keep a good health: when the far-infrared ray effect on humans skin, the resonated activation of cell in human body will be produced, which can adjust the micro circulation of capacity vessel in skin, good to adjust the status of cell in human body. Soya bean functional fibre is the unique functional fibre in the world fibre history that won four functions in it, so it named the "soya bean functional fibre "in textile. In soya functional fibre, there are many substance that could control kinds of germinal like staphylococcus aureus, bacillus coil and Candida albicans etc.

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