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COMPARATIVE STUDY ON FASTNESS PROPERTIES OF BASIC AND REACTIVE DYES ON LOTUS SILK

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ABSTRACT: In this our present study an attempt is made to study on fastness properties of reactive and basic dye on lotus silk and their rubbing and wash fastness properties were analyzed. Finally these fabrics are compared based on their fastness properties. Conclusion is drawn for suitability of best class of dye on Lotus silk. It was found that dye absorbing character of lotus silk fabric varies for different dyes, dye absorbed by the fabric dyed with hot brand reactive dye is considerably higher than that of the fabric dyed with acid or basic dyes. Also, the washing fastness properties of the fabric that was dyed with hot brand reactive dye was found to be higher than that of fabric dyed with acid and basic dyes. Similarly the rubbing fastness of the fabric dyed with the basic dye was found to be considerably higher compared to fabric that was dyed with acid and reactive dye class.

INTRODUCTION

Lotus, the national flower of India is more than just its beauty. A flower of religious and cultural importance, blooms out of mud. This symbol of purity and knowledge serves many purposes. The pastel petals, the large green leaves and the brownish stems are of high value. The lotus stems, apart from being nutritious are much appreciated for its fibers. Delicate, thin strands of fibers are extracted from the lotus stem and woven into fabric with silk-like properties and are thus called “Lotus Silk”.

Extracting fibers from lotus stems have been in practice since 1910. Later during the 90's designers of Japan setup workshops to create a foreign market for their fabric. But due to low

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demand in Japan, lotus fibre fabric remained a rare and handmade textile. Lotus silk is extracted and woven in Myanmar, Cambodia, Vietnam and even some parts of Manipur. Lotus silk is one of the most expensive and rarest fabrics in the world. One of the major reasons is that the entire process of manufacturing Lotus fiber is completely manual. This natural fiber is only extracted by a few skilled craftspeople across the world. It is a highly time-consuming process. Moreover, the quantity of fabric produced is also limited. Extracting enough lotus silk for one scarf can take two months, and the final product can cost 10 times as much as regular silk!

Manufacturing of lotus silk:

Step 1: Lotus Harvesting: Lotus of different shades and colours are spread across thousand of water bodies and are harvested during the rainy season of June – November. The threads need to be processed within 24 hours while they're still wet; otherwise, they'll break. So, harvesting has to be done each day.

Step 2: Lotus Fiber Extraction:

Younger women gather the stems of the lotus flowers in the mornings. Stems of the lotus plants are collected cut, snapped, and twisted to expose its fibres. These stems are cut with shallow knife and 5-6 stems are snapped at one time, which reveals 20-30 fine white filaments of fiber. These filaments are drawn out of the stem hung to dry and then rolled into single thread of 100-yards in length. It is very painstaking and time-consuming process. To keep one weaver busy; around 25 thread makers are required.

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Step 3: Preparing the Lotus Yarn

Fibers extracted from the stem are spun into yarn. Extracted fibers are placed in the skeins on a bamboo spinning frame to prepare yarns and transfer the thread into winders for warping. Threads are made; up to 40 meters long to avoid entanglement. The threads are then taken from the warping posts, and are coiled into huge plastic bags. Yarns for the weft are wound into bamboo bobbins.

Step 4: Weaving of Lotus fabric

Fabrics are woven in the traditional looms. The woven fabric has a width of approximately 24 inches. During the process of weaving, threads are frequently moistened with water, as lotus fibres need to be kept cool. The fabric is woven in 100-yard batches, and it takes about a month and a half to complete one batch. It's estimated that around 32,000 lotus stems are required to make just 1.09 yards of fabric and 120,000 stems are required for one outfit, making the textile extremely exclusive. After weaving, the fabric is dyed with natural dyes and every part of the precious material is utilized in some way. Leftover scraps of yarn are twisted into the wicks of pagoda lamps, and leftover pieces of fabric are made into sequin-studded robes for mini-Buddha statues.

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Step 5: Dyeing of Lotus Fabric, Fiber and Yarns

Only Natural dyes are used on lotus fiber. Natural dyes are made from the bark of a tree, flower petals, leaves, and fruits. Yarns are dyed in skein forms in different dye baths. After dyeing, fabric and skeins are dried outside in sunlight.

The Lotus fabric is the first natural microfiber and probably the most ecological fabric in the world. The plain-woven pure Lotus fabric is recommended for jackets, one piece and dresses, as it is hard wearing and soft. The airy pure Lotus fabric is recommended for scarves, as it is especially breathable and light. Because of the time-consuming nature of the thread-making process, pure lotus cloth is rare and expensive, retailing at up to 400 USD per piece. For this reason, it is often mixed with cotton or silk.

Properties of Lotus Fiber:

- It is a cellulosic fiber and finest aquatic fiber. (Waterproof fiber)
- It is cool, stiff, breathable and comfortable fiber.

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- It has good elasticity.
- It is Crease resistant fiber.
- It absorbs moisture but dries fast.
- Fabric produced with this fiber has outstanding properties.
- It doesn't contain any chemical or toxic products so it produces ecological fabric.
- The manufacturing process doesn't require any gas, petrol, electricity or additional water.
- The lotus flower is a phyto sanitary plant that cleans the water in which it grows and preserves the ecosystem while protecting fish and insects.

The plantis grown in muddy water without the use ofany chemicals in cultivation and production making it the most eco-friendly material in the world with GOTS (Global Organic Textile Standard) certification. Itis organic and biodegradable. It serves in uplifting the employment of trial and rural people. The amazing combination of linen and silk can be seen in the lotus textiles, with good breathable and wrinkle resistant property. In addition, ithasUV resistance property, good moisture absorption, air permeability, soft and comfort properties, bio-degradable, eco-friendly, organic, handmade, handcrafted, absorb free radicals generated by body, inhibit fat production. The fiber has negative oxygen ion generated by lotus fiber is good for developing immune system of the body.

Lotus fiber is served as a novel kind of slender, soft and fragrant natural cellulose fiber which own perfect moisture absorption, good ventilation and culture meaning. They are naturally stain-resistant that makesits exotic. Lotus fabric has unique properties. itis naturally soft, light, especially breathable, and almost wrinkle free. Itis also an eco-friendly fabric containing no chemicals ortoxic products. The plant is believed to have healing abilities and wearing a fabric made from lotus fibersis also believed to have the same effects. Lotus plants are pure by virtue, and they radiate this purity through their fibers.

LITERATURE REVIEW

History of Lotus textiles

Lotus is considered as a very spiritual plantand the motif of lotus flower is a very popular design in textiles. Among various religions Hinduism and Buddhism has a strong religious connection with lotus plant. In olden days, Cambodian monks were believed towear natural dyed lotus fabric as a symbol of peaceful living, purity and divinity. Lotus textiles are very popular in Thailand and Myanmar as a luxurious fabric, with high production time with the look and feel of silk-linen combination. In Cambodia, lotus textiles are made by plucking the stems of lotus plant from the spectacular giant lotus flower lake ofKampingPoy near Battambang. Here, they farm the lotus round the year, from generation to generation in order to extract and sell the seeds of lotus flower. According to sources, this activity began around 1910 when a DawSaOo (Madame Sparrows Egg) in the interest of gaining merit set outto produce a set of robes for the highly revered abbot of a nearby monastery, from the fibers of the local padonma-kya lotus plant, which grew wildin the shallows of the lake. As a team, they experimented with various filament extraction, preparation processes, eventually weaving a

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set of robes toher liking. The delighted abbot had the weavers name changed toDaw Kya Oo (Madame Lotus Egg) in honor ofher pious achievement. DawKyaOoand her friends throughout their lives continued to weave with lotus yarn for meritorious rather than commercial purposes, producing one or two sets of robes a year for eminent local abbots. None ofDaw Kya Oos progeny are currently involved in weaving, but the descendants of her friends havecontinued the tradition.

Advantages of lotus fabric

- A waste (lotus stems) transformed into a quality textile
- No chemical or toxic product
- No use of polluting energy
- Hand spun,
- Hand woven, following traditional Cambodian methods

Facts about Lotus Textiles;

The reason for claiming lotus tobe the best fiber are due to very facts the first being thatit uses no toxic chemicals and pesticides during its cultivation. Approximately 40,000 stems are used in 3,000 meters of thread and create a one meter of fabric. In a day lotus canbe harvested four times, and one spinner can handle uptoan area of 1 lakh hectre. He can spin 250 meters of yarn per day. In data, 30 kg of stems can be transformed into 250 meters of thread. One kilograme of lotus plant sells for 10 cents and a the workers are paid $150 per month which is a good salary compared to the yield in agriculture. The plant is usually supplied by the local farmers. Hong kong, Japan, Europe and United States of America have very strong market potential for lotus fabric. Samatoa, is the brand that procduces lotus fiber at a large scale with a strong export market. They also sell silk, kapok, banana fiber as individual fabrics and as blends with lotus fiber. The products are handspun, hand woven, natural dyes which are extremely benefial for nature and skin.

Care of lotus fabric

- Hand wash
- Do not bleach
- Dry flat in the shade
- Do not require iron
- Dry-clean: petroleum solvent only

Disadvantages:

- Raw material collection to yarn spinning and weaving is completely handmade.
- Time consuming and expensive.
- The lotus fabric must be weaved within 24 hours to prevent the deterioration of fibre.
- The process is labor intensive.

MATERIALS AND METHODS

LOTUSSILK FABRIC :

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Lotus silk fabric was used for the project and was procured from the market with the following specification

Ends/inch: 99

Picks/inch: 83

Warp count: 38 Ne

Weft count: 34 Ne

Weight: 120 gsm

Chemicals :

- Hot brand reactive dye: Reactive dyes react with the fibrethat too mainly react with cellulosic fibers.Reactive dyes contain reactive group and this reactive group makes covalent bond with fibers and becomes part of fibers. By their nature, reactive dyes also react with water.Dyes which react with fiber is said to be fixed to the fiber.Dyes which reacts with water is said to hydrolysed.
- Acid dye: Acid dyes are normally used to dye protein fibers i.esilk.Acid dyes get attached to the amino group of silk by electrostatic force of attraction.
- Basic dye: Basic dyes are normally used to dye protein fibers i.esilk.Basic dyes get attached to the carboxylic acid group by electrostatic force of attraction.
- Wetting agent: It is used to make the material soft to absorb the solvent and dyes.
- Common salt: It is used as exhausting agent
- Acetic acid: It is helpful to maintain acetic media by reducing PH.
- Soda ash: It acts as a fixing agent that is helpful to fix the dye.

METHODS

Dyeing of lotus silk using hot brand reactive dye

Recipe:

1. M:L::1:3
2. Dye -2% OWN
3. Soda ash-15 GPL
4. Common salt-60 GPL
5. Temperature- 70^0c
6. Timing- 80 min

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Procedure:

1. Firstly weight the given lotus fabric and note down its initial weight (W1)
2. Prepare the dyeing bath with the following ingredients:

Dye- 2%OWN

Common salt -60 GPL (add it at 3 installments)

Soda ash-15 GPL

M:L::1:30

3. Calculate the amount of above given ingredients according to initial weight of fabric,and prepare the dyeing bath.
4. Put the given lotus silk fabric in the dyeing bath at room temperature,gradually temperature is raised to 70^0c and dyeing is continued at this temp for 80 min.
5. During dyeing process common salt is added in 3 installments.
6. After dyeing the material is taken out and dried.

Dyeing of lotus silk fabric using acid dyes:

Recipe

1. Acid dyes – 2% OWN
2. Wetting agent – 0.5 to 1 GPL
3. Glabular salt – 15 GPL
4. Acetic acid – 3% OWN
5. M:L::1:40
6. Time-90 min
7. Temperature - 90^0c

Procedure:

1. Firstly weight the given lotus fabric and note down its initial weight (W1)
2. Prepare the dyeing bath with the following ingredients:

Dye- 2%OWN

Wetting agent – 0.5-1 GPL

Acetic acid – 3% OWN

Glabular salt – 15 GPL

M:L::1:40

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3. Calculate the amount of above given ingredient according to initial weight of fabric and prepare the dyeing bath.
4. Put the given lotus silk fabric in the dyeing bath at room temperature,gradually temperature is raised to 90^0c and dyeing is continued at this temp for 90 min.
5. During dyeing process glabular salt is added in 3 installments.
6. After dyeing the material is taken out and dried.

Dyeing of lotus silk fabric using basic dyes

Recipe:

1. Basic dye – 2% OWN
2. Acetic acid – 2% OWN
3. Glabular salt – 10 GPL
4. M:L::1:40

Procedure:

1. Firstly weight the given lotus fabric and note down its initial weight (W1)
2. Prepare the dyeing bath with the following ingredients:

Dye - 2%OWN

Acetic acid – 2% OWN

Glabular salt – 10 GPL

M:L::1:40

3. Calculate the amount of above given ingredient according to initial weight of fabric and prepare the dyeing bath.
4. Put the given lotus silk fabric in the dyeing bath at room temperature,gradually temperature is raised to 85^0c and dyeing is continued at this temp for 90 min.
5. During dyeing process glabular salt is added in 3 installments.
6. After dyeing the material is taken out and dried.

TESTING METHODS

Thread density:

Thread density of fabric is determined by using counting glass.

Thickness:

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Thickness of the fabric was determined using thickness gauge and the averages of 5 reading were taken

Color fastness of dyed fabric for washing:

Aim: To determine the color fastness property of dyed fabric for washing.

procedure:

- The given sample is cut to a size of 10*4 cms with that 2 pieces of undyed cloth of same length and breadth are cut.
- Dyed fabric of 10*4 cmsis then sandwitched between the 2 undyed/bleached fabric and they are sewn in sewing machine only longitudinally.
- Stitched sample is weighted and kept in the material container with

  M:L::1:40

  Soap OWF – 0.5%
- The material is treated for 30mins in machine.
- After the treatment time it is taken out and washed with cold water and dried
- Then the stitch is removed and the samples are compared with the grey scales and grade is given.

Grey scale rating	Remarks
1	Very poor
2	or
3	erage
4	Good
5	cellent

Fastness properties of dyed fabric for rubbing by crockmeter:

Aim: To determine the fastness properties of dyed fabric for rubbing by using crockmeter

Procedure:

- Conditioning of fabric to be tested i.e dyed and bleached fabrics in standard testing atmosphere for 24 hours.

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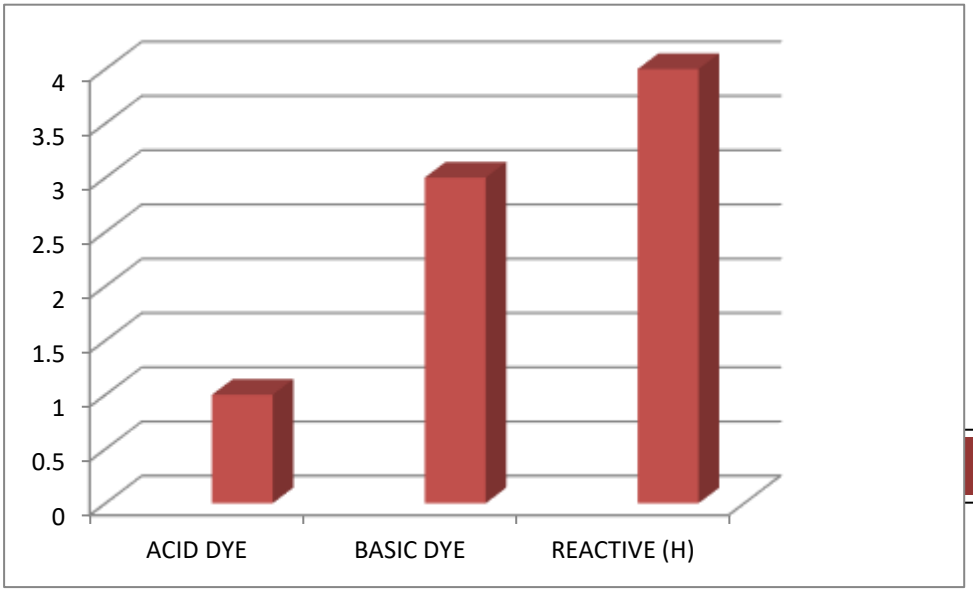
- Bleached /undyed is cut to 5*5 cm size of required number and then the fabric is to be tested is fixed to the rubbing peg i.e finger of crockmeter.
- Dyed fabric is fixed to the base and tightly held in portion by clamp. Then the rubbing peg is given an forward and backward action with the help of hand pedal for 10 min with downward force of 900 gms on the finger.
- Rubbing fastness is determined and then rating is given using degreeof staining grey scale.

RESULTS

Lotus silk fabric were dyed with protein and cellulosic dyes mainly acid ,basic and hot brand reactive dye at various temperature 90^0c, 85^0c and 70^0 c. The sample were subjected to various testing methods to study the changes in their physical properties Viz, wash fastness and rubbing fastness properties.The dye absorption and fastness properties of these fabric samples were analysed.

WASH FASTNESS

WASH FASHNESS					
Dye class	**Rating**			**Avg**	**Remarks**
Acid Dye	**1**	**1**	**2**	**1**	**VERY POOR**
Basic Dye	**3**	**3**	**2**	**3**	**AVERAGE**
Reactive (H)	**4**	**4**	**3**	**4**	**GOOD**



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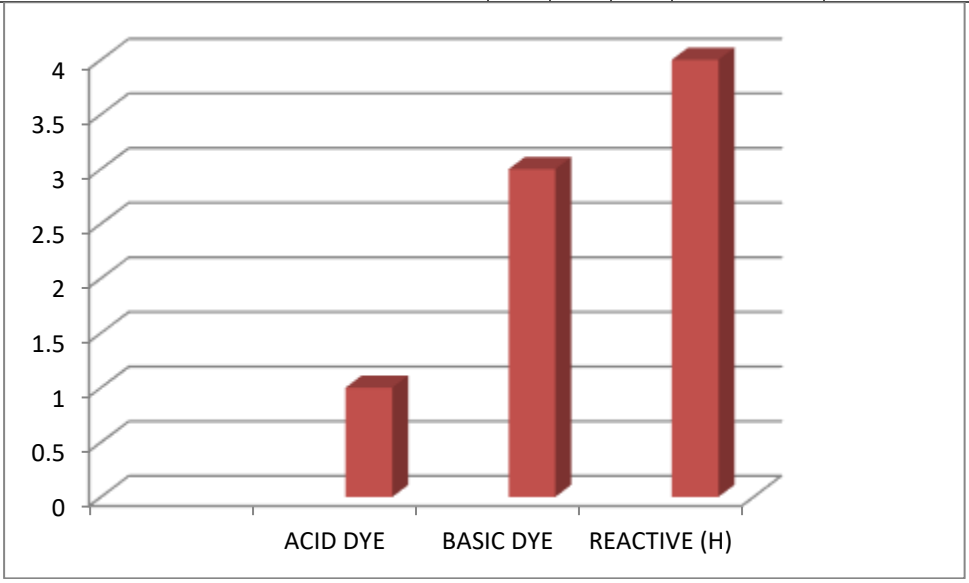
RUBBING FASTNESS:

RUBBING FASTNESS					
Dye class	**Rating**			**Avg**	**Remarks**
Acid Dye	**2**	**2**	**1**		POOR
Basic Dye	**4**	**4**	**3**	**4**	GOOD
Reactive (H)	**3**	**2**	**3**	**3**	AVERAGE



CONCLUSION

- From the present study we observed that the lotus silk fabric shows good affinity towards cellulosic dyes.
- In our present study we observed that the lotus silk fabric shows good wash fastness property for Reactive dye class, while basic dyes shows average wash fastness compared with that of acid dye class.
- In our present study we observed that the lotus silk fabric shows good rubbing fastness property for basic dye class while reactive dye shows average rubbing fastness compared with that of acid dye class.
- The Lotus silk fabric is extracted from the stem of lotus plant, i.e comes under the family of cellulosic fiber. Even then it's named as Lotus Silk.
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