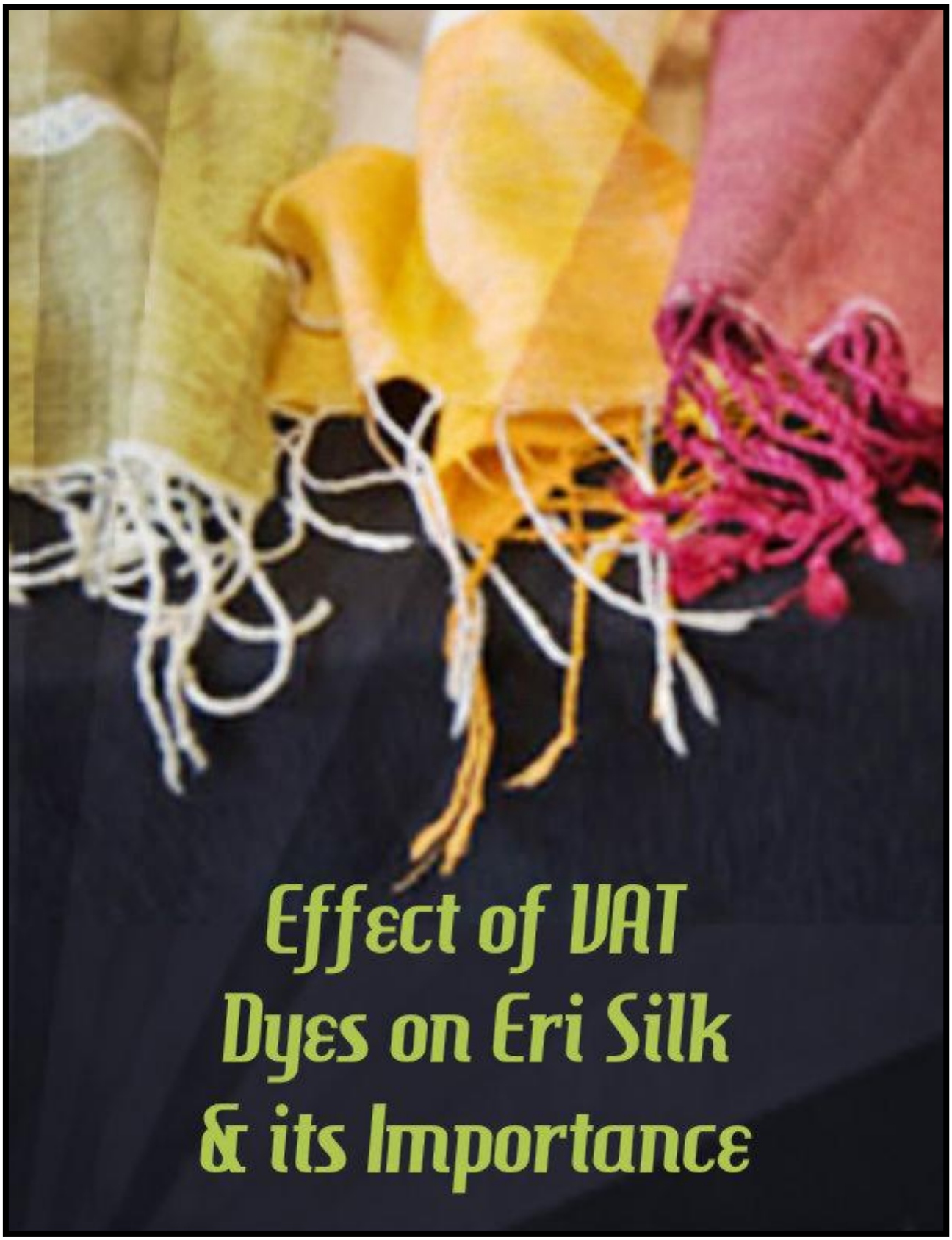
Effect of VAT
Dyes on Eri Silk
& its Importance

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By: Vinaya. K.S, Mr. D. Sheshachala, Dr. M.A. Joseph, Mr. S.A. Hipparagi & Mr. Sreenivasa

INTRODUCTION:

Silk is known as the queen of all textile fibres because of its soothing luster and elegance. None of the natural or manmade fibres have been able to rival its versatility and share its beauty. Lustre, softness, elasticity, strength, drape, absorbency and affinity for dyes and its adaptability to various forms of twisting continue to meet a variety of market demand has made silk as a highly valued textile fibre. India produces all the four varieties of silks namely Mulberry, Eri, Tasar and Muga. Eri silk is the second largest variety of silk being produced in India.

Eri silk is a variety of wild silks and unlike other varieties it does not come in continuous filamet form. Eri cocoons are open mouthed in nature. Eri silk is having good aesthetic values cause of smoothness, luster, liveliness and improved thermal properties. Fine suitings, ladies wear, fine knit wears produced using Eri silk are having great market demand.

Eri silk is important amongst non-mulberry silks in India. Besides possessing commercial value, it is well documented to possess high medicinal value as per the traditional folk knowledge. India is the sole producer of Eri silk at global level. In India the production of Eri silk is confined to north eastern states and very little is known about this silk in other parts of the country. Although detailed information is available on Eri silkworm rearing for the production of good quality cocoons, information on Eri silk fibre material and yarn characteristics is scanty.

IMPORTANCE OF ERI SILK:

Sericulture in India can be broadly classified in to two distinct sectors viz., mulberry and non-mulberry. Mulberry sericulture is practiced mainly in the states of Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal and Jammu and Kashmir. Non-mulberry silk is mainly confined to the states of Bihar, Jharkhand, Orissa, West Bengal, Assam, Meghalaya and Andhra Pradesh. Of this Eri silk, mainly produced from the North Eastern states of India, positioned next only to Tasar silk from the commercial importance point of view.

The name Eri derives from the Assamese word ‘Era’, which means castor plant, the main food plant of this silkworm. Samia Cynthia ricini a multivoltine silkworm commonly called as ‘Eri silkworm’ is known for its white or brick-red Eri silk. It is distributed in North-Eastern part of India, China and Japan. The primary food plant of this polyphagous insect is castor, but it also feeds on a wide range of food plants such as Heteropanax fragrans, Manihot utilissima, Evodia flaxinifolia, Ailenthus gradulosa etc.

The wild samia Cynthia ricini silkworm completes one to three generations per year depending on geographical position and climatic conditions of the region, however, up to six generations occur in the domesticated cultures. Populations of Samia Cynthia

ricini, that have been commercially exploited and are present in different regions of north-east India show wide morphological and quantitative variations in characters such as silk content, larval weight, cocoon weight, cocoon shell weight and silk ratio. Eri silkworms were successfully acclimatized in America and Europe, but could not take firm hold.

Recent trends suggest a steady gaining popularity for non-mulberry silks in the export market due to their unique natural characteristics. Thus there is a strong need for increasing Eri silk production. Eri silk in addition to its fibre value, it is known for its traditional medicinal value in the north eastern states.

The wild Eri silkworm Samia Cynthia is generally uni, bi or trivoltine. The commercially exploited S.ricini is multivoltine and has eco-races like Nongpoh, Kokrajhar Red, Borduar local, Titabar local Sille, Dhanubhnga, Mendipathar and Khanapara based on the locations of their collection. Eri silk is a fibre available in cocoon form and is non continuous. It can be opened and cut to the required length.

PROPERTIES OF ERI SILK:

Properties of eri fibre

- Size of eri cocoon is 4.8*2.5 cm
- Denier of eri fibre is 2 -3
- Cocoon weight (g): 2.5-2.82
- Shell weight(g): 0.31-0.44
- Shell ratio: 15-17

Physical properties

- Filament denier(d): 2.2-2.5
- Fineness(microns): 13-15
- Tenacity 3-3.5 g/d
- Elongation 20-22%
- Whiteness(%): 43.31
- Yellowness(%): 13.90

Chemical properties

- Sensitive to high alkaline conditions
- High concentration of acidic conditions Specifically H2S04 of 80% strength can dissolve this.
- Having good resistance to mild organic solvents/organic acids (citric and tartaric acid).

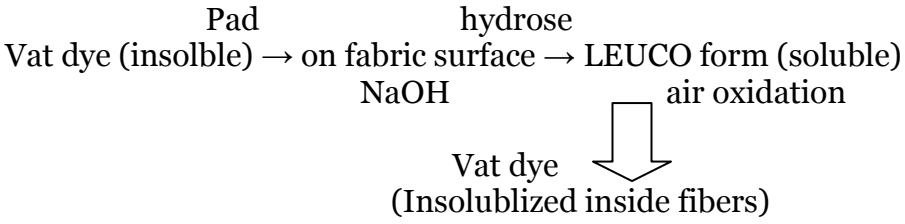
Eri Silk - Fibre Composition

Sl. No	Content	(%)
1	Fibroin	72.2%
2	Sericin	11.9%
3	Fat(carbohydrates, waxy material etc)	1.3%
4	Moisture	14.6%

APPLICATION OF VAT DYES ON ERI SILK:

Large quantity of water is used in processing of silk. Liquor ratio, type of silk, & class of dyes are certain criteria will decide the effluent load. As quantity of water is used in vat dye is less compared to other process by controlling few parameters like pH, Time, and Temperature, concentration of Sodium hydroxide & sodium Hydrosulphite, we can reduce the BOD & COD.As wet processing industry is one of the industries in the textile sector which uses large quantity of water and this water after the process is released out without treatment will have a direct impact on the ecology due to the release of toxic and carcinogenic substances.

"Vat dyes" are a special class of dyes that work with a special chemistry. The name Vat was derived from the large wooden vessel from which vat dyes were first applied. Vat dyes provide textile material with the best color fastness of all the dyes in common use. Vat dyes are an ancient class of dye based on the original natural dye Indigo, which is now produced synthetically and its close chemical relative historic tyrain purple. Vat dyeing means dyeing in a bucket or vat it can be done whenever a solid even shade is required.



Conversion of vat insoluble form to soluble form

Before chemical reducing agents were readily available, vat dyes were converted to their soluble leuco form by fermentation of organic matter in wood tubs called vats. This method of reduction and application is the source of the name for this class of dyes. Once the vat dyes have been regenerated inside the fiber, they are very insoluble. This accounts for their excellent wash fastness. Because they can be applied as dispersion by padding, solubilized by reduction, and finally reoxidized when inside the fibers, vats are well- suited to continuous dyeing operations. Such treatments exhibit a number of advantages:

a) Very efficient use of the dye.
b) The insoluble vat is very evenly distributed over the fabric surface, leading to level dyeing.
c) continuous processes are normally more economical processes than batch processes.[17]

Vat dyes, so called because indigo, the first member belonging to this class of dyes was dyed on textile materials in wooden vats (tubs) in ancient days, water-insoluble coloured compounds. As such they cannot be directly applied to be converted in to a water-soluble form, having sufficient affinity for fibres. During the dyeing process, it is this soluble form, of the dye that is applied on cotton, followed by reconversion of the soluble form into original insoluble form. As a result, the insoluble dye is trapped in the

fibre substance and come out during soaping or any other wet treatements, there by ensuring excellent washing fastness. Most of the vat dyes are extremely fast to light; in fact, the brilliance and depth of shades produced from some of the vat dyes on cotton fabrics lost longer than the fabrics themselves i.e., the dyed fabric may lose its strength on prolonged usage and exposure to sunlight, but the brilliance and depth of shade remain unaltered.Subsequently it was found that these dyes absorbed light energy from sunlight and in the presence of atmospheric oxygen and moisture caused an accelerated degradation or tendering of cotton fabrics on which they were present. These two dyes were then withdrawn from the market and are not manufactured any more. This property is called photochemical tendering activity of vat dyes.

The name “vatting” once meant using natural fermentation processes in a vat to produce the reducing conditions to make the dye soluble. Indigo, the blue of blue jeans is a common vat dye. Vat dyes, with the notable exception of indigo are generally very lightfast and washfast. Many have very good resistance to chlorine bleach. Multiple applications of dye may be required to build strong shades because of limited substantivity of the colour. Sulfur dyes use processes similar to vat dyes, but are distinguished by their sulfur content. Some modern vat dyes are supplied in already-reduced soluble form.

PREPARATION OF LEUCO VAT DYE SOLUTION:

The vat dyestuff powder is taken in a separate vessel and made in to a paste with Turkey red oil (the some weight of dyestuff to be taken) and add some hot water (50-60 deg C). The caustic soda is first added and then sodiumhydrosulphite is added, and allows standing for 10-20 minutes with occasional stirring, the complete vatting taking place.In above 10-20 minutes the dyestuff will be reduced completely and going to solution. This can be seen by the clearness of the solution and charecteristics of the vat colour. The vatting stage temporarily alters the original colour of the dye (reduced colour).Most vat dyes are sold in insoluble oxidized form. The first operation therefore, consists of reducing to the lecuo compound and dissolving the latter in alkali, a process commonly referred to as vatting. The classical nature vat dyes such as Indigo and Tyrian purple were reduced in fermentation vat.

APPLICATION OF VAT DYES:

Generally, the application of vat dyes to textile materials involves four distinct steps.

Vatting:

In which the insoluble commercial dye is reduced and solidifies (vatting) by using sodium hydro sulphite (hydrose) and sodium hydroxide (NaOH).

Dyeing:

In which the soluble sodium salt of the leuco vat dye is absorbed by the textile material from an alkaline reducing medium in the presence of either a retarding agent or an exhausting agent depending on the rate of dyeing.

Oxidation:

In which the soluble form of the dye absorbed by the fibre, is reconverted in to the original insoluble dye by atmospheric oxygen (Airing) or by the use of "chemical oxidation" (that is involving the use of a chemical like sodium per borate or potassium dichromate or Hydrogen peroxide). Soaping off in the dyed material is subjected to a treatment either boiling soap or other detergent solution in order to get a proper tone by way of aggregation of smaller dye particles in to bigger one and also to get the optimum fastness, especially rubbing fastness by removing the surface deposited dye particles.

AFTER TREATMENT:

Soaping off in the dyed material is subjected to a treatment either boiling soap or other detergent solution in order to get a proper tone by way of aggregation of smaller dye particles in to bigger one and also to get the optimum fastness, especially rubbing fastness by removing the surface deposited dye particles.

CONCLUSION:

Dyeing is a process of application of colour to the textile material in scientific and systematic way. Normally the dye liquor consists of dye, water and auxiliaries. To improve the effectiveness of dyeing, heat is usually applied to the dye liquor. Although Acid dyes, Metal complex dyes, Reactive dyes are popular in silk industry. Some criteria like overall fastness properties of vat colour have been the attention of processors to use them in dyeing of vanya silk. Generally vanya silk is showing higher overall resistance compared to mulberry silks can be safely dyed with special criterion colours. Vat is basically an insoluble in water produces a good fastness properties compared to regular acid and metal complex dyes. Keeping eye on production of washable silk an attempt has been made to optimize dyeing of Eri silk with vat dyes. [2]

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