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Improve the Quality of Coloring Performance of Silk Fabric

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Abstract

ENVIRONMENTAL concerns are becoming increasingly significant, and there is a movement to restrict the usage of harmful products. Consumers, like the textile industry, prefer natural dyes cloth over synthetic dyes. The purpose of this research is to identify natural dyes components derived from natural dyes. Indigo, Turmeric, Madder and Terminalia, Cassia singueana Plant, and Stink bean pod (PARKIA SPECIOSA HASSK.) on silk fabrics, and Synthetic Dyes as a reactive dye as well as to assess the quality of silk dyed with natural dyes. The natural dyes were then applied to the silk and then performed testing the quality of the silk color. The results revealed that natural dyes primarily generate pastel hues, According to the quality test, all-natural dyes have a poor resistance to washing at 40o C and a poor fade resistance to acid sweat, but they perform well against bases perspiration. It may be determined that all silk colored with natural dyes has better tensile strength than uncolored silk.

Keywords: Natural dyes, synthetic dyes, and various treatments on silk textiles.

Introduction

Silk is a unique natural polymer that serves a vital purpose in our society. Every year, one hundred billion dollars are spent on silk-based products. Silk threads from the Bombyx mori silkworm have laid the groundwork for a millennium-old textile industry with a thriving business. More than 120 000 tonnes of silk are produced worldwide, with China, India, and Japan having the most economic clout. Even though spider silk threads are far more enticing due to their superior intrinsic mechanical properties, they have yet to be commercialized. Insects create silk proteins in several ways, but each species can only produce one kind. A single spider, on the other hand, can manufacture up to eight different types of silk thread. [1, 2]

Silk proteins are produced by insects in a variety of ways, but each species can only make one form. In contrast, a single spider may produce up to eight distinct kinds of silk thread. [1, 2] This significant variance may imply that silk has diverse purposes in the natural world for insects and spiders. However, this is not the case because the function of silk in insects and spiders is comparable.

Silk is dyed with a combination of Natural dyes to have better biodegradability, a wider range of non-toxic, non-carcinogenic, easily available and renewable, eco-friendliness, and overall higher compatibility with the environment; and provide a wide range of beautiful shades with acceptable levels of Colour fastness. [3-5] As a result, it is the best natural colorant option in textile applications when compared to synthetic dyes. [6] Colorants can be obtained from plant sources such as roots, bark, leaves, fruits, and flowers. Natural colors not only release therapeutic compounds but also boost the aesthetic value of the product, and they are one-of-a-kind and environmentally friendly. [7-9]

Silk

Since ancient times, silk, the only known natural fiber in the shape of a continuous, strong, and easy-to-weave thread, has been extensively utilized as a luxury raw material for textile manufacture. Silk textiles have traditionally been regarded as high-value, refined fabrics due to their glittering look. Sericulture, or the captive raising of silkworms for the production of silk, has been practiced for over 5000 years. [10] This practice began in China and

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moved to Korea and Japan, then to India, and lastly to Western countries.

The silkworm (larva or caterpillar) of the farmed B. mori moth, a member of the Bombycid family wholly dependent on humans and no longer occurs naturally in the wild, is the most widely produced silk. B. more moths were domesticated in China from the wild Bombyx mandarin progenitor moth. [11] B. mori silk is also known as mulberry silk because it is generated by silkworms that feed on the leaves of white mulberry trees (Morus Alba). Mulberry silk is higher in quality than other varieties of silk, such as wild silk, which is less consistent in Colour and texture and has shorter strands. [12]

Natural silkworm silk threads are made up of an inner polymer silk core, a protein skin, and a sericin coating. Several writers hypothesized that the center of a silk thread is made up of Nano fibrils, some of which form bundles known as microfibrils. [13] The coating acts as a glue to hold all of the structures together, but there are some signs that it may also operate as a fungicidal or bactericidal agent, or even play a significant role during the extrusion process. Spider and mulberry silkworm silk substructures are quite similar. Both are made of orientated Nano fibrils and have elongated tubular chambers or vacuoles that allow controlled fracture development in the fibers when stretched or loaded. [14] Silk thread diameter varies, but the average width of Nano fibrils reveals that they are independent of the fiber size, ranging from 90 to 170 nm. [15] Generally, the silk fibers produced by silkworms are composed of two protein monofilaments – named brins – surrounded by sericin, a glue-like coating. [16-18] The brins are essentially fibroin filaments made up of bundles of Nano fibrils, which are oriented parallel to the axis of the fiber and are thought to interact strongly with each other. [18]

The sericin coating, which accounts for 25-30% of the weight of silk protein, wraps the fibroin fiber in consecutive sticky layers that help the cocoon develop. Furthermore, sericin keeps the cocoon together by gluing silk threads together. [19] Sericin, like fibroin, is a macromolecular protein with a molecular weight ranging from roughly 10 to more than 300 kDa. [20] Sericin is a water-soluble protein composed of several amino acids, the majority of which have highly polar side groups including hydroxyl, carboxyl, and amino groups. Sericin is made up of roughly 33.4 and 16.7% of the amino acids serine (Ser) and aspartic acid (Asp). Sericin has several appealing traits, including resistance to oxidation and ultraviolet (UV) radiation, antimicrobial capabilities, and the capacity to absorb and release moisture.

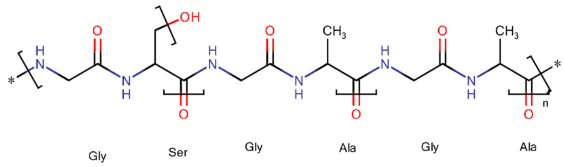
The heavy and light chains (H-fibroin and L-fibroin chains, respectively) of fibroin from the silkworm B. mori are joined together by a disulfide bond at the C-terminus of these two subunits. [19] Aside from these two types of chains, the protein may also contain a glycoprotein known as P25 (25 kDa), which is non-covalently connected to the aforementioned chains. [21]

P25 has been proposed to operate as a chaperone to aid in the transport and secretion of the H-fibroin chains, [19] and is thought to have an important part in the structure's integrity.50, comfortably. [22]

Even though H-fibroin contains over 5000 amino acids, the bulk of the protein is made up of non-polar and hydrophobic glycine (Gly, 45.9%), alanine (Ala, 30.3%), Ser (12.1%), tyrosine (Tyr, 5.3%), and valine (Val, 1.8%) residues. [23] Numerous studies in the past indicated that the basic structure of B. mori fibroin had a simple and regular unit and that roughly 70% of the amino acid sequence could be simply described as (-Gly-Ser-Gly-Ala-Gly-Ala-)n. [24] The H-fibroin chain is now known to be composed of a highly repeating crystalline proportion of Gly-X repeats, with the X position inhabited by Ala, Ser, Tyr, Val, and threonine (Thr) residues and 1.3% of the repetitions, respectively. [25] As will be addressed more below,

Chemical composition of silk fiber

Raw silk consists of two major protein components: Fibroin (approximately 75–83 wt. %) and sericin (25–17 wt. %).



Element of silk fiber	Amount%
Fibroin	75
Ash of silk fibroin	0.5
Sericin	22.5
Fat & Wax	1.5
Mineral Salt	0.5
Total	100

Advantages of silk fabric

Luxurious hand (the feel of a fiber, yarn, or fabric to the wearer). Excellent drape (a fabric's ability to fold while worn). Wonderful luster (reflection of light on fabric). Hydrophilic. Stain resistant. Strong but lightweight

Disadvantages of silk fabric

Fair abrasion and resiliency. Turns yellow if bleached. Poor resistance to exposed sunlight.

Expensive. Degrades over time with exposure to oxygen, making it difficult to preserve.

uses **of silk fabric**

Silk's good absorbency makes it comfortable to wear in warm weather and while active. Its low conductivity keeps warm air close to the skin during cold weather. It is often used for clothing such as shirts, blouses, formal dresses, high fashion clothes, negligees, pyjamas, robes, skirt suits, sun dresses, and underwear. Silk's elegant, soft luster and beautiful drape make it perfect for many furnishing applications. It is used for upholstery, wall coverings, window treatments (if blended with another fiber), rugs, bedding, and wall hangings.

Comparison between the natural and synthetic dye

Natural dyes are more expensive than synthetic colors because they cannot be made in big numbers. Natural dyes, on the other hand, are less expensive to apply. Natural colors have a larger tinctorial value than synthetic colors. Using various mordents, they make a wide spectrum of excellent glossy, mild, soft, and biodegradable hues. All natural colors derived from plants are renewable. Natural-dyed goods provide an excellent potential for value-added exports from nations that are already world leaders in textile production. Natural dyes are the safest dyes since they do not produce any unwanted by-products while also helping to regenerate the environment. Despite the numerous benefits that natural dyes have over synthetic dyes, their usage is still limited due to a lack of dyes in nations that are already global leaders in textile manufacturing. In the standardized farm, there is a dearth of qualified dyers, a knowledge gap, and increased manpower costs associated with dye collection and preparation. However, many natural materials that are carelessly squandered or end up as waste products include important pigments. Natural dyes' eco-friendliness results in wonderful, appealing, earthy colors. [5, 26-40]

Silk Dyeing

Because silk is a natural polyamide or polypeptide fiber, its dyeing qualities are extremely comparable to those of wool, another natural polypeptide fiber, and nylon, a synthetic polyamide fiber. They may be colored using comparable techniques. Silk's dyeing behavior is determined by two characteristics: its very thin fibrillar structure and high orientation of fiber molecules. Silk is less sensitive to temperature and dyes more easily. However, there is always the potential for silk filament damage during dyeing, and coloring on damaged material may appear to be defective dyeing. Silk fiber has a somewhat cationic nature, with an isoelectric point around pH 5.0. Silk is colored using a variety of dyes such as acid dyes, metal-complex dyes, reactive dyes, and so on. Acid dyes are more suited to silk and wool fabrics. There are various dyestuff ranges available for use in silk dyeing. Almost every dyestuff used for cotton or wool may also be used to dye silk. The dyestuffs are often applied using processes similar to those used for wool or cotton. The basic goal of coloring a textile fiber is that the color is permanent and does not harm the fiber's nature. It is consequently critical that the dyestuff keep its color throughout the fabric's usable life. There are various dyestuff ranges available for use in silk dyeing. Almost every dyestuff used for cotton or wool may also be used to dye silk. The dyestuffs are often applied using processes similar to those used for wool or cotton. The basic goal of coloring a textile fiber is that the color is permanent and does not harm the fiber's nature. It is consequently critical that the dyestuff keep its color throughout the fabric's usable life.

Natural Dye Sources and Their Applications in Textiles

Dyes are colorant substances that enter the fabric and appear to become a part of it. Dyes might be natural or manufactured. There are many natural dyes available in different plants and vegetables in the Universe that may be used as supplementary synthetic dyes. [41] Those colorants which can be extracted from vegetables or animal sources are in general considered to be eco-friendly in nature. [42] Natural dyestuff can produce a wide range of colors by mix and match system. A small variation in the dyeing technique or the use of different mordents with the same dye can shift the colors of a wide range or create new colors, which are not easily possible with synthetic dyestuffs.

Sources of natural dyes

Natural colors are more biodegradable and, in general, more environmentally friendly. They are non-toxic, non-allergic, and non-carcinogenic since they are derived from animal or vegetable materials without the use of chemicals. [42] Natural colors are classified into three types based on their origin: plant, animal, and mineral.

Natural dyes are derived from a range of substances found in nature, including plants, insects (cochineal beetles and lac scale insects), and animals (certain types of mollusks or shellfish). As well as minerals (ferrous sulfate, clay). [43]

Vegetable dyes

They may be produced from a variety of plant components such as roots, stems, stalks, leaves, barks, berries, and seeds. [38-40]

Dyes derived from animals

Natural colors are mostly derived from insect secretions and dried insect corpses. [33]

Mineral sources

These are the dyes obtained from natural earth pigments, which owe their tinctorial properties due to the presence of oxides or the hydrated oxides of manganese. Examples of mineral dyes are chrome yellow, iron buff, Prussian blue, nankin yellow and manganese Prussian blue, nankin yellow, and manganese brown, etc.

Silk dyeing using natural dyes

The dyeing of silk samples was carried out with four natural dyes. Indigo, Turmeric, Madder, and Terminalia.

In the case of turmeric, the yellow is Because of the presence of curcumin, however, in the case of madder, the chromophoric group is a flavone derivative. That produces orange to red color with or without the application of mordants. [44] Similarly, In the case of indigo, the chromosphere containing disulfide donor groups responsible for blue hues nevertheless, in the instance of Terminalia chebula various beige to brown hues can be used. Be obtained, where the chromophoric color group is A tannin condensation product. [45]

Silk fabric with commercially chosen natural dyes that are individually and collectively available using the top dyeing procedure, two or three colors are mixed. Light fastness, washing, and rubbing of colored samples colors or a combination of colors are provided in. All samples are colored either individually or with a mixture of dyes. The dye mixture shows sufficient all-around fastness except turmeric, which exhibits low light whilst rubbing Indigo dyes were discovered to have low fastness In comparison to Terminalia chebula. Offers high washing resistance and is light as well as rubbing. The fastness features of the color of colored samples are determined by the attachment. Dye with the fabric and dye to the attachment of fibers is determined by the existence of an auxochromic group and its implications affinity towards the fiber. Turmeric includes curcumin, which may have anti-inflammatory properties that created a hydrogen connection with the silk fiber

As a result, light fastness is weak. Terminalia chebula and Madder were present. High to extremely good all-around speed this might be because of the stronger connection. Between the fibers and dye. Finally, In the case of indigo, rubbing fastness was seen. Considered to be inadequate - an indirect indication because of the auxochromic group prevalent in indigo, but has a low affinity towards the fibers. It could have been trapping preserved on the fiber mechanism responsible for the dye molecule should be surface-attached on the surface or to stay stuck in part, As a result, the rubbing will suffer.

Silk fabric can be dyed successfully with Indigo, Turmeric, Madder, and Terminalia chebula either independently or with the help of metallic mordants. Various shades of yellow, red, and blue can be produced using four natural dyes individually or in combination.

The effect of natural dye on selected silk fabric

Marigold flower (figure2), a rich source of carotenoids and lutein, is produced as a cut flower as well as for therapeutic purposes. Marigold leaves and petals, in particular, have been used to treat a variety of ailments. [46]

Fig. 1. Marigold

Hibiscus Rosa-Sinensis (figure3) is a well-known member of the Malvaceae family that grows as an evergreen herbaceous plant. These lovely blooms are grown in several parts of the Asian continent and are known by various names, including China rose. [47]

Fig. 2. Rosa-sinensis Hibiscus

Often called Damask rose (figure 4), is known as Gole Mohammadi in Iran.R. Damascene is primarily cultivated for usage in perfume, medicinal, and the food sector. [48]

Fig. 3. Rosa damascene mill L

Borassus flabellifer Linn (figure5). Belongs to the family Arecaceae, commonly known as Palmyra palm. The Palmyra tree was used to avoid the skin irritation of using the natural dyeing process. [49]

Fig. 4. Borassus flabelliform Linn.

Results and Discussion

Fabric Weight: When compared to the original fabric, the fabric weight of colored silk cloth rose by (16.07%). The weight gain is related to the dyeing of the cloth.

Fabric Strength

the tensile strength of colored silk fabric was enhanced by 20% when compared to the original fabric. The tensile strength of the original cloth has enhanced after treatment.

Abrasion Resistance:

the abrasion resistance of colored cloth rose by (33.3%) when compared to the original fabric. Silk processing improves abrasion resistance.

Drapability

The drapability of colored silk fabric was reduced by (12.20%) when compared to the original fabric.

Sinking Examination

The sinking level of colored silk fabric rose by (77.68%) when compared to the original fabric.

Sunlight fastness, washing, pressing, and crocking the color fastness to sunshine was great. The color fastness to washing yielded a very nice outcome. The wet condition result was extremely good, and the dry condition of the crocking test was superb, with no color bleeding. The color fastness to pressing was tested in both wet and dry situations. The effect of pressing in moist circumstances was good. However, under the dry pressing condition, there is a tiny variance of colored cloth, and displayed a very nice result.

Sometimes known as the Palmyra palm, is a member of the Arecaceae family. To reduce skin discomfort during the natural coloring process, the Palmyra tree was employed.

Dyeing of Silk Fabric with Natural Dye Extracted from Cassia singueana Plant

In general, the dyeing silk fabric with extracted natural dye from Cassia singueana plant and extracted mordant from Aloe Vera will give the following advantages

Since no synthetic dyes or chemicals are added during dyeing it is possible to say this is fully environmental. [50]

Fig. 5. Cassia singueana Plant

Friendly dyeing method Since the Cassia singueana plant and Aloe Vera has a property of anti-malarial and anti-microbial activity respectively, this dyed silk fabric will behave as anti-malarial and antimicrobial at the same time. [51]

Natural dye extraction from Cassia singueana plant optimization Natural dye solution was extracted from the bark of the Cassia singueana plant at various concentrations of bark powder and temperatures as well as time. The absorption of the resulting solution was measured using optimal extraction with UV-Visible spectroscopy.

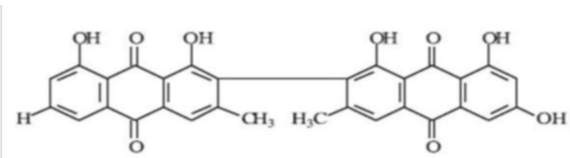


Fig. 1. typical chemical structure of tannins and anthraquinones of cassia singueana plant

Performance test results of dyed silk fabric specimens

Dyed samples which are pre-mordant with Aloe Vera were higher than the other dyed samples.

brained maximum color strength Dyed after pre-mordant with Aloe Vera which is nearly similar result with the

Simultaneously mordant with copper sulfate. The dyeability of silk fabric with the extracted natural dye was evaluated

By dying different samples of silk in the presence of Aloe Vera leaf and copper mordants. Maximum K/S (color strength) was got from dyed fabric samples at a maximum temperature of 70ºC and time of 60 min. This is due to the increments of kinetic energy leading to increased diffusion of dye molecules inside the silk at high temperatures and increase diffusion rate of dye molecules into the leather structure at long dyeing time.

Fastness test results

Except for certain samples that were directly colored without mordant and samples that were post-mordant with Aloe Vera, all dyed silk fabric samples performed well (6-5&5,7). As mordant concentration increases, so do the fastness qualities of dyed silk fabric samples in all mordents and mordanting processes. Samples pretreated with Aloe Vera juice and directly colored silk fabric samples exhibited very good to exceptional rubbing and washing fastness, as well as good to very good light fastness. Premordanted had poor rubbing fastness findings that were less than 3. In general, natural dye derived from the bark of the Cassia singueana plant might be utilized for commercial purposes within the permissible color fastness range of international standards. For (Washing fatness, rubbing fastness more than three, and Light fastness greater than five). [52-55]

The current study demonstrates that the bark of the Cassia singueana plant may be utilized as a dye for silk fabric coloring in the presence of a natural mordant produced from Aloe Vera. In addition to being a natural colorant, it possesses antibacterial and anti-mosquito properties. This plant extract for silk fabric coloring would reduce the import of synthetic dyes while also minimizing environmental pollution. All colored silk textiles had good washing, light, and rubbing fastness without and with natural mordant. The dye has a wide range of applications in the commercial dyeing of protein fibers.

Dyeing silk fabrics with stink bean pod

Arkia speciosa is known as stink bean or “sator” in Thailand and “petai” in Malaysia as shown in Fig. 6 It bears long and flat beans pod with green seeds. These beans are popular in Southeastern Asia including the south of Thailand, Malaysia, and Northeastern India. These pods are regarded as waste material

Fig. 7. stink bean pod

During the processing in the food industry. Multifunctional properties of dyeing plant extracts, as shown by Shahid et al. [56] Nonetheless, as regards the UV-protection properties of natural dyes, few researches have been performed on natural fabrics and most of these concern animal fibers, as reported by Grifoni et al. [57-59] Very few studies exist on the UV-protection properties of natural dyes in combination with fabrics made from vegetable fiber [57-59] because very few natural dyes provide plant fibers with strong colors without the aid of mordents. Ecofriendly natural dyeing can, however, be achieved by replacing metal mordant with natural mordants, like tannic acid or other vegetable tannins, even if metal mordents such as potassium alum and aluminum sulfate can also be used in eco-friendly natural dyeing as their environmental toxicity is almost nil. Tannins are water-soluble phenolic compounds that have been used on textiles for several hundred years both as a pre-treatment and post-treatment factor to increase wash fastness and light fastness.

The silk cloth was colored with natural dye taken from the stink bean pod (Parkia speciosa Hassk.). The mordents used to dye the silk fabrics were aluminum potassium sulfate, iron chloride, sodium hydroxide, and mud. The results showed that the dyeing silk fabrics with stink beans pod were fair to good fastness to washing and crocking and very poor to poor light fastness except for samples mordant with iron chloride. The scores for water and sweat fastness were medium to good. Even while undyed stink bean pods can produce functional dyes that might be imparted into the silk dyeing natural colorant system, silk textiles mordant with iron chloride and dyed with stink bean generally demonstrated good UV-protection levels.

Dyeing of silk with Synthetic Dyes

Dyeing of silk with an Acid dye

Acid dyes are sodium salts derived from sulphonic or carboxylic acid sodium salts (R-SO3Na/R- COONa) that may Colour wool and silk fibers at acidic pH levels. [60] Most azo-based acid dyes have been prohibited due to their carcinogenicity. Metal complex dyes have now surpassed these dye groups. Acid dyes affect cellulose fibers. [61]

Types of Acid Dyes

Neutral acid dye

Neutral acid dyes are supra milling or fast acid dyes that have moderate to good wet fastness qualities but poor light fastness in bright hues. Many neutral acid dyes are exclusively used to create their colors. They are used on fibers that have a mildly acidic or neutral pH.

Weak acid dye

Weak acid dye: these dyes are milled. Although these dyes are fast, their light fastness is moderate to poor.

Strong acid dye

These dyes, sometimes known as leveling dyes, are utilized in very acidic conditions, however, their wet fastness qualities are limited. These dyes are ideal for creating color combinations.

Dyeing of silk with direct dye

In the absence of any compounds, direct dyes have a very great affinity for natural fibers. Because of inadequate hydrogen bonding with the functional groups, materials colored with direct dyes have moderate washing and light fastness qualities. [62] Fiber cationic fixing, on the other hand, has the potential to increase fastness properties. Because of their carcinogenicity, the usage of Azo and benzidine-based direct dyes in the centralized sector has reduced; nonetheless, cottage firms continue to employ them due to their low cost. On wool, silk, polyester, and acrylic multi-fibers, direct colors have varying washing, light, sweat, and other wet fastness capabilities, as well as staining attributes.

Unless post-treated, most direct dyes have low wet fastness in medium to full hues, although others are stronger. Than others. Resin finish after dyeing improves wet fastness greatly, especially in regenerated cellulosic fiber. [63, 64]

Dyeing of silk with reactive dye

A chromophore, one or two reactive auxophores, and a solubilizing group make up a reactive dye.

The paint, which is most typically used on cellulosic fibers, creates covalent bonds with the functional groups of the fiber via a replacement or extension process. An electrolyte, as well as an alkali, are essential for stabilization after depletion. [65] Similarly, triazine and sulphatic ethyl sulphone reactive groups have recently been combined in a single dye molecule to produce bifunctional reactive dyes. Choose a moderate dyeing temperature to improve dye fixation and fastness. Long-term characteristics include reactive dyes with low salt/alkali fixation, dyeing equipment with a low materials-to-liquor ratio, and excellent bleaching fastness. [66, 67]

Types of reactive dyes

dichlorotriazine dyes

DCT dyes were the first commercially effective form of reactive dye. Their application methods for silk. [68]

Maximum fixing of dichloro triazine dyes on silk occurs in weakly acidic solutions at 60°C after dying for 2 hours

The amount of dye fixed correlates to histidine's free amino groups. Under acidic circumstances, they discovered that just one of the dye's two reactive chlorine atoms reacted with silk. After treatment, 20% aqueous pyridine or 1% sodium bicarbonate resulted in a significant increase in fixing, which was attributed to the dye reacting with the hydroxyl groups of tyrosine, serine, and threonine.

DCT dyes can also be applied using a pad-batch approach at low temperatures. The fabric is padded with the dye solution at pH 8, then batched for 5 hours at 20-22°C, followed by cold and hot rinses, soaping for 15 minutes at 65"C, and a final cold rinse. Heat treatment of dye-impregnated fibers in diethyl phthalate for 10 minutes at 90°C or 5 minutes at 180°C, followed by treatment with base, increases the covalent fixing of DCT dyes in a high-temperature dyeing process The increased fixing has been attributed to significantly reduced dye hydrolysis and potential fiber swelling in diethyl phthalate.

monochlorotriazine dyes

MCT dyes are characterized by silk and are said to provide mediocre to poor results. [68]

This inadequate build-up contributes to dye-fiber bond hydrolysis during dyeing. [68] There is rivalry between bond-forming and bond-breaking processes at pH10 and 90°C, the optimal dyeing conditions. The difficulty may be solved by raising the reactivity of the dye, which increases the pace of the reaction. The addition of tertiary amines, which create quaternary ammonium ions with the dye, might boost the reactivity of chlorotriazinyl dyes. The quaternary ammonium groups are more effective than chlorine as leaving groups. One of the most widely utilized tertiary amines is 1, 4-diaza-2, 2, 2-bicyclo-octane (DABCO), and it has been shown that utilizing 0.3% DABCO at pH 7.4 allows for the formation of tertiary amines. It is feasible to significantly improve MCT dye fixation on silk. [68] The influence of pH on equilibrium adsorption, fixed dye quantity, adsorption rate, dye hydrolysis rate, and fixing rate of MCT dye on silk has been investigated. Maximum fixing was discovered to occur under neutral circumstances when the dye fiber bonds are generally stable and the dye concentration is high. [68]

The effect of plasma treatment with the use of oxygen on the dyeability of silk

The effects of oxygen plasma treatment on the dyeability of silk fabric on its surface. Both raw and degummed silk materials were plasma-treated, and the effect of the plasma treatment on dyeability was examined. Dyebility was investigated. It was discovered that oxygen plasma treatment might increase color absorption in silk materials. Oxygen is an excellent medium for introducing hydrophilic groups onto the surface of a substance. It may be used to increase fiber qualities including adhesion, wettability, and capillarity (faster dye or ink uptake), resulting in a considerable improvement in dyeing depth. [69-72]

The higher the colorant concentration in the substrate, the higher the K/S value. The K/S values for plasma-treated degummed silk fabrics are higher than those for untreated degummed silk fabrics, indicating that the dye concentration in the plasma-treated degummed silk fabrics is higher, indicating that the dyeability of the fabrics has been improved by the plasma treatment. This is most likely due to the development of polar groups on the fabric surface. Etching causes surface roughness, which increases surface area and promotes wetting raw silk fibers have higher K/S values than degummed silk fabrics. This might be due to raw silk textiles. Are thicker, and hence have more dye per unit surface area of fabric (independent of fabric thickness), resulting in greater K/S values. [69-72]

The surface looks like unprocessed raw silk fibers. Sericin coats the silk fiber, resulting in a rough surface roughness. The surface of the raw silk fiber becomes smoother after plasma treatment than the surface of the untreated silk fiber, it is noticed that plasma treatment can partially remove sericin from the surface of silk fibers by physical etching action. The surface appearance of untreated degummed silk fiber is shown in Figure. A smooth fiber surface is seen because the degumming procedure successfully removes the sericin. [69-72] However, tiny spots are seen following plasma treatment, resulting in the roughness of the degummed silk fiber surface. According to the SEM Based on the results of the investigation, it can be inferred that plasma treatment can assist in eliminating sericin from the raw silk fiber surface, allowing water to readily access the fiber. [69-72] The formation of surface roughness on degummed silk as a result of plasma treatment, on the other hand, would boost its water absorption property.

Conclusion

As natural dye shows non-toxic, non-allergic effects and results in less pollution as well as fewer side effects, it has become a thrust area in the field of textile dyeing research. Natural dyes are not only biodegradable but also have medicinal properties like anti-bacterial, and anti-inflammatory the current study demonstrates that the barks of the Cassia singular plant may be utilized as a dye for silk fabric coloring in the presence of a natural mordant produced from Aloe Vera

This plant extract for silk fabric coloring would reduce the import of synthetic dyes while also minimizing environmental pollution.

For the first time, this work proved that natural colorants may be removed from stink bean pods (Parkia speciosa Hassk.) using a classic extraction process applied to silk fabric. Dyed samples were discovered to be fascinating. Colorfastness and UV protection are both advantages. Color enhancements in the future with various methods of mordanting.

The dyeing performance of raw and degummed silk textiles treated with oxygen plasma under various conditions was studied in this article. The dyeability of plasma-treated degummed silk materials was greatly enhanced, according to the findings of the experiments.

Conflicts of interest

There are no conflicts to declare

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تحسين جودة أداء تلوين النسيج الحريري.

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أصبحت المخاوف البيئية ذات أهمية متزايدة ، وهناك حركة لتقييد استخدام المنتجات الضارة. يفضل المستهلكون ، مثل صناعة النسيج ، قماش الأصباغ الطبيعية على الأصباغ الاصطناعية. الغرض من هذا البحث هو تحديد مكونات الأصباغ الطبيعية المشتقة من الأصباغ الطبيعية. النيلي والكركم والفوة والمحطة الطرفية ونبات كاسيا سينغيانا وجراب الفاصوليا النتنة (PARKIA SPECIOSA HASSK.) على الأقمشة الحريرية ، والأصباغ الاصطناعية كصبغة تفاعلية وكذلك لتقييم جودة الحرير المصبوغ بالأصباغ الطبيعية. ثم تم تطبيق الأصباغ الطبيعية على الحرير ثم إجراء اختبار جودة لون الحرير. كشفت النتائج أن الأصباغ الطبيعية تولد في المقام الأول ألوان الباستيل ، وفقا لاختبار الجودة ، تتمتع جميع الأصباغ الطبيعية بمقاومة ضعيفة للغسيل عند 40 درجة مئوية ومقاومة ضعيفة للتلاشي للعرق الحمضي ، لكنها تعمل بشكل جيد ضد عرق القواعد. يمكن تحديد أن جميع الحرير الملون بالأصباغ الطبيعية لديه قوة شد أفضل من الحرير غير الملون.

الكلمات المفتاحية: الأصباغ الطبيعية والأصباغ الاصطناعية والمعالجات المختلفة على المنسوجات الحريرية.