Effect of Mordant' s in cotton and polyester dyeing with Onion.

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Abstract: Onion which are red, yellow, shallots, sweet, pearl, green in color are a rich source of lutein. Nowadays, lutein in becoming an increasingly popular active ingredient used in textile coloration. The potential use of onion as a natural textile colorant has not been exploited to it full extent. This is due to the lack of information on its safety, stability and capability in textile coloration. In this study an experiment was conducted to study the use of an extract isolated from onion as a natural dye. Using the onion in 100% cotton fabrics and 100% polyester fabrics under normal dyeing conditions. Studies of the dye concentration and dyeing method and also the mordant were undertaken. The tests which led us to decision were color fastness to wash and rubbing.

Index Terms: Natural dyes, Common dyes, Onion, Onion dyes, Extraction, Onion natural dyes, Color fastness, Washing and Rubbing.

1. NATURAL DYES

1.1 NATURAL DYES

The word 'natural dye' covers all the dyes derived from the natural sources like plants, animal and minerals. Natural dyes are mostly non-substantive and must be applied on textiles by the help of mordants, usually a metallic salt, having an affinity for both the coloring matter and the fiber. Transition metal ions usually have strong coordinating power and/or capable of forming week to medium attraction/interaction forces and thus can act as bridging material to create substantively of natural dyes/colorants when a textile material being impregnated with such metallic salt (i.e. mordant) is subjected to dyeing with different natural dyes, usually having some mordant able groups facilitating fixation of such dye/colorant. These metallic mordant's after combining with dye in the fiber, it forms an insoluble precipitate or lake and thus both the dye and mordant get fixed to become wash fast to a reasonable level.

1.2 HISTORY OF DYES

The ability of natural dyes to color textiles has been known since ancient times. The earliest written record of the use of natural dyes was found in China dated 2600BC. Chemical tests of red fabrics found in the tomb of King Tutankhamen in Egypt show the presence of alizarin, a pigment extracted from madder. In more modern times, Alexander the Great mentions having found purple robes dating to 541BC in the royal treasury when he conquered Susa, the Persian capital. Kermes (from the Kermes insect) is identified in the bible book of Exodus, where references are made to scarlet colored linen. By the 4th century AD, dyes such as wood, madder, weld, Brazil wood and indigo and a dark reddish-purple were known. Brazil was named for the wood found there.

Purple was made from a mollusk and clothing made from it was so expensive only the royal family could afford it. It was extracted from a small gastropod mollusk found in all seas or from a crustacean called a Trumpet Shell or Purple Fish, found near Tire on the Mediterranean coast. Their body secreted a deep purple fluid which was harvested by cracking the shell and digging out a vein located near the shellfish head with a small pointed utensil. The mucus-like contents of the veins were then mixed together and spread on silk or linen. Estimates are that it took 8,500 shellfish to produce one gram of the dye, hence the fact this dye was worth more than its weight in gold. This expensive dye was also mentioned in the bible, in Acts, where Lydia is a seller of purple.

By the 15th century, dyes from insects, such as cochineal and Kermes, were becoming more common. By the 17th century, dyeing cloth "in the wood" was introduced in England: logwood, fustic, etc. In the 18th century a method of bleaching linen with kelp was introduced in Scotland, a Swedish chemist discovered chlorine destroys vegetable colors and the French began to recommend chlorine water for commercial bleaching. Indigo began to be grown in England, and Cudbear, a natural dye prepared from a variety of lichens, is patented. Another natural dye, Quercitron, from the inner bark of the North American oak, is patented in 1775. By the 1800's, Prussian blue and Sulphuric acid are available commercially. Prussian blue was formed from prussite of potash and iron salt, making it one of the earliest known chemical dyes. In 1856, William Henry Perkin, while experimenting with coal tar in hopes of finding an artificial quinine as a cure for malaria, discovered the first synthetic dye stuff which he called "Mauve". The color quickly became a favorite of the royal family, and a new industry was begun.

1.3 SOURCES OF NATURAL DYES

Natural dyes can be sorted into three categories:

1. **Natural dyes obtained from plants.**
    a) Catechu or Cutch tree (brown)
    b) Gamboge tree resin (dark mustard yellow)
    c) Himalayan rubhada root (yellow)
    d) Indigofera plant (blue)
    e) Kamala tree (red)
    f) Madder root (red, pink, orange)
2. **Natural dyes obtained from animals.**
    a) Cochineal insect (red)
    b) Cow urine (Indian yellow)
    c) Lac insect (red, violet)
    d) Murex snail (purple)
    e) Octopus or Cuttlefish (sepia brown)
3. **Natural dyes obtained from minerals.**
    a) Hematite (red)
    b) Limonite (yellow)

1.4 CLASSIFICATION OF NATURAL DYES

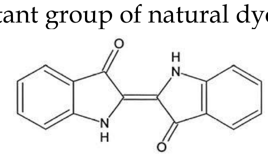
A. Based on color
B. Based on chemical structure

A. Based on color

Color	Botanical Name	Parts used	Mordant
Red Dyes			
Safflower	Carthamus tinctorious	Flower	---
Caesalpina	Caesalpinia sappan	Wood chips	Alum
Maddar	Rubia tinctorium	Wood	Alum
Lac	Coccus lacca (insect)	Twigs inhabited by these insects	Stannic chloride
Yellow Dyes			
Bougainvillea	Bougainvillea glabra	Flower	Tin
Golden rod	Solidago grandis	Flower	Alum
Teak	Tectona grandis	Leaves	Alum
Marigold	Tagetes species	Flower	Chrome
Parijata	Nyetanthesar bortristis	Flower	Chrome
Blue Dyes			
Indigo	Indigofera tinctoria	Leaves	---
Woad	Isatis tinctoria	Leaves	---
Suntberry	Acacia nilotica	Seed pods	---
Water lily	Nymphaea alba	Rhizomes	Iron and acid
Black Dyes			
Lac	Coccus lacca (insect)	Twigs inhabited by these insects	Ferrous sulphate
Alder	Alnus glutinosa	Bark	---
Custard apple	Anona reticulata	Fruit	Ferrous sulphate
Brown Dyes			
Caesalpina*	Caesalpinia sappan	Wood chips	Ferrous sulphate
Marigold	Tagetes species	Flower	Chrom
Black berries	Rubus fructicosus	Berries	Iron
Green Dyes			
Tulsi	Ocimum sanctum	Leaves	Ferrous sulphate
Bougainvillea	Bougainvillea glabra	Flower	Alum + Base and Ferrous Sulphate + Acid
Lily	Convallaria majalis	Leaves and stalk	Ferrous sulphate
Orange/Peach Dyes			
Bougainvillea	Bougainvillea glabra	Flower	Stannous chloride + Acid; Alum + base Tin Alum / chrome
Balsam	Impatiens balsamina	Flower	
Dahlia	Dahlia species	Flower	

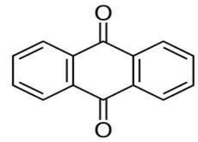
B. Based on chemical structure

1. **Indigoid dyes:** This is perhaps the most important group of natural dyes, obtained from Indigofera tinctoria.



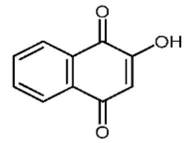
Indigo

2. **Anthraquinone dyes:** Some of the most important red dyes are based on the anthraquinone structure. They are obtained both from plants and insects. These dyes are characterized by good fastness to light. They form complexes with metal salts and the resultant metal-complex dyes have good wash fastness.



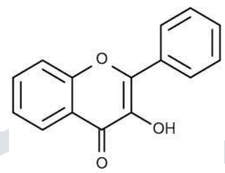
Anthraquinone

3. **Alpha-hydroxy-napthoquinones:**The most prominent member of this class of dyes is Lawson or henna, obtained from Lawsonia inermis.



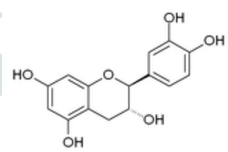
Alpha-hydroxy-napthoquinones

4. **Flavones:** Most of the natural yellow colours are hydroxy and methoxy derivatives of flavones and iso flavones.



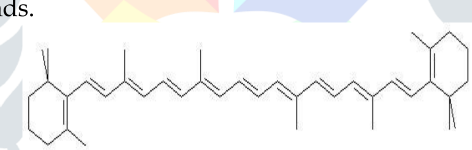
Flavones

5. **Dihydropyrans:** Closely related to flavones in chemical structure, are substituted dihydropyrans like the one shown here.



Dihydropyrans

6. **Anthocyananidins:** Carajurin obtained from Bignonia chica.
7. **Carotenoids:** The class name carotene is derived from the orange pigment found in carrots. In these, the color is due to the presence of long conjugated double bonds.



Beta-carotene

1.5. ADVANTAGES AND DISADVANTAGES OF NATURAL DYES

In the recent years, there has been a trend to revive the art of natural dyeing. This is mainly because in some aspects natural colorants are advantageous against synthetic dyes.

Some of these advantages along with some limitations (disadvantages) are listed below:

1.5.1. ADVANTAGES OF NATURAL DYES

- The shades produced by natural dyes are usually soft, lustrous and soothing to the human eye.
- 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 mordants with the same dye (polygenetic type natural dye) can shift the colors to a wide range or create totally new colors, which are not easily possible with synthetic dyestuffs.
- Natural dyestuffs produce rare color ideas and are automatically harmonizing.
- Unlike non-renewable basic raw materials for synthetic dyes, the natural dyes are usually renewable, being agro-renewable/vegetable based and at the same time biodegradable.
- In some cases like harda, indigo etc., the waste in the process becomes an ideal fertilizer for use in agricultural fields. Therefore, no disposal problem of this natural waste.
- Many plants thrive on wastelands. Thus, wasteland utilization is an added merit of the natural dyes. Dyes like madder grow as host in tea gardens. So there is no additional cost or effort required to grow it.
- This is a labor intensive industry, thereby providing job opportunities for all those engaged in cultivation, extraction and application of these dyes on textile/food/leather etc.
- Application of natural dyes has potential to earn carbon credit by reducing consumption of fossil fuel (petroleum) based synthetic dyes.
- Some of its constituents are anti-allergens, hence prove safe for skin contact and are mostly non-hazardous to human

health.
- Some of the natural dyes are enhanced with age, while synthetic dyes fade with time.
- Natural dyes bleed but do not stain other fabrics, turmeric being an exception.
- Natural dyes are usually moth proof and can replace synthetic dyes in kid's garments and food-stuffs for safety

1.5.2. LIMITATION OR DISADVANTAGES OF NATURAL DYES

- It is difficult to reproduce shades by using natural dyes/colorants, as these agro products vary from one crop season to another crop season, place to place and species to species, maturity period etc.
- It is difficult to standardize a recipe for the use of natural dyes, as the natural dyeing process and its color development depends not only on color component but also on materials.
- Natural dyeing requires skilled workmanship and is therefore expensive. Low color yield of source natural dyes thus necessitates the use of more dyestuffs, larger dyeing time and excess cost for mordants and mordanting.
- Scientific backup of a large part of the science involved in natural dyeing is still need to be explored.
- Lack of availability of precise technical knowledge on extraction and dyeing techniques.
- The dyed textile may change color when exposed to the sun, sweat and air.
- Nearly all-natural dyes with a few exceptions require the use of mordants to fix them on to the textile substrate. While dyeing, a substantial portion of the mordant remains unexhausted in the residual dye bath and may pose serious effluent disposal problem.
- With a few exceptions, most of the natural dyes are fugitive even when applied in conjunction with a mordant. Therefore, sometimes their color fastness performance ratings are inadequate for modern textile usage.

EXTRACTION OF DYES FROM NATURAL SOURCE

2.1. EXTRACTION PROCESS OF COLOR COMPONENT FROM NATURAL DYES

Extraction of color component from source natural dye material is important step for dyeing any textile substrate to maximize the color yield. Moreover, standardization of extraction process and optimizing the extraction variables both, for a particular source natural dye material have technical and commercial importance on color yield and cost of extraction process as well as dyeing cost. The natural dyes can be taken from various vegetable sources like flowers, stem or wood, roots, bark, etc. as well as animal sources and mineral sources. The color component present in these sources needs to be extracted so that it can be applied suitably on textiles. Natural dyes of different origin can be extracted using aqueous method i.e. by using water for the extraction with or without addition of salt/acid/alkali/alcohol in the extraction bath, supercritical fluid extraction, enzyme assisted extraction, alcoholic/organic solvent extraction by using relevant extracting equipment or solvent extraction method with use of alcohol and benzene mixture and finally to filterate, evaporate and to dry using ultra filtration equipment or centrifuge rotatory vacuum pump/or by extraction under reduced pressure.
Now a day, there has been an industrial method available for extracting color components or purified color substances from natural dyes for their easy applications. The collected source material is generally shadow dried in air or sun dried within a temperature range of 37-40°C for the moisture content of the source natural dye material is reduced to 10-15% with proper drying since most of the material have moisture content of 40-80% and cannot be stored without drying. After drying, grinding is carried out to break down the material into very small units or preferably powder form. Extraction refers to separating the desired color component by physical or chemical means with the aid of a solvent. Optimum conditions of extraction variables are determined through extracting the natural color component from source material by varying extraction parameters of liquor and measuring the optical density of corresponding colored liquor by using spectrophotometer. Also, the gravimetric yield of color can be measured by filtering the extraction liquor through standard filtration process followed by evaporation of solvent, washing and finally drying to get the purified natural color.

2.2. AQUEOUS EXTRACTION SYSTEM

For optimizing the extraction method of color component in aqueous medium, dried and finely cut source material of natural dye is grinded in powdered form and then the color component is extracted in water employing a standard process. The aqueous extraction of dye liquor is carried out under varying condition, such as time of extraction, temperature of extraction bath, pH of extraction liquor, concentration of color-source material (powdered form of source natural dye material) and Material-to-liquor ratio (MLR). In each case, the optical density or absorbance value at a particular (maximum) absorbance wavelength for the aqueous extract of the natural dye material can be estimated using UV-Vis absorbance spectrophotometer. Many scientists have reported the optimized process of extraction of natural dyes from source. Color from leaves of eucalyptus hybrid, seeds of cassia tora and grewia optiva are extracted by using aqueous medium under varying conditions. Natural dyes are extracted from biomass products namely cutch, ratanjot, madder and from hinjal, jujube bark in aqueous medium.
An attempt has been made to extract natural dye from the coffee-seed for its application in dyeing textiles like cotton and silk. Grey jute fabric is dyed with extracts from deodar leaf jackfruit wood and eucalyptus leaf by soaking it soft water and boiling it for 4 hours separately.
Extraction of natural dyes is also reported from overnight soaked wattle bark in distilled water followed by boiled it in pressure vessel and filtered it to obtain a residual dye powder of about 15 to 20 % (w/w) of the bark. Colors are extracted from marigold

and chrysanthemum flowers by boiling the dry petals with acidified or salt water and reported it to be the best color extraction process has also been optimized in aqueous media for various source natural dye materials as follows:

Pomegranate Rind: Pre-cut and dried rind is initially crushed to powder form and then it is extracted in water using an optimized condition of extractions using MLR- 1:20, temperature -90°C and time - 45 min and then it is filtered to obtain approximately 40% (w/w) clear extract of colored aqueous solution of pomegranate rind having pH 11.

Marigold (Genda): Dried petal of marigold is initially crushed to powder form and then extracted in water using an optimized condition of extraction using MLR 1:20 at 80°C for 45 min at pH 11 and then it is filtered to obtain approximately 40% (w/w) colored aqueous extract of marigold.

Babool (Babla): Sun- dried chips (pre-cut) of babool bark is initially crushed to powder form and then it is extracted in water using an optimized condition of extractions, by boiling in water at 100°C for 120min. and using MLR 1:20 and then it is filtered to obtain 40% (w/w) clear extract of colored aqueous solution of babool having pH 11.

Catechu (Khayer): Pre-dried powder of catechu is initially crushed to powder form and then extracted in aqueous medium using an optimized condition of extractions by heating in water bath at 90°C having MLR 1:20 and then it is filtered to obtain 40% (w/w) extract of colored aqueous solution of catechu having pH 12.

Jack fruit wood: Pre-cut and dried chips of jack fruit wood is initially crushed to powder form and then color is extracted in water using an optimized conditions of extractions by boiling in water at 100°C for 30 minutes and using ML ratio (MLR) 1:10 and then it is filtered to obtain 40% (w/w) clear extract of colored aqueous solution of jack fruit wood having pH 11.

Red sandal wood: Dried pre-cut chips are crushed to powder form and color is extracted under optimized conditions by heating it in water at 80°C for 90 minutes at pH 4.5 and MLR 1:20.

2.3. EXTRACTION BY NON-AQUEOUS AND OTHER SOLVENT ASSISTED SYSTEM

Due to increasingly stringent environmental regulations, supercritical fluid extraction (SFE) has gained wide acceptance in recent years as an alternative to conventional solvent extraction for separation of organic compound in many analytical and industrial process. In recent past decade, SFE has been applied successfully to the extraction of a variety of organic compounds from herbs, other plant material as well as natural colorant from source natural dye material. With increasing public interest in natural products, SFE may become a standard extraction technique for source natural dye material and other herbs and food items.

Supercritical fluid extraction using carbon dioxide as a solvent has provided an excellent alternative to the use of chemical solvents. Over the past three decades, supercritical CO_2 has been used for the extraction and isolation of valuable compounds from natural products. Supercritical fluids are utilized to extract and purify natural colorant from eucalyptus bark. Extraction of dye from food is best achieved with ethanol/oxalic acid.

The comparative behavior of other red food dyes is also studied and a process is developed for the extraction of natural dye from the leaves of teak plant is carried out using aqueous methanol. A brick red shade from dyeing for silk/wool using the isolated dye in presence of different mordants is achieved. Attempts has been made to standardize colorant derived from arjun bark, babool bark and pomegranate rind.

Extraction of well-grounded henna leaves, directly in a solvent assisted dyeing process, employing organic solvent: water (1:9) as the dyeing medium is studied and superior dyeing properties are obtained, when applied to polyester. Natural dye is obtained from the grape skin waste by using solvent extractor, and later on distilled it under vacuum to obtain the concentrated dye solution. Colorant/dye is extracted by using a reflux condenser; source dye material is refluxed for 1 hour and filtered it to yield natural colorant.

ONION

3.1. ONION

Botanical name: Allium cepa
Plant type: Vegetable
Soil type: Any, Loamy
Soil pH: Neutral
USDA Hardiness Zones: 3,4,5,6,7,8,9

Onions are a cold-season crop, easy to grow because of their hardiness. Onions grow well on raised beds or raised rows at least 4 inches high.

3.2. HISTORY OF ONIONS

Onions are small and their tissues leave little or no trace, there is no conclusive opinion about the exact location and time of their birth. Many archaeologists, botanists, and food historians believe onions originated in central Asia. Other research suggests onions were first grown in Iran and West Pakistan.

It is presumed our predecessors discovered and started eating wild onions very early long before farming or even writing was invented. Very likely, this humble vegetable was a staple in the prehistoric diet.

Most researchers agree the onion has been cultivated for 5000 years or more. Since onions grew wild in various regions, they were probably consumed for thousands of years and domesticated simultaneously all over the world. Onions may be one of the earliest cultivated crops because they were less perishable than other foods of the time, were transportable, were easy to grow, and could be grown in a variety of soils and climates. In addition, the onion was useful for sustaining human life. Onions prevented thirst and could be dried and preserved for later consumption when food might be scarce. While the place and time of the onion origin is still a mystery, many documents from very early times describe its importance as a food and its use in art, medicine, and mummification.

Onions grew in Chinese gardens as early as 5000 years ago and they are referenced in some of the oldest Vedic writings from India. In Egypt, onions can be traced back to 3500 B.C. There is evidence that the Sumerians were growing onions as early as 2500 B.C. One Sumerian text dated to about 2500 B.C. tells of someone plowing over the city governor onion patch.

In Egypt, onions were considered to be an object of worship. The onion symbolized eternity to the Egyptians who buried onions along with their Pharaohs. The Egyptians saw eternal life in the anatomy of the onion because of its circle-within-a-circle structure. Paintings of onions appear on the inner walls of the pyramids and in the tombs of both the Old Kingdom and the New Kingdom. The onion is mentioned as a funeral offering, and depicted on the banquet tables of the great feasts both large, peeled onions and slender, immature ones. They were shown upon the altars of the gods.

Frequently, Egyptian priests are pictured holding onions in his hand or covering an altar with a bundle of their leaves or roots. In mummies, onions have frequently been found in the pelvic regions of the body, in the thorax, flattened against the ears, and in front of the collapsed eyes. Flowering onions have been found on the chest, and onions have been found attached to the soles of the feet and along the legs. King Ramses IV, who died in 1160 B.C., was entombed with onions in his eye sockets.

Some Egyptologists theorize that onions may have been used because it was believed that their strong scent and/or magical powers would prompt the dead to breathe again. Other Egyptologists believe it was because onions were known for their strong antiseptic qualities, which construed as magical, would be handy in the afterlife.

Onions were eaten by the Israelites in the Bible. In Numbers 11:5, the children of Israel lament the meager desert diet enforced by the Exodus: We remember the fish, which we did eat in Egypt freely, the cucumbers and the melons and the leeks and the onions and the garlic.

In India as early as the sixth century B.C., the famous medical treatise Charaka Sanhita celebrates the onion as medicine a diuretic, good for digestion, the heart, the eyes, and the joints.

Likewise, Discords, a Greek physician in first century A.D., noted several medicinal uses of onions. The Greeks used onions to fortify athletes for the Olympic Games. Before competition, athletes would consume pounds of onions, drink onion juice, and rub onions on their bodies.

The Romans ate onions regularly and carried them on journeys to their provinces in England and Germany. Pliny the Elder, Roman keen-eyed observer, wrote of Pompeii onions and cabbages. Before he was overcome and killed by the volcano heat and fumes, Pliny the Elder catalogued the Roman beliefs about the efficacy of the onion to cure vision, induce sleep, and heal mouth sores, dog bites, toothaches, dysentery, and lumbago. Excavators of the doomed city would later find gardens where, just as Pliny had said, onions had grown. The bulbs had left behind telltale cavities in the ground. The Roman gourmet Apices, credited with writing one of the first cookbooks (which dates to the eighth and ninth centuries A.D.), included many references to onions.

By the middle Ages, the three main vegetables of European cuisine were beans, cabbage, and onions. In addition to serving as a food for both the poor and the wealthy, onions were prescribed to alleviate headaches, snakebites, and hair loss. They were also used as rent payments and wedding gifts.

Later, the first Pilgrims brought onions with them on the Mayflower. However, they found that strains of wild onions already grew throughout North America. Native American Indians used wild onions in a variety of ways, eating them raw or cooked, as a seasoning or as a vegetable. Such onions were also used in syrups, as poultices, as an ingredient in dyes, and even as toys. According to diaries of colonists, bulb onions were planted as soon as the Pilgrim Fathers could clear the land in 1648.

3.3. DIFFERENT TYPES OF ONIONS

A Glossary of Onion Types & Which Onion to Choose For Cooking

When should you use which type of onion? Onions come in all shapes and sizes and a variety of colors, and their textures and flavors can be quite different. Different types of onions can't necessarily be substituted for one another. So how do you know which onions are best for which dishes? From French onion soup to succotash, the onion varietal you use does matter! To help get your onions in order, take a look at the most common ones: brown onions, green onions (scallions), leeks, pearl onions, red onions, shallots and yellow onions, among others.

A. Green Onions or Scallions:

Also known as scallions, this long, thin varietal is commonly found in Asian cuisine. Green onions are mild and need little to no cooking time. You can cook with the entire stalk if you wish: the white lower portion as well as the green leaves. We prefer to slice the leaves thin, on the bias, for a garnish on whatever it is you're cooking. Bear in mind that if a recipe calls for "minced green onions," it does not necessarily require you to truly mince them to smithereens, as you would with garlic. Slicing very thin rings will almost always suffice in a recipe, and it preserves the integrity of the onion's shape, adding a bit of visual appeal.

B. Leeks:

Though they look like jumbo scallions, leeks are actually quite different, and heartier. They are typically best sweated or sautéed, and leeks can add body to a soup, stew, or other recipe that their smaller relatives cannot. Clean them well though; leeks grow in sandy soils and have open stalks, so they collect a lot of sand between their layers. Here's a great way to clean leeks:

1. Chop off the root end, as well as the stalk where it begins to turn green and get tough.
2. Split the cylinder that remains down the middle, halving the leek lengthwise.
3. Slice as you would a green onion, yielding half-rings.
4. Soak the pieces in a large bowl of cold water for a few minutes, agitating the leeks, then remove in large handfuls, shaking out the excess water, and place in a colander to dry.

C. Pearl Onions:

Also known as Button or Baby onions, these adorable little guys are relatively mild and have a unique and appealing look. This makes them ideal for a dish like succotash, or perhaps a stew: anywhere you will be able to show them off nestled among other vegetable pieces of a similar size. If you cook them whole, they have a pleasant texture when they burst sweetness in your mouth.

D. Red Onions or Bermuda Onions:

Typically the next most common onion at the market, Red Onions actually contain less sugar than their yellow & white brothers. Because of this, they are a no-no for caramelizing; not to say you can't caramelize them, but the result will not be as sweet as with the yellow or white. Red onions, however, stand up surprisingly well when grilled, especially when sliced into thick rings. Simply brush with oil, sprinkle with salt and pepper, and let them go about 3-5 minutes on each side. They're a great addition to summer salads.

E. Shallots:

A sweeter member of the onion family, shallots are notoriously ubiquitous in French cuisine. Their ideal use, however, is in place of their larger, more common cousins if a sauce or dish is on the delicate side. Cooking halibut with a beurre blanc sauce, for example, would be the perfect place to use shallots. Making green bean casserole for the holidays? Try topping it with crispy shallots for a touch of refinement.

F. Sweet Onions:

Maui, Vidalia and Walla Walla onions are sweet onion varieties named after the areas in which they're grown. While previously available only during spring and summer, they are now more widely available.

G. White Onions:

Although they comprise only 5% of U.S. onion harvest, white onions are an all-purpose onion. They are commonly used in white sauces, pasta salad, potato salad, and in Mexican and Southwestern cuisine. But they're an all-purpose onion, and they work in any recipe that calls for onions. They are a best bet when sweating onions or sautéing them for a sauce or stew. If a recipe does not specify what kind of onions to use, you're always safe going with white. However, as a spring/summer onion, white onions do not have as long a shelf life as other varieties.

H. Yellow Onions or Brown Onions:

These popular, all-purpose onions comprise 87% of the U.S. onion crop. The best type of onion for caramelizing, cooking brings out this variety's nutty, mellow, often sweet, quality. Also referred to as Brown Onions, these are probably equally as common as the white varietal. They function in almost exactly the same way, with one exception: Many cooks contend that yellow onions are best for caramelizing, and as such are called for in many classical French recipes. (However, this may very well be due to the fact that they were simply the most abundant when France was establishing itself as a culinary heavyweight.).

3.4. CULTIVATION:

Onion has potential in treating cardiovascular disease, hyperglycemia and stomach cancer, although few quality clinical trials are available to support these uses. Topical preparations have been evaluated for the prevention of surgical scarring with varying results.

DYEING OF COTTON & POLYESTER FABRIC

4.1. MATERIALS

1. Dye solution
2. Mordant
3. Sample dyeing machine
4. Scissor
5. Digital Balance
6. Normal water

4.2. MORDANT

A mordant is a chemical binding agent that adheres well to both the fibers and the dye.

A mordant is a substance used to set dyes on fabrics by forming a coordination complex with the dyes which then attaches to the fabric. A mordant is always is a polyvalent metal ion. The resulting coordination complex of dye and ion is colloidal and can be either acidic alkaline.

Mordant's can be added before, during or after dyeing process. Most recipes use mordanting before dying. The type of mordant used can change the color of both the dye-plus-mordant solution and influence the shade of the final product. Some mordant's ($FeSO_4$) darken the color, some ($SnCl_2$) brighten the color. They improve light and wash fastness properties.

4.3. COMMON DYE MORDANT

Mordants are used to set the color when using natural dyes. Different mordants will give different results.

Alum: (Aluminum Potassium Sulfate)

This is the most widely used mordant. The compound is the hydrated aluminum potassium sulfate with the formula $KAl(SO_4)_2.12H_2O$.

Copper: (Copper Sulfate)

This mordant is used to bring out the greens in dyes. It will also darken the dye colors.

Chrome: (Potassium Dichromate, $K_2Cr_2O_7$)

Chrome brightness dye colors and is more commonly used with wool than with any other fiber. Extremely toxic: Chrome should not be inhaled and gloves should be worn while working with chrome. Left over mordant water should be disposed of at a chemical waste disposal site and treated as hazardous waste.

Tara Powder: (Caesalpinia Spinosa)

Tara powder is a natural tannin product. It is needed for darker colors on action, linen and hemp.

Tartaric Acid:

A must for cochineal. This mordant wills expand the cochineal colors.

Tin: (Stannous Chloride)

Tin will give extra bright colors to reds, oranges and yellows on protein fibers. Using too much will make wool and silk brittle. To avoid this you can add a pinch of tin at the end of the dying time with fiber that was pre-mordanted with alum. Tin is not commonly used with cellulose fibers.

4.4. DYEING METHODS

The three methods used for mordanting are:

Pre-mordanting (Chrome): The substrate is treated with the mordant and then dyed.

Meta-mordanting (Meta chrome): The mordant is added in the dye bath itself.

Post-mordanting (After chrome): the dyed material is treated with a mordant. The type of mordant used changes the shade obtained after dyeing and also affects the fastness property of the dye.

4.5. PROCESS FLOW CHART OF DYE EXTRACTION PROCESS OF ONION:

Take 25 gm Onion skins with 200 ml water in a pot

↓

Then the pot is heated at 50^0C for 1 hour

↓

Lowering the temperature

↓

Filtered the solution

↓

Then collected the dye solution (pH 7)

4.6. Dyeing Processes

4.6.1. Cotton dyeing with onion (Pre-mordanting with 1% Alum)

Recipe:

Fabric weight: 10 gm

Dye solution: 400 ml

Procedure:

The sample fabric of cotton is immersed into alum solution for 24 hours

↓

Take 400 ml dye solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80⁰C in 60 minute

↓

Then lowering the temperature

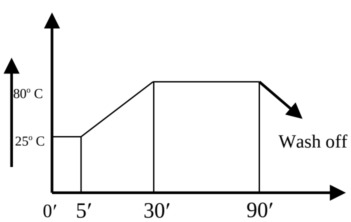
↓

Washing the sample fabric

↓

Drying the fabric

Dyeing Curve:



Dyeing Sample

4.6.2. Cotton dyeing with onion (Pre-mordanting with 1% $CuSO_4$)

Recipe:

Fabric weight: 10 gm

Dye solution: 400 ml

PROCEDURE:

The sample fabric of cotton is immersed into $CuSO_4$ solution for 24 hours

↓

Take 400 ml dye solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^0C in 60 minute

↓

Then lowering the temperature

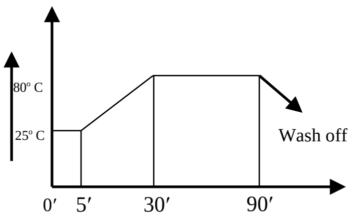
↓

Washing the sample fabric

↓

Drying the fabric

DYEING CURVE:



DYEING SAMPLE

4.6.3. COTTON DYEING WITH ONION (META-MORDANTING WITH 1% ALUM)

Recipe:
Fabric weight: 10 gm
Dye solution: 400 ml

PROCEDURE:

Take 400 ml dye solution and alum solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^0C in 60 minute

↓

Then lowering the temperature

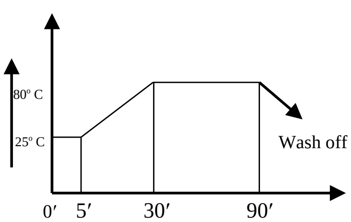
↓

Washing the sample fabric

↓

Drying the fabric

DYEING CURVE:



DYEING SAMPLE

4.6.4. COTTON DYEING WITH ONION (META-MORDANTING WITH 1% $CuSO_4$)

Recipe:
Fabric weight: 10 gm
Dye solution: 400 ml

PROCEDURE:

Take 400 ml dye solution and $CuSO_4$ solution into a pot then the sample of fabric immersed

↓

Then the pot is heated at 80^0C in 60 minute

↓

Then lowering the temperature

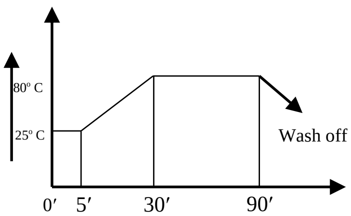
↓

Washing the sample fabric

↓

Drying the fabric

DYEING CURVE:



DYEING SAMPLE

4.6.5. COTTON DYEING WITH ONION (POST-MORDANTING WITH 1% ALUM)

Recipe:

Fabric weight: 10 gm

Dye solution: 400 ml

PROCEDURE:

Take 400 ml dye solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^0C in 60 minute

↓

Then lowering the temperature

↓

The sample fabric of cotton is immersed into alum solution for 24 hours

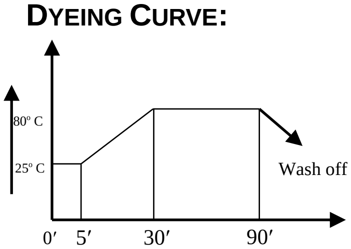
↓

Washing the sample fabric

↓

Drying the fabric

DYEING CURVE:



DYEING SAMPLE

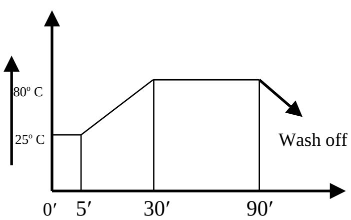
4.6.6. COTTON DYEING WITH ONION (POST-MORDANTING WITH 1% $CuSO_4$)

Recipe:
Fabric weight: 10 gm
Dye solution: 400 ml

PROCEDURE:

Take 400 ml dye solution into a pot then the sample of fabric immersed into it
↓
Then the pot is heated at 80^0C in 60 minute
↓
Then lowering the temperature
↓
The sample fabric of cotton is immersed into $CuSO_4$ solution for 24 hours
↓
Washing the sample fabric
↓
Drying the fabric

DYEING CURVE:



DYEING SAMPLE

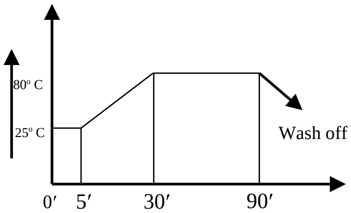
4.6.7. POLYESTER DYEING WITH ONION (PRE-MORDANTING WITH 1% ALUM)

Recipe:
Fabric weight: 10 gm
Dye solution: 400 ml

PROCEDURE:

The sample fabric of cotton is immersed into alum solution for 24 hours
↓
Take 400 ml dye solution into a pot then the sample of fabric immersed into it
↓
Then the pot is heated at 80^0C in 60 minute
↓
Then lowering the temperature
↓
Washing the sample fabric
↓
Drying the fabric

DYEING CURVE:



DYEING SAMPLE

4.6.8. POLYESTER DYEING WITH ONION (PRE-MORDANTING WITH 1% $CuSO_4$)

Recipe:

Fabric weight: 10 gm

Dye solution: 400 ml

PROCEDURE:

The sample fabric of cotton is immersed into **$CuSO_4$** solution for 24 hours

↓

Take 400 ml dye solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^{0}C in 60 minute

↓

Then lowering the temperature

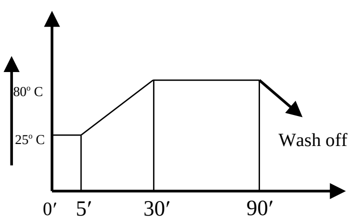
↓

Washing the sample fabric

↓

Drying the fabric

DYEING CURVE:



DYEING SAMPLE

4.6.9. POLYSTER DYEING WITH ONION (META-MORDANTING WITH 1% ALUM)

Recipe:

Fabric weight: 10 gm

Dye solution: 400 ml

PROCEDURE:

Take 400 ml dye solution and alum solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^{0}C in 60 minute

↓

Then lowering the temperature

↓

Washing the sample fabric

↓

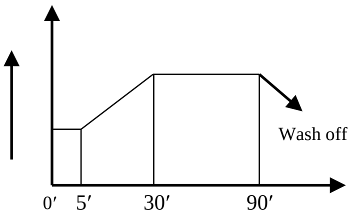
Drying the fabric

DYEING CURVE:

DYEING SAMPLE

80° C

25° C



4.6.10. POLYESTER DYEING WITH ONION (META-MORDANTING WITH 1% $CuSO_4$)

Recipe:
Fabric weight: 10 gm
Dye solution: 400 ml

PROCEDURE:

Take 400 ml dye solution and $CuSO_4$ solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^0C in 60 minute

↓

Then lowering the temperature

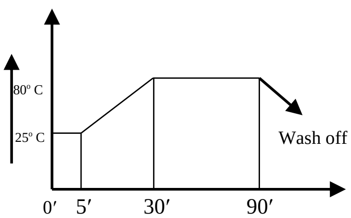
↓

Washing the sample fabric

↓

Drying the fabric

DYEING CURVE: **DYEING SAMPLE**



4.6.11. POLYESTER DYEING WITH ONION (POST-MORDANTING WITH 1% ALUM)

Recipe:
Fabric weight: 10 gm
Dye solution: 400 ml

PROCEDURE:

Take 400 ml dye solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^0C in 60 minute

↓

Then lowering the temperature

↓

The sample fabric of cotton is immersed into alum solution for 24 hours

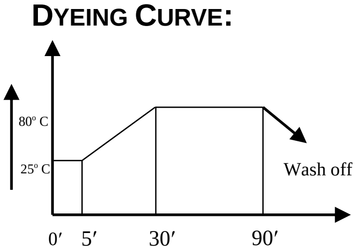
↓

Washing the sample fabric

↓

Drying the fabric

DYEING CURVE: **DYEING SAMPLE**



4.6.12. Polyester dyeing with onion (Post-mordanting with 1% $CuSO_4$)

5. **Recipe:**
6. **Fabric weight:** 10 gm
7. **Dye solution:** 400 ml
8. **Procedure:**

Take 400 ml dye solution into a pot then the sample of fabric immersed into it

↓

Then the pot is heated at 80^{0}C in 60 minute

↓

Then lowering the temperature

↓

The sample fabric of cotton is immersed into $CuSO_4$ solution for 24 hours

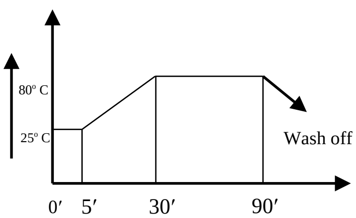
↓

Washing the sample fabric

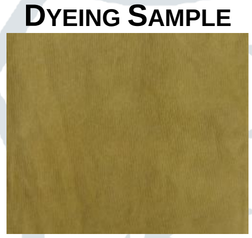
↓

Drying the fabric

Dyeing Curve:



Dyeing Sample



RESULT AND DISCUSSION

5.1. Color Fastness

Color fastness is one of the important factors in case of buyers demand. The outstandingly important property of a dyed material is the fastness of the shade of color. Color fastness refers to the resistance of color to fade or bleed of a dyed or printed textile materials to various types of influences e.g. water, light, rubbing, washing, perspiration etc. to which they are normally exposed in textile manufacturing and in daily use. We have written a lot of articles on color fastness.

5.2. Types of Color Fastness

Important color fastness tests are given below:

- Color Fastness to Washing
- Color Fastness to Rubbing
- Color Fastness to light
- Color Fastness to Water
- Color Fastness to perspiration

5.3. Factors Affecting the Color Fastness Properties:

- The chemical nature of the fiber. For example, cellulosic fibers dyed with reactive or vat dyes will show good fastness properties. Protein fibers dyed with acid mordant and reactive dyes will achieve good fastness properties and so on. That is to say compatibility of dye with the fiber is very important.
- The molecular structure (e.g.) of a dye molecule: If the dye molecule is larger in size, it will be tightly entrapped inside the inter-polymer chain space of a fiber. Thus the fastness will be better.
- The manner in which the dye is bonded to the fiber or the physical form present.
- The amount of dye present in the fiber i.e. depth of shade. A deep shade will be less fast than a pale or light shade.
- The presence of other chemicals in the material.
- The actual conditions prevailing during exposure.

5.4. Standards of Color Fastness:

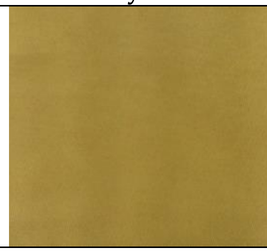
- AATCC (American Association of Textile Chemists and Colorists) technical manual. Describes 66 numbers of different color fastness tests.
- SDC (Society of Dyers and Colorists). In 1927, SDC (Europe) made fastness test committee.
- ISO (International Organization for Standardization) in 1947, ISO made color subcommittee. ISO also grades the fastness:

For light fastness: 1~8

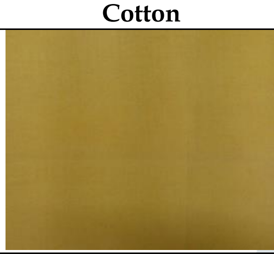
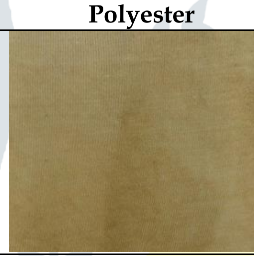
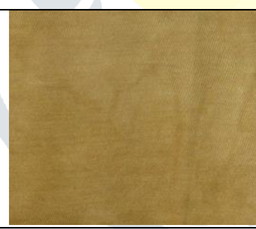
For other fastness: 1~5

5.5. Visual Comparison

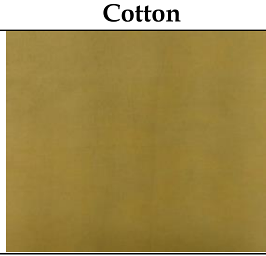
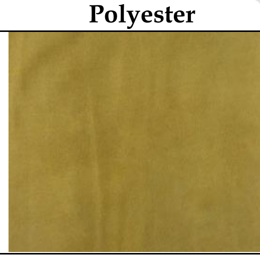
5.5.1. Pre-mordanting sample

Mordant	Cotton	Polyester
1% Alum		
1% $CuSO_4$		

5.5.2. Meta-mordanting sample

Mordant	Cotton	Polyester
1% Alum		
1% $CuSO_4$		

5.5.3. Post-mordanting sample

Mordant	Cotton	Polyester
1% Alum		
1% $CuSO_4$		

5.6. Color Fastness to Rubbing (Dry & Wet) Test

Test Method: ISO 105 X12

Sample size:

Dyed Fabric: 15 cm × 5 cm

White rubbing cloth: 5 cm × 5 cm

Dry Rubbing Procedure:

By using the holding clamp the specimen is mounted on the baseboard of the Crock meter. The long direction of the specimen is parallel to the track of rubbing.

A dry rubbing cloth is mounted over the end of the peg on the Crock meter and taut by means of the spring clip provided.

Rub the specimen back and forth for 10 complete cycles (i.e. 10 times back and forth) at a rate of one second for each cycle.

Wet Rubbing Procedure:

The dry rubbing cloth is wet out by distilled water. The next steps are as same as the procedure of dry rubbing test.

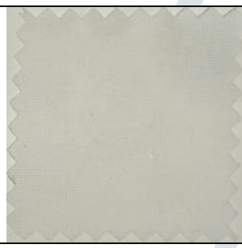
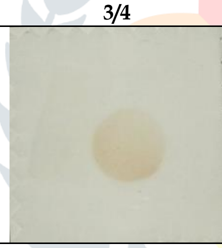
The wet rubbing cloth is then dried at room temperature.

Evaluation:

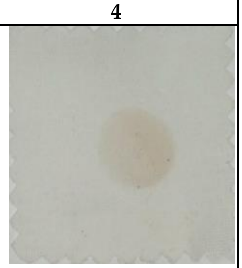
Change of the shade of the sample is measured with gray scale.

5.7. Comparison of Color Fastness to Rubbing (Dry & Wet) of Cotton and Polyester Fabric

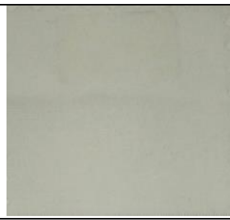
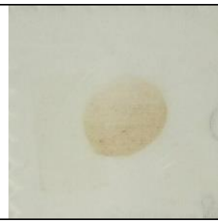
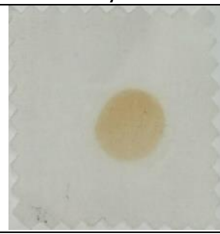
Pre Mordant Sample

Mordant Used	Test	Cotton	Polyester
Alum 1%	Dry		
	Result	4/5	3/4
	Wet		
	Result	3/4	3

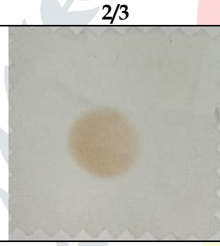
Pre Mordant Sample

Mordant Used	Test	Cotton	Polyester
$CuSO_4$ 1%	Dry		
	Result	4/5	4
	Wet		
	Result	3/4	3/4

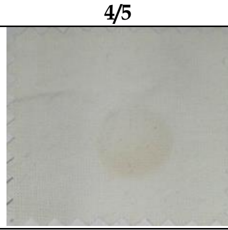
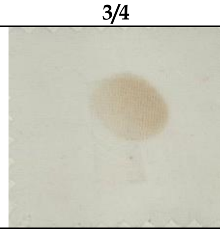
META MORDANT SAMPLE

Mordant Used	Test	Cotton	Polyester
Alum 1%	Dry		
	Result	4/5	2/3
	Wet		
	Result	4	2

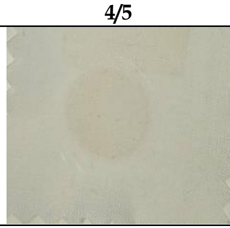
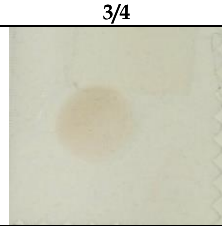
META MORDANT SAMPLE

Mordant Used	Test	Cotton	Polyester
$CuSO_4$ 1%	Dry		
	Result	4/5	2/3
	Wet		
	Result	4	2/3

POST MORDANT SAMPLE

Mordant Used	Test	Cotton	Polyester
Alum 1%	Dry		
	Result	4/5	3/4
	Wet		
	Result	3/4	3

Post Mordant Sample

Mordant Used	Test	Cotton	Polyester
$CuSO_4$ 1%	Dry		
	Result	4/5	3/4
	Wet		
	Result	4	2/3

5.8. Color Fastness to Wash Test

Test Method: ISO 105 C03

Required Materials:

Sample size: 4 cm × 10 cm
Multi fiber size: 4 cm × 10cm
ECE Detergent: 4 gm/L
Na Perborate: 1 gm/L
Normal cold water
Steel balls

Required instrument:

Washing machine
Scissor
Stitch machine

Procedure:

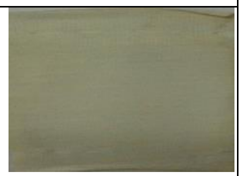
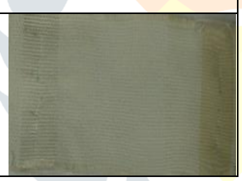
- Sample & multi fiber fabric is cut at (4 cm × 10 cm) & sewn together.
- Making the solution of 4 gm/L ECE detergent & 1 gm/L sodium perborate.
- 50 ml ECE detergent solution and 50Ml sodium perborate solution are taken into a pot.
- Putting the specimen with multi fiber fabric into the solution in rota wash m/c.
- The sample is kept in 60^0C for 30 minutes in the machine.
- Rinsing with hot water respectively.
- Rinsing with cold water.
- Drying at 60^0C by hanging or by flat iron pressing but temperature should not be more than 150^0C.

Evaluation:

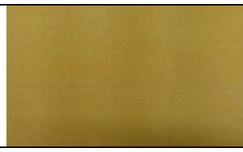
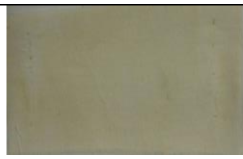
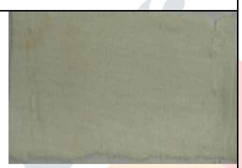
After drying the specimen the change of shade & degree of staining is measured by grey scale & staining scale.

5.9. Comparison of Color Fastness to Washing of Cotton and Polyester Fabric

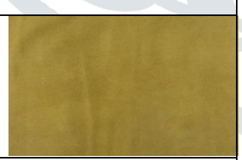
Pre Mordant Sample

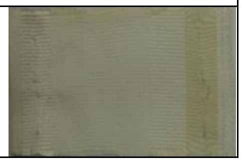
Mordant Used	Test	Cotton	Polyester
Alum 1%	Before wash		
	After wash		
	Multi Fiber		
$CuSO_4$ 1%	Before wash		
	After wash		
	Multi Fiber		

META-MORDANT SAMPLE

Mordant Used	Test	Cotton	Polyester
Alum 1%	Before wash		
	After wash		
	Multi Fiber		
$CuSO_4$ 1%	Before wash		
	After wash		
	Multi Fiber		

POST-MORDANT SAMPLE

Mordant Used	Test	Cotton	Polyester
Alum 1%	Before wash		
	After wash		
	Multi Fiber		
	Before wash		

$CuSO_4$ 1%	After wash		
	Multi Fiber		

CONCLUSION

6.1. Conclusion

From the results of the experiments conducted in this paper, it is evident that mordant has a significant influence on dyeing, the stability of dyes on the fabric. The color fastness properties depend on fabric construction, type of fabric, method of dyeing, mordant used etc.

- The color fastness to rubbing of cotton are good which average grade is 4/5 to 4.
- The color fastness to rubbing of polyester are poor which average grade is 3 to 3/2.
- Again the color fastness to washing of both cotton and polyester are very poor.

6.2. Recommendation

Further research is recommended in the following areas:

- The effect of different mordant concentration on cotton and polyester dyeing with onion may be studied.
- Color fastness to perspiration, light and chlorine water of cotton and polyester fabric can also be researched.
- The effect of other chemical along with mordant on cotton and polyester fabric dyeing by natural dye onion may be researched.
- The result of this investigation are kinetic in nature. No attempts were made to achieve equilibrium conditions.

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