DESIGNING AND DEVELOPING APRON WITH WATER REPELLENT FINISH USING BEES WAX AND LINSEED OIL

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ABSTRACT

An apron is a protective garment worn over other clothes covering the front part of the body. Apron is a garment that protects the wearer's clothing from dirt and stains while working. Apron comes from French word 'napperon', meaning small decorative table cloth. Over the years aprons have been worn as part of uniforms, trades and rituals and simply as fashion statements. They are made using different materials according to the end use including cotton, linen, leather or even rubber. No matter their function, aprons have been worn throughout many eras and culture. While the apron had long been a housewife's essential accessory, it became unpopular and old-fashioned during the 20th century. As they became unpopular with women, they remained a staple for workplace. They were worn primarily for functional reasons by chefs, butchers, barbers and waitresses. In the recent times, cultural influences have seen the apron undergo a revival. The kitchen and craft movements, increased the popularity in cooking, and renewed interest in retro fashions have brought back the apron and made it popular again. Whether used for practical, decorative or ceremonial purposes, aprons have played a valuable through the ages. With its renewed popularity, it is once again a functional and fashionable garment worn and appreciated by many.

Keyword :- *Home textiles, Apron, Textile Finishes, Water Repellent Finish, Conventional Method, Bees Wax, Linseed Oil, Turpentine Oil*

INTRODUCTION

An apron is a protective garment worn over other clothes covering the front part of the body. Apron is a garment that protects the wearer's clothing from dirt and stains while working. An apron is a garment worn at the front of the body, since ancient times, for practical, decorative, as well as ritualistic purposes, [Dolores Monet, 2023,1]. In artistic depiction of ancient people, there seems to be a fine line between an apron and a loincloth. In Europe, during the middle ages, aprons were worn by homemakers, working people, tradesmen, and artisans. When it comes to choosing an apron, there are several aspects to consider. From different colors and styles to different types of fabrics – aprons are not only versatile but they are very effective too. Knowing the bit about the different fabrics that are available is always a good idea, as it will help you to choose an apron that will be perfect for specific application that the aprons will be used for, including the environment that they will be used in.

Cotton is a very common fabric and makes up most of the aprons that we usually find. Cotton aprons are perfect for applications like baking, especially when working with dry materials. They are usually used at home, as well as in bakeries and other kitchen environments. Rubber or nylon is another common fabric when manufacturing aprons. This fabric is a bit heavier and more durable than cotton, so it is perfect for users that will come in contact with water, or other substances that can harm the skin or clothing. Nylon is common with industrial aprons, as they are offer more protection than normal. Nylon aprons are also commonly used for things like working with chemicals, paint products, and other materials that can easily damage the clothing.

Leather is probably one of the best fabrics for apron, as it is very durable and last for a very long time. Leather aprons are perfect for users who will work with mild chemicals, heat, and a list of other products. Apart from this there are other materials that are used in aprons like plastics, rubber coated cotton, and more. These aprons may serve as spill catchers, hand wipers and garden- tool holders. But they are also fashion statement, [Nancy Lofholm, 2012,2]. Aprons have many benefits, which is why it is popular in many kitchens. Apart from protection they have numerous advantages as they can be worn for hygienic purposes by covering the front of the body. To prevent the inner clothes from dust, dirt, spills and debris during cooking, serving, cleaning or performing a creative

task. Aprons protect your clothes and acts as a protective barrier. As long as there has been dirty work, and the need to keep clean aprons have existed, [Gloria Nixon, 2010,3]. Many home makers apart from cooking do many other works like washing, cleaning, mopping and washing vessels, etc., This makes their garments to get wet and messy often. The kitchen tends to get dirty with all cooking, occasional spills, oil spatters, water from washing vessels; it can get on your clothes and some stains can also get stubborn. In this research possibility of giving a functional finish to an apron has been looked upon, to provide a solution to the homemakers from protecting their garments while doing their household works. Not only homemakers, working women, students and even many men are doing household works. Dish washing, is the process of cleaning cooking utensils, dishes, cutlery and other items to prevent foodborne illness. While washing up we may sometimes, wet our garments. An apron can take in all these stains leaving your clothes intact. Merely wearing an apron won't just do the trick. It's important to use the right one which is contingent with your requirement.

OBJECTIVES:

- Selection of natural ingredients- Cotton Fabric,
- bees wax and linseed oil
- Preparing the finishing solution using the natural sources.
- Applying the finish on the selected and prepared cotton material
- Designing an apron using the treated fabric.
- To study the performance of the treated apron

2. REVIEW OF LITERATURE

2.1.1 Home Textiles

Home textiles can be defined as the textiles used for home furnishing. It consists of a various range of functional as well as decorative products used mainly for decorating our houses. Home textile is a branch of technical textile comprising application of textiles in household purposes. The fabric used for home textiles consists of both natural and man-made fibers. Generally home textiles are produced by weaving, knitting, crocheting, knotting, or pressing fibers together. Home textiles segment in textiles is growing by leaps and bounds, [Karthik & Gopalakrishnan, 2020,4].

2.1.2 Kitchen Textiles

Kitchen textiles comprise of the products that are used to produce kitchen products. Products that are primarily used in our kitchen both for functional and decorative purposes are known as kitchen textile products. A wide range of products are available in this category. The materials most commonly used in the production of kitchen textiles are cotton, rayon, wool, polyester, plastic, leather, satin, organza and organdy. Kitchen textile products include:

- poly bag holders
- aprons
- kitchen curtains
- kitchen towels
- kitchen wears
- kitchen linen
- table cloth
- mats
- food packaging material
- pot holders
- tea cozy
- napkins
- wash cloths

2.1.3 Apron

An apron is a garment that is worn over other clothing to cover the front of the body. An apron has several different purposes and perhaps most known as functional accessory that protects one's clothes and skin from stains and marks. It is also worn as a uniform, adornment, ceremonial garb or fashion statement. An apron is usually held in position by two-ribbon-like strips of cloth that are tied at the back.

2.1.4 Types of Apron

There are many different aprons on the purpose of the apron. Throughout history, there have been many types of aprons used by maids, housewives, workers and even ancient goddesses. They are classified according to the style, material and purpose.

2.2.1 Finishes

Any operation for improving the appearance of a fabric after it leaves the loom or knitting machine can be considered a finishing step. Finishing is the last step in fabric manufacturing and is when the final fabric properties are developed. The term 'finishing' in its widest sense, covers all processes which fabric undergo after their manufacture in looms or knitted machines. A simple definition of finishing is the sequence of operations, other than scouring, bleaching and coloration, to which the fabrics are subjected after leaving the loom or knitting machine [Marsh, 1968,5].

2.2.2 Textile Finishes

Textiles have been historically and traditionally used to make clothes, but even in ancient times there were technical textiles for making sails, tents, etc. Today technical textiles are used in various industries for a legion of purposes and applications. Recently, there have been exciting developments on various fronts in the textile field to impart novel and innovative functionalities to textiles – like easy to clean or dirt repellent, flame retardancy, anti-bacterial, to name a few. All this has been possible through adopting novel ways for finishing textiles. Textile finishing gives textile its final commercial character with regard to appearance, shine, handle, drape, fullness, usability, etc. The finishing auxiliaries are applied using finishing machines, padders or mangles with one or two sided actions or by impregnation or exhaustion [Bartels, 2011,6]

2.2.3 Classification of Textile Finishes

The finishing processes may be broadly classified into two groups:

- Physical or mechanical
- Chemical.
- functional

The physical or mechanical processes encompass simple processes like drying on a steam-heated cylinder to various types of calendars, raising for soft effects on the surface of the fabric and breaking the finishing of filled goods for comfortable feel. Most of the mechanical finishes are known from ancient times and few changes have occurred in their method of operations. Mechanical finishing or 'dry finishing' uses mainly physical means to change fabric properties and usually alters the fabric's appearance as well.

Chemical finishing or 'wet finishing' involves the addition of chemicals to textiles to achieve a desired result. In chemical finishing, water is used as the medium for applying the chemicals. Heat is used to drive off the water and to activate the chemicals.

Functional or special finishes are applied to improve the performance of the fabric for some specific purposes. Many of these effects are required to increase the appeal of products to augment fabric properties for particular end uses, such as outdoor wear or protective clothing. Fire proof, water proof, water resistant, water repellent, bullet proof.

2.2.4 Water Repellent Finish

Water repellency is one important property that is needed on protective clothing like apparel, home and technical textiles without deteriorating the comfort ability of the fabric. Water repellency is increasingly becoming the focus of interest for protective clothing. The repellency can be achieved by implementing water repellent chemicals on textile fibers with minimal effects on other functional properties like strength, flexibility, breathability, softness etc. Repellent finishes achieve their properties by reducing the free energy at fiber surfaces [Uddin et al, 2021,7]. Water repellent finishes are surface finishes imparting some degree of resistance to water but are more comfortable to wear because the fabric pores remain open. Such finishes include wax and resin mixture, aluminum salts, silicones, and fluorochemicals.

2.2.5 Principle of Water Repellency

The key of fabric wetting is the contact angle, and the angle depends on the surface energy of the fabric surface and the surface tension of the liquid. The droplets wet the surface of the fabric only when the surface tension of the water is less than the surface energy of the surface of the fabric [Schindler & Hauser, 2004,8] Surface energy depends on the groups present on the surface of the fabric. Water repellent finishing is to reduce the critical surface tension by changing the surface properties of fabric. Hence the surface of the fabric is modified to produce a large contact angle with water having a large surface tension, to achieve water repellent finish.

2.3.1 Bees Wax

In nature, there are some insects that produce wax, but some Apoidea, especially bees, produce wax more appreciated and used by man. Bees wax is a complex product secreted in liquid form by special wax glands in the abdomen of the younger worker bees. In contact with air, it solidifies in scales. The pure bees wax when secreted by the bee is almost white in color: only after contact with honey and pollen it assumes yellowish color and turned brown after four years. Beeswax is a creamy substance used by bees to build the comb that form the structure of their nest. Beeswax has generally a melting point which is about 10-20^{o} C lower than other waxes. Beeswax is an inert material with high plasticity at a relatively low temperature. Beeswax is insoluble in water and resistant to many acids. Beeswax is extremely a complex material containing over 300 different substances. It mainly consists of higher fatty acids, alcohols and small quantities of hydrocarbons, acids and other substances, [Stefan Bogdanov, 2004,9].

2.3.2 Uses of Bees Wax

Beeswax is an important by product of beekeeping besides honey. It is used in diverse applications. Beeswax is used in a variety of products and processes from packaging to processing, few of them as follows:

- Candle making has long involved the use of beeswax.
- Models and casting in industry and art, wax is used to make figures for decoration or sculpture and jewellery as a mould.
- Refined beeswax plays a prominent role in art materials both as a binder and as a stabilizer in oil paint.
- Beeswax is used in surgery to control bleeding from bone surfaces.
- They are formerly used in the manufacture of phonograph cylinders.
- Beeswax is a common ingredient of natural chewing gums.
- To make polish for cars, furniture, shoes and for treatment of other leather products.
- In grafting waxes.
- In lubricants for industrial use.
- Electronics used as insulation in electronic components in the computer industry, and in the manufacture of CDs
- Beeswax is used as sealant to make air and water proof sealing.
- In batik dyeing of fabrics.
- Beeswax is processed to create Petroleum Remediation Product (PRP). It is used to absorb oil or petroleum-based pollutants from water.
- In making drawing crayons
- It is used in strengthening threads used in darning and sewing.
- In cosmetics
- Food processing
- In textiles
- Varnishes and polishes
- Printing
- In medicines and much more.,

2.3.3 Linseed Oil

Linseed oil, is a colourless to yellowish oil obtained from the dried, ripened seeds of the flax plant hence also known as flaxseed oil or flax oil. The oil is obtained by pressing, sometimes followed by solvent extraction. Linseed oil is an edible oil in demand as a dietery supplement, as a source of an omega-3 fatty acid.Linseed oil is a drying oil, it can polymerize into a solid form. Owing to its polymer-forming properties, linseed oil can be used on its own or blended with combinations of other oils, resins or solvents as an impregnator

2.3.4 Uses of Linseed Oil

Linseed oil was first used for nutrition, it is much later that several other uses were discovered. They are easy to use, affordable and usually environmentally friendly. The various uses of linseed oil are as follows:

- It is used as a finishing product in wooden furniture manufacturing.
- It deeply nourishes wood while providing a flexible protection that is waterproof.
- They are used in oil-based paints and varnishes.
- Linseed oil is probably the best known binder.
- Typical linseed oil is of great value to nutrition.
- It is used as a plasticizer and hardener in putty.
- It is used in the manufacture of linoleum.
- It used in making oil cloth.

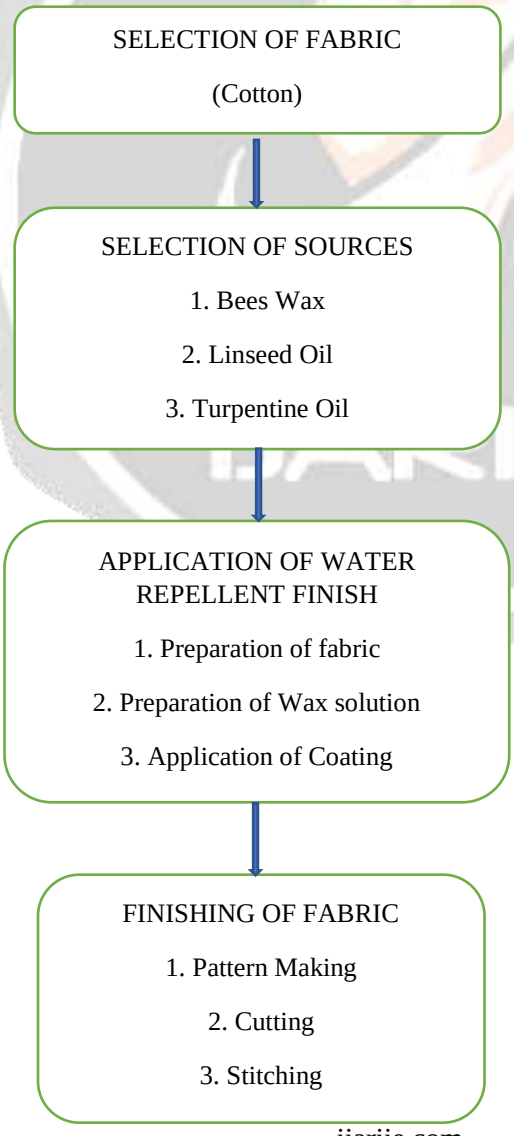
2.3.5 Turpentine Oil

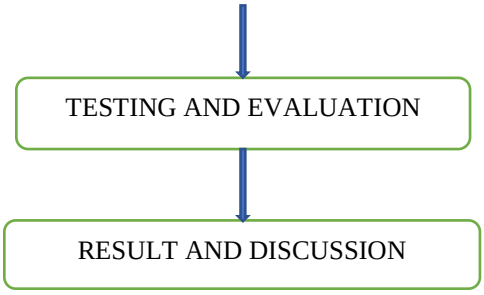
Turpentine oil is made from the resins of certain pine trees. It is highly useful industrial chemical, used as solvent. Turpentine is naturally derived and highly effective, making it an excellent option for thinning, cleaning, etc. Turpentine is one of the oldest known and most widely used industrial solvents. Compared with other chemical solvents, turpentine is unique in the fact that it is made from a renewable source. It is derived naturally from live pine trees. after distillation process, it is ready for use in industrial application.

2.3.6 Uses of Turpentine Oil

- It is a traditional go-to quality paint thinner for oil-based paints, varnishes and enamels.
- It aids the paint in coating, bonding and penetrating all types of wooden surfaces.
- They are used to create waterproof cement products in construction and building.
- It is used for lubricating industrial equipment's such as drills and grinders.
- They are used to clean brushes, rollers and spray equipment's.
- It is also used in new wood before finishing.
- It is blended to create medicinal products.
- The anti-microbial properties of turpentine make it an excellent choice for sanitation.
- Distilled turpentine oil can be used as a flavor enhancer in foods and beverages.
- It is used in cosmetics for thinning and cleaning purposes.
- Certain blend of turpentines can be used in insecticides.
- It is used for some oil and gas lamps.

3. Methodolgy





3.1.1 Selection of Fabric

In this experiment 100% cotton printed fabrics were used. The material was purchased from a retail shop in Coimbatore. It was purchased at the cost of Rs. 150 per meter. Cotton is a natural fiber derived from cotton plants whose use dates back to the fifth millennium B.C. cotton materials are most widely used and highly preferred by many people because of its comfort.

3.1.2 Ingredients Used for Water Repellent Coating

Three ingredients were used to achieve the water repellent finish on the pretreated fabric. Bees wax, linseed oil and turpentine oil were used at different proportions to obtain the result.

- Bees Wax – 16oz
- Boiled Linseed Oil – 8oz
- Turpentine Oil – 8oz
- Stir Stick
- Paint Brush
- Pot

3.1.3 Water Repellent Application

In this research, the water repellency using the natural ingredients is achieved by double boiling the ingredients and brushing the liquid on to the fabric, followed by heat treatment.

3.2.1 Preparation of Material

The selected fabric to be treated with the water repellent chemicals should be scoured first. Hydrophobic sizing agents, surfactants, oil solutions and other substances are present on most textiles, as the presence of these substances will effect the result of the finishing treatment. Hence the fabric is immersed in water with alkali solution for about 3-4 hours. The fabric is then rinsed and dried in sunlight. It is then ironed neatly.

3.2.2 Preparation of Wax Solution for Coating

- The pot was filled with water partially and placed on the burner and allowed to boil.
- The wax pellets were added in another bowl and was placed on the pan with boiling water.
- The temperature of the boiling water makes the wax to melt.
- After few minutes, the wax melts and forms a liquid solution.
- The Turpentine and Linseed oil are then added to the wax slowly and stir while adding to the mixture.
- Do not boil the mixture as they are very, very flammable.
- Pull the solution from the heat source.

3.2.3 Application of the Wax Coating

The prepared mixture is applied to the scoured fabric by using a brush. A clean brush is taken and is dipped in the wax solution and applied on to the fabric evenly. The temperature of the wax solution should be maintained, otherwise the solution will get solidified.

3.2.4 Heat Treatment

In general, the fabric should be dried to remove moisture or solvent in preparation for heat treatment. In this research, the heat treatment is given to the fabric by using a hair dryer. The dryer is switched on and is moved

constantly over the fabric, the heat from the dryer helps to melt the wax solution. The melted wax solution is penetrated into the fiber of the fabric, thus forming a coat which is water repellent.

3.2.5 After treatment

The fabric thus treated with water repellent solution must be allowed to dry. The linseed oil and turpentine oil produce a strong smell; hence the fabric should be dried in shade in an open atmosphere to reduce the odour.

3.3.1 Construction of Apron

Apron is used to protect the inner garments, while working in the kitchen. Straps are attached at the shoulder and side seam. These straps are used to tie the apron around the bodice at the waist and at the neck.

3.3.2 Stitching of Apron

After drafting the pattern on paper, the drafting pattern is traced on the coated fabric and is cut accordingly. The cut pattern is then sewed on a normal sewing machine. After stitching the apron, it is ironed neatly.

3.4 Evaluation

The prepared samples were subjected to objective evaluation to calculate the effectiveness of the wax coating. The following tests was conducted on the wax coated and uncoated fabric, to evaluate the effect of the wax coated fabric from the normal uncoated fabric. The physical properties of the fabric were tested using thickness test, weight test, stiffness and elongation test. The repellency property was analyzed by sinking, wicking, spray and drop test.

3.4.1 Fabric Weight (GSM) (ASTM D2646/D3776, ISO 3801)

Gsm cutter (Fig – 1) is used to cut out the specimen. The sample cutter cuts out rapidly and accurately circular specimen of 100cm^2 which is exactly one hundredth of a square meter. The Gsm cutter contains blades on the bottom region which enables efficient cutting. For lock position: the blades are held inside the knobs. For unlock position: The blades are allowed for cutting and knobs are opened to cut the fabric. The cut specimen should be weighted and noted. The weight of the specimen is measured using Electronic Balance (Fig – 2). For the above procedure the weight of both the uncoated and coated fabric samples were calculated and noted. The results in grams are multiplied by 100, to get the Gsm directly.

Grams per Square Meter = Specimen Weight in Grams * 100.

Fig – 1, GSM Cutter

Fig – 2, Electronic Balance

3.4.2 Fabric Thickness Test (ASTM D1777, ISO 1765)

The thickness of a fabric is one of its basic properties giving information on its warmth, heaviness or stiffness and is measured in thickness tester plate of fabric in use (Fig - 3). As per ASTM standards three load of different weight is given to use the fabric. In practice thickness measurement are rarely used as they are very sensitive to the pressure used in the measurement. The sample should be free from folds, crease or wrinkles. Place the sample on the anvil, by lifting the pressure foot up and leave it gently down. Now place the standard weight on the top of the device and note the reading displayed on the dial gauge. The sample specimen is cut from various parts of the fabric and the readings are noted and calculated.

Fig – 3, Fabric Thickness Test

Fig - 4, Fabric Stiffness Test

3.4.3 Fabric Stiffness (IS 6490:1971)

Stiffness is one of the most widely used parameters to judge the rigidity and fabric handling. Fabric stiffness and fabric handling is an important decision factor for the end users. The method for determination of stiffness of fabrics is done in stiffness tester (Fig - 4), denoted by Indian Standard, 1971. The tester is placed on a table so that horizontal platform and inclined reference line were at eye level of the operator. The platform was adjusted, with the help of a spirit level so that it was horizontal. One of the specimens was placed on the platform with the scale on top of its lengthwise and the zero of the scale coinciding with the leading edge of the specimen. The scale was held in horizontal plane, the specimen was pushed along with the scale slowly and steadily. The leading edge of the specimen starts to project beyond the edge of the platform. An increasing part of the specimen would overhung and start bending under its own weight. The length of the overhanging portion was noted from the 80 scale to the nearest millimeter. Five readings from each warp and weft direction of the fabric was taken, with each side up, first at one end and then at the other.

3.4.4 Fabric Tensile Strength (ASTM D5035)

Tensile testing is the most commonly applied test method for analyzing the mechanical properties of fabric materials. Tensile strength measures the force needed to elongate and break a sample. It is used to determine the strength and elasticity of woven or non-woven fabrics. Although the direction of force applied is always in tension, there are a variety of tensile test methods available for capturing the most relevant data for final product usage.

The strip test is a tensile test in which the full width of the test specimen is gripped in the tensile grip jaws of a universal testing machine (Fig – 5). During this test, tensile force is applied on the fabric specimen until it ruptures. The strength is displayed on the dial is noted. The test is carried out on the uncoated and coated fabric in both warp and weft directions.

3.4.5 Fabric Elongation Test (ASTM D5035)

The strength and elongation are two prime quality attributes of any woven or non woven fabric. The breaking strength and elongation of clothing fabrics are considered to be unacceptable if they are lower than the minimum values. The ASTM D5035 tester is used to determine the maximum force and the elongation at maximum force of textile fabrics using strip method.

Fig – 5, Fabric Elongation Test

Fig – 6, Fabric Spray Test

3.4.6 Fabric Spray Test (AATCC-22, ISO-4920)

This test is suitable for measuring the water repellent efficiency of finishes applied to fabrics.

Spray tester (Fig - 6) is an instrument used to any textile fabric, which may or may not have been given a water-repellent finish. It measures the resistance of fabric to wetting by water. In the test three specimens are tested each one 180mm square. Each specimen in turn is held in taunt over a 150mm diameter embroidery hoop which is mounted at 45^{o} to the horizontal stand. A funnel which is fitted with a standard nozzle containing 19 holes of a specified diameter is held 150mm above the fabric surface. 250ml of distilled water is poured into the funnel to give a continuous shower onto the fabric surface which is mounted on the embroidery frame. After the water spray has finished, the hoop and the specimen are removed and tapped twice slowly against a solid object on opposite points of the frame while the fabric being kept horizontal. This removes any large drops of water. The fabric is then assigned a spray rating using a photographic standard. In this test, water sprayed against the taut surface of the test specimen under controlled conditions produces a wetted pattern whose size depends on the relative repellency of the fabric. Evaluation is accomplished by comparing the wetted pattern with pictures on a standard chart. The spray test was conducted for both the uncoated and coated fabric and the result was noted.

3.4.7 Sinking Test (AATCC 17-1994)

Sinking test method is used to evaluate the wetting of the fabric. It is done by measuring the time required for a piece of fabric to sink completely from the surface layer of water in a beaker. A sample of 3 x 3 cm was cut from both the original and the treated fabric and placed on the surface layer of water in a 500 ml beaker. The wetting time was estimated with a stop watch as the time interval between the movement of immersion and the movement when the sample sunk under the water level. If the sample does not sink within 1 minute it is considered as having floated.

3.4.8 Wicking Test (AATCC197)

This method is used to evaluate the ability of vertically aligned fabric specimens to transport liquid along or through them. Cut 5 specimens in each direction, all measuring 18cm x 5cm. the specimen end is folded and secured on a rod or pen using a needle or clip. Place the rod over the opening of a glass bowl, so the specimen hangs in the bowl. The bowl is filled with distilled water upto a marked level. Mark 1cm on the bottom end of the specimen using a marker pen. The specimen is immersed in the water till the marked level. Leave the specimen for 1 minute. After 1 minute, measure how high the water has moved from the marked edge. The test is repeated for 5 samples of the uncoated and coated fabric, the average of the results are calculated and noted.

3.4.9 Drop Test

Absorbency can be checked by dropping a single droplet of water on the fabric and visually observing its absorbency. In a pipet water is taken and water drop are dropped on the surface of the fabric and the absorption of the water drop is observed visually. The standard time for the absorption of one drop is 0.5 – 0.8 sec up to 1 second. The uncoated and the uncoated fabric samples were tested by this method and the results are noted.

3.4.10 Washing Test

The treated fabric is washed simultaneously and after each wash the fabrics absorbency property is tested and the effect of repellency of the fabric is evaluated. The fabric is washed using a mild detergent at home and dried in a shade. The dried fabric is then tested and evaluated.

3.5 Result

Table – 1, Result Analysis

S.NO	TEST	COTTON FABRIC	WAX COATED FABRIC
1.	Fabric Weight (GSM)	227.8	605.5
2.	Fabric Thickness (mm)	0.966	1.244
3.	Fabric Stiffness (cms)	2.88	3.1
4.	Fabric Strength (kg)	30	34.25
5.	Fabric Elongation (%)	10	7.5
6.	Spray Test	50	100
7.	Wicking Test (cm)	0.2	0

Chart – 1, Result Analysis

3.6 Findings of the Study

Wax coated samples of cotton fabric were evaluated under physical and absorbency properties. The test results were analyzed statistically.

- By analyzing the Fabric Weight test results, it is understood that there is considerable weight gain in the wax coated fabric.
- Thickness test, the coated fabric has gained thickness when compared to the uncoated fabric.
- From the tensile strength test, it is observed that the coated fabric sample has more strength than the uncoated sample.
- The coated fabric has lesser elongation than the uncoated fabric sample.
- From stiffness test, it is found that there is an increase in the stiffness of the coated sample.
- Spray test was carried out to check the repellency of the fabric sample and it was found that the coated sample showed no absorbency while the uncoated sample have moderate absorbency. While the test specimen was analyzed with the standard spray rating chart it showed a grade of 50 for the cotton fabric and 100 for coated sample which means no wetting
- As far as the sinking test was concerned, both the coated and uncoated fabrics did not sink in the water contained in the beaker.
- No significant difference was observed in both the uncoated and the coated fabric samples.

4. Conclusion

In this research, water repellent coating was given to a cotton fabric which was then stitched to an apron. The water repellent finish was obtained using natural sources like bees wax, turpentine oil and boiled linseed oil. The wax coating was applied to the cotton fabric and various tests were conducted on the fabric to evaluate the efficiency of the wax coating. The various physical and mechanical tests were conducted on both the uncoated and the coated fabrics in order to compare and highlight the efficiency of the wax coated fabric. The fabric was then designed to an apron and the performance study was made on it. From the results and summary, it was evident that the wax coated fabric had higher efficiency of water repellency. The use of harmless solvents and non-toxic chemicals should be the characteristic of the process.

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