

Analysis and Evaluation of effects of detergents on the selected fabrics

By

AFIDA NAZA KHAN

(21PBX001)

A Thesis submitted to the

Avinashilingam Institute for Home Science and Higher Education for Women

Coimbatore -641043

In Partial Fulfilment of the Requirement for the

DEGREE OF MASTER OF SCIENCE IN

BIOTEXTILES

MAY ,2023

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fabric**


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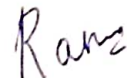
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MAY,2023**

Certified as Bonafide Research Work


Signature of Head of the Department


Signature of the Supervisor

DECLARATION

I declare that the dissertation entitled “**Analysis and Evaluation of effects of detergents on the selected fabrics**” submitted by me for the degree of Master of Science (M.Sc.) is the record of work carried out by me during the period from 2022 to 2023 under the guidance of Dr. U. RATNA, M.Sc., M.Phil., Ph.D., Professor, Department of Textiles and Clothing, Avinashilingam Institute for Home Science Higher Education for Women, Coimbatore -642043 and has not formed the basis for the award of any Degree, Diploma, Associate ship, Fellowship, Titles in this University or any other similar institution of higher learning.



Signature of the Candidate

CERTIFICATE FROM THE SUPERVISOR

I certify that dissertation entitled “Analysis and Evaluation of effects of detergents on the selected fabrics” submitted for the degree of Master of Science (M.Sc.,) Biotextiles by AFIDA NAZA KHAN is the record of project work carried out by her during the academic year 2022 to 2023 under my guidance and supervision and this work has not formed the basis for the award of any Degree, Diploma, Associate ship, Fellowship, Titles in this University or any other similar institution of higher learning

Rakn

Signature of the Supervisor with Designation

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Signature of the HOD

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ACKNOWLEDGMENT

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Afida Naza Khan

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INTRODUCTION

1. INTRODUCTION

The purpose of apparel care is to give the consumers accurate care information to extend the useful life of the apparel. Manufacturers and importers of textiles, apparel and piece goods and any organization that controls the manufacturing or import of textile wearing apparel or piece goods for making wearing apparel are covered. The object of this care label is to increase life management skills and save money by properly caring for clothing. Water plays a major role in how clean the laundry is hardness or softness, level and temperature all affect the laundry process (Felthem , 2006).

The apparel and textile industries worldwide have set different standards for care label a product. It becomes the suppliers or manufacturers responsibility to make sure customers understand the right methods of maintaining a product. Any piece of a textile product has two major kinds of labels, one that describes the fibre composition of the fabric and the other that contains washing and ironing instructions, which is generally called care label. Labels in clothes and other textile articles play a huge role in the buying decision of a consumer. For some, the convenience of dry cleaning might be a reason to pick up a certain garment, while some might prefer machine wash more economic. Hence consumers, look beyond the aesthetics and fabric of a product (Martin, 2006).

The after use and maintenance is vital to push their decision forward or backward to buy. Apart from this, the care label functions as a guideline to washing and caring. The instructions also help laundry washers and dry cleaners, while cleaning clothes and other textile articles like carpets, curtains, or cushion covers for their consumers. It also serves as guidelines to consumers for increasing the life of a product and can prevent them from causing damage of a garment (Kyln, 2015).

Colour fastness, shape, ironing, appearance, are also the matters of concerns with consumers post purchase of a product. According to the chemical sensitivity of the fabric, the type of detergent, bleaching, or dry cleaning will be determined, and depending on heat sensitivity of the fabric, the washing, drying, and ironing will be established. Fabrics that are loosely woven, and can easily get out of shape, require special care while washing, drying, and ironing. All these things help in maintaining the condition and serviceability of the garments and other products. The creation of a garment or a textile article adds to the intricacy of caring procedures. It is not possible to add all details to strengthen the life of a product; hence

it is only fair on the part of the suppliers to help customers with care label to guide them (Richard, 2015).

Laundry is both science and art. It is based on the application of scientific techniques which require certain skills. Laundering involves different processes example washing, drying, ironing, pre- treatment stain removal, starching dry-cleaning etc. To take good care of the fabrics is the main aim of laundry. Knowledge of laundry is very essential to achieve this aim. When there were no washing machines then our ancestors had only one option- hand wash their clothes. It has many advantages such as it is delicate on clothes, better cleaning performance, better for delicate fabric. Whereas, in the modern age, we have many sophisticated machines which make our lives easier. It doesn't required labour activity saves time and wash more clothes at a time (Kym, 2011).

The textile industry is scaling new heights and entering new horizons, so do the field of laundry. Majority of people in Indian families launder their clothes at home. The urban families use electric washing machines and new laundry reagents in household laundry. The method of laundering depends upon the type of fabric and the type of dirt. Choosing the most appropriate method of laundering is important in order to make the clothes last longer and serve us better. Different types of clothes require different treatment while washing. This is because of a variety of factors like fibre content, surface of the fabric, amount of soil present in the fabric and so on. There are few scientific methods of washing or laundering clothes. Laundry processes include washing (usually with water containing detergents or other chemicals), agitation, rinsing, drying, pressing (ironing), and folding. The washing will sometimes be done at a temperature above room temperature to increase the activities of any chemicals used and the solubility of stains, and high temperatures kill micro-organisms that may be present on the fabric. However, it is advised that cotton be washed at a cooler temperature to prevent shrinkage. Laundering is generally by detergents, apart from this there are many laundering methods (Farlex, 2012)

Nowadays laundry detergents are becoming increasingly popular as they can be metered automatically into the washing machine, impart softness, antistaticness, resiliency to fabrics, mild to eyes and skins and shows good dispersed in water. Because it is consumed when it is used, the sale of laundry detergent is a rather large business. There are many different kinds or brands of laundry detergent sold, many of them claiming some special qualities as selling points. A Laundry detergent composition is a formulated mixture of raw materials that can be

classified into different types based on their properties and function in the final product. The different classes of raw materials are surfactants, builders, bleaching agents, enzymes, and minors which remove dirt, stain, and soil from surfaces or textiles gave them pleasant feel and odour. The physico-chemical properties of surfactants make them suitable for laundry purposes. Laundry detergent has traditionally been a powdered or granular solid, but the use of liquid laundry detergents has gradually increased over the years, and these days use of liquid detergent equals or even exceeds use of solid detergent. This review paper describes the history, composition, types, mechanism, consumption, environmental effects and consumption of laundry detergents (Clin, 2019).

A detergent is a surfactant or a mixture of surfactants with cleansing properties when in dilute solutions. There are a large variety of detergents, a common family being the alkylbenzene sulfonate, which are soap-like compounds that are more soluble in hard water, because the polar sulfonate (of detergents) is less likely than the polar carboxylate (of soap) to bind to calcium and other ions found in hard water. The word *detergent* is derived from the Latin adjective *detergens*, from the verb *detergere*, meaning to wipe or polish off. Detergent is a surfactant or a mixture of surfactants with cleansing properties when in dilute solution. However, conventionally, detergent is used to mean synthetic cleaning compounds as opposed to *soap* (a salt of the natural fatty acid). In domestic contexts, the term *detergent* refers to household cleaning products such as *laundry detergent* which are in fact complex mixtures of different compounds, not all of which are by themselves detergents. Detergency is the ability to remove unwanted substances termed 'soils' from a substrat(e.g.clothing).

Detergents are a group of compounds with an amphiphilic structure, where each molecule has a hydrophilic (polar) head and a long hydrophobic (non-polar) tail. The hydrophobic portion of these molecules may be straight- or branched-chain hydrocarbons, or it may have a steroid structure. The hydrophilic portion is more varied, they may be ionic or non-ionic, and can range from a simple or a relatively elaborate structure. (Cahn, 2003).

Many kinds of molecules and ions can serve high efficiency surfactants. They are often classified according to the charge of the molecule or ion, the three main classes being anionic, neutral and cationic detergents. Anionic detergents are most commonly encountered for domestic laundry detergents. Detergents are ions or molecules that contain both polar and non polar components. The polar component allows the detergent to dissolve in the water,

whereas the non polar part solubilizes greasy (" hydrophobic") materials that are the usual target of the cleaning process (Philip, 2016).

Care instructions are small solutions to big problems. Care labels provide guidelines to consumers about apparel care, and the best cleaning procedures to be used for a particular combination of fabric, thread decoration and construction techniques. Following the instructions on the care labels is an assurance that the appearance and fit of the garment will be maintained after repeated cleaning treatments. The country where the garment is sewn is the country of origin listed on the care label. Care labels must be permanently attached so that they are easily accessible to the consumer at the point of purchase. Generally, it is placed on the side or bottom. The manufacturer or importer who directs production is responsible for the accuracy of care instructions .A product may be imported without a care label, but it must be attached before the product is sold. Care labels provide information on the temperature settings to be used for ironing. In certain cases, ironing is not recommended at all. Indicates the care instructions of the garments by some internationally recognized signs. It shows washing, bleaching, drying, laundering, ironing, dry cleaning. The consumer usually does not have the experience or technical knowledge to decide which care treatment is suitable, so it is the responsibility of the apparel manufacturers to provide the necessary care information for the products. Without care information, the consumers will face trouble in deciding on the appropriate conditions for care treatment of the apparel. Care labels should not be considered as a guarantee or a quality mark of the product (Mazharul, 2012).

Care labels are essential when making the decision to purchase items, especially clothing. Without the guidance of an accurate care or content label; it would not be known how to properly **care for a particular garment** which in the long run could ruin the fabric. The care labelling standards applies to everyone who is a part of the manufacturing process i.e. suppliers, importers, distributors, retailers, and producers of the products. Although every country follows its own set of standards and mandatory rules of care label, there are a few set of pre-requisites that apply to most of them (Kansal, 2006).

The care labels need to be permanently attached to the product and must be legible. It must be able to put up with the procedures mentioned thereby. For consumers care symbols make sense when they can understand and follow the instructions. Symbols should provide the same information to everyone without language barriers. It is also very much essential for the garment manufacturers to make awareness campaign regarding the utility of care labels for

the consumers. However, while applying the care labels it is very important for the garment manufacturers to understand the comfort criteria of care labels. Proper care of textiles will determine the durability and attractiveness of a textile product during usage. Care of textiles may include airing, washing, bleaching, drying and ironing, dry cleaning, stain removal (Martin, 2006).

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

2.1. DETERGENT

2.1.1. INTRODUCTION

The word *detergent* is derived from the Latin adjective *detergens*, from the verb *detergere*, meaning to wipe or polish off. Detergent is a surfactant or a mixture, of surfactants with cleansing properties when in dilute solutions. However, conventionally, detergent is used to mean synthetic cleaning compounds as opposed to *soap* [a salt of the natural fatty acid], even though soap is also a detergent in the true sense. In domestic contexts, the term *detergent* refers to household cleaning products such as *laundry detergent*, dish detergent, which are in fact complex mixtures of different compounds, not all of which are by themselves detergents. Detergency is the ability to remove unwanted substances termed 'soils' from a substrate (e.g clothing) (Falbe, 2012).

Laundry detergent is a type of detergent (cleaning agent) used for cleaning dirty laundry (clothes). Laundry detergent is manufactured in powder (**washing powder**) and liquid form .While powdered and liquid detergents hold roughly equal share of the worldwide laundry detergent market in terms of value, powdered detergents are sold twice as much compared to liquids in terms of volume (Michael, 2019).

Detergents are a group of compounds with an amphiphilic structure, where each molecule has a hydrophilic [polar] head and a long hydrophobic [non polar] tail. The hydrophobic part of these molecules may be straight –or branched-chain hydrocarbon, or it may have a steroid structure. The hydrophilic part is more varied, they may be ionic or non-ionic, and can range from a simple or a relatively elaborate structure. Detergents are surfactants since they can decrease the surface tension of water. Their dual nature facilitates the mixture of hydrophobic compounds [like oil or grease] with water. Because air is not hydrophilic, detergents are also foaming agent to varying degrees (Bayly, 2008).

Detergents work better in an alkaline PH. The properties of detergents are dependent on the molecular structure of the monomer. The ability to foam may be determined by the head group, for example anionic surfactants are high-foaming, while non-ionic surfactants may be non-foaming or low foaming. Nowadays laundry detergents are becoming increasingly popular as they can be metered automatically into the washing machine, impart softness,

antistaticness, resiliency to fabrics, mild to eyes and skins and shows good dispersibility in water. Because it is consumed when it is used, the sale of laundry detergent is a rather large business. There are many different kinds or brands of laundry detergent sold, many of them claiming some special qualities as selling points. A Laundry detergent composition is a formulated mixture of raw materials that can be classified into different types based on their properties and function in the final product. The different classes of raw materials are surfactants, builders, bleaching agents, enzymes, and minors which remove dirt, stain, and soil from surfaces or textiles gave them pleasant feel and odour. The physico-chemical properties of surfactants make them suitable for laundry purposes. Laundry detergent has traditionally been a powdered or granular solid, but the use of liquid laundry detergents has gradually increased over the years, and these days use of liquid detergent equals or even exceeds use of solid detergent (Strandorf, 2003).

2.1.2. HISTORY

Though the beginning of detergent industry is not shrouded in the veils of history as were the start of soap industry, it is nevertheless not easy to find when the detergent industry, as such, came into existence. An important issue is to decide exactly what is being termed as a synthetic detergent as the term itself leads to confusion. In the United States of America, the word surfactant or syndet is being used, while in Europe the term 'tenside' (for tensio-active material) came into fashion. The earliest developed synthetic detergents were short-chain alkyl naphthalene sulphonates that were later found to be only somewhat good detergents and so their properties were improved. Those detergents are still used today as wetting agents. During 1920's and 30's, straight chain alcohols were sulphonated to produce straight chain detergents. During the same time long chain alkyl and aryl sulphonates with benzene were developed as the aromatic nucleus (the alkyl portion was derived from kerosene) (Fred, 2001).

Between 1950 and 1965, more than half of the detergents were based on the formula of a propylene tetramer conjugated to benzene (PT benzene), but later they were blamed for a rise in eutrophication in lakes and streams as they contain phosphates (from Sodium triphosphate). Although the problem has not been completely resolved in some cases, in some countries there has been an agreement for reducing the uses of phosphates however in countries where it is not a big issue no such action has been taken. The problem was set down to the branched chain formation of PT benzene that resulted in the bacteria's' inability to

degrade them. Straight-chain alcohols are degradable, hence the steps were taken to form and produce a linear alkyl benzene molecule. Over the years, many types of detergents have been developed for a variety of purposes, for example, low-sudsing detergents for use in front-loading washing machines, heavy-duty detergents effective in removing grease and dirt, all-purpose detergents and specialty detergents (Paul, 2008).

By 1970 there had become a trend for liquid laundry detergents as Laundry tablets disappeared from the market. This was mainly down to the fact that Laundry powders and laundry tablets were clogging up washing machines. This new technology also improved washing of clothes due to the fact that laundry liquids dissolved much faster than laundry powder in water. Laundry Liquid also dissolved completely at lower temperatures unlike washing powders. In the 1980`s the trend was for concentrated laundry powders and liquids for washing machines. This was mainly down to an environmental drive by governments to reduce packaging and our carbon footprint. Whilst this was a great idea clothes washing became complicated for the average user of laundry detergents. These concentrates would often damage clothes and washing machines as the dosing rates could be complicated (William, 2018).

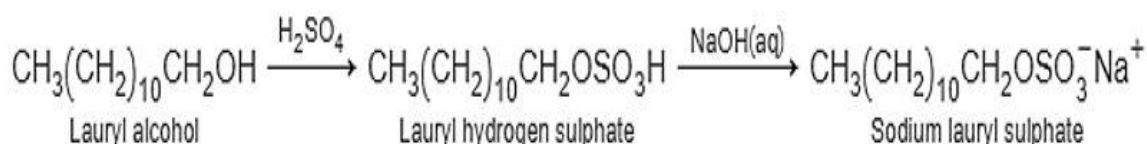
In 2016 the synthetic detergents complete the 100 years and story they evolved as cleaners. Their uses and objectives have been expanded and today it is already part of the routine of thousands of people worldwide. Today are made surfactants of linear chain, which facilitate the biodegradation of the product (Hakkinen, 2005).

2.1.3. CLASSIFICATION

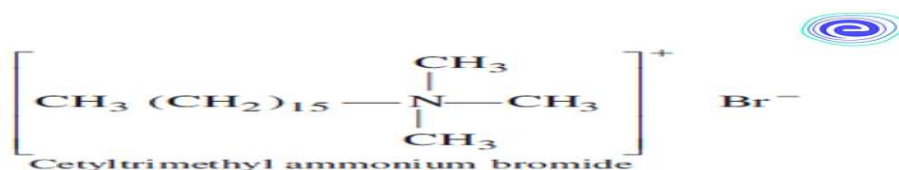
Detergents are generally classified into four different groups:

- On the basis of structure
1. **Anionic Detergent**- Anionic Detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons. They have anions at the soluble ends of the chains. Typical anionic detergents are alkyl benzene. The alkyl benzene portion of these anions is lipophilic and the sulfonate is hydrophilic. Two varieties have been popularized, those with branched alkyl groups and those with linear alkyl groups. The former were largely phased out in economically advanced societies because they are

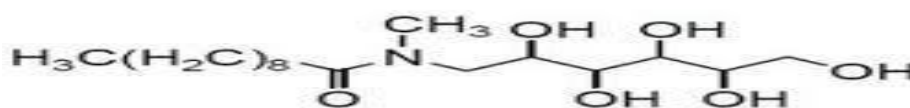
poorly biodegradable. Anionic detergents is the most common form of detergents, and an estimated 6 billion kilograms of anionic detergents are produced annually for the domestic markets. Bile acids, such as deoxycholic acid (DOC), are anionic detergents produced by the liver to aid in digestion and absorption of fats and oils. E.g: Sodium Lauryl sulphate and sodium n-dodecyl benzene sulphonate. (Thomas, 2004).



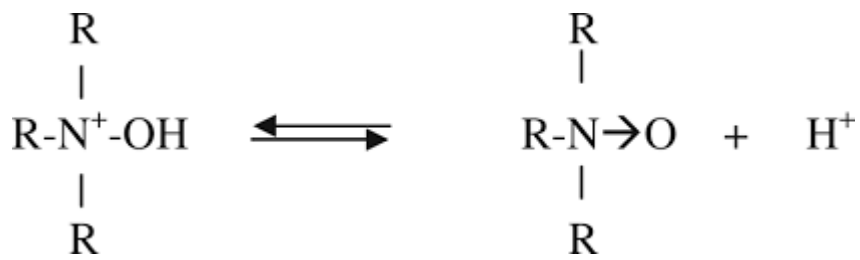
2. **Cationic Detergent**-Cationic detergents are quaternary ammonium salts of amines with anions as acetates, chlorides or bromides. The ammonium sulfate center is positively charged. Cationic surfactants generally have poor detergency. For example, the most common cationic Detergent is cetyltrimethylammonium bromide and Sapamine (Henry, 2011)..



3. **Non-ionic Detergent**- The most important non-ionic detergents are obtained by condensing compounds having a hydrophobic molecular group, usually a hydroxyl [OH] group, with ethylene oxide or propylene oxide (Otto, 2009).



4. **Amphoteric or Zwitterionic Detergent**- Amphoteric or zwitterionic detergents have zwitterion within a particular pH range, and possess a net zero charge arising from the presence of equal numbers of +1 and -1 charged chemical groups. Amphoteric surfactants have a polar functional groups whose charge depends on the PH of the solution [Koley D and Bard AJ, 2010].



- On the basis of Physical State

1. **Powder Detergent**- By definition, it's a soap in the form of a powder that is used to wash clothes, sheets, towels, and fabrics in general. It can be used in a washing machine or for manual washing. Powder detergent is one of the more traditional washing solutions, with two key advantages: **affordability** and **power against heavy stains** (Rolsky and Kelkar, 2022).

POWDER DETERGENT ADVANTAGE:

- Affordability
- Recyclable Packages
- Excellent for removal of heavy stains
- Brightening and Whitening Properties
- Specific optional ingredients such as oxygen bleach
- Added softening agents to soften the hard water.

POWDER DETERGENT DISADVANTAGE:

- Dosing can be tricky and messy
- Lower quality formulas can leave residue or dissolve only partially on low temperatures
- The package is sensitive to water and tear
- Not the best solution for pre-treatment of stains.

2. **Liquid Detergent**- Liquid detergents possess a higher ability to release and break down fat, and their ingredients are resilient to minerals typically found in hard water. Moreover, liquid detergents are more suitable for washing colored fabrics, since many formulas preserve the hue better than powder detergents (Smith, 2014).

LIQUID DETERGENT ADVANTAGE:

- “Particularly effective on oil and grease stains because the liquid will penetrate the fibers of the fabric to help release the stain”
- The liquid laundry detergents completely dissolve in water
- Perfect to use as a stain pre-treater or spot targeting cleaning

LIQUID DETERGENT DISADVANTAGE:

- They usually come on plastic packaging, not very eco-friendly.
- They are more expensive.

3. **POD DETERGENT**- The chemistry of laundry detergent packs is the same as in liquid detergents (including alkylbenzenesulphonates). The dissolvable packets are typically polyvinylalcohol (PVA) or a derivative of PVA. Although the formulas are similar, a detergent pack's liquids may contain 10% water compared to 50% in liquid detergents (Sharon, 2016).

POD DETERGENT ADVANTAGE:

- Cheaper than liquid detergent
- Eco-friendliness: the packaging (recycled cardboard) is more eco-friendly
- Added softening agents: some powder detergents contain agents that soften water which can help if you have hard water

POD DETERGENT DISADVANTAGE:

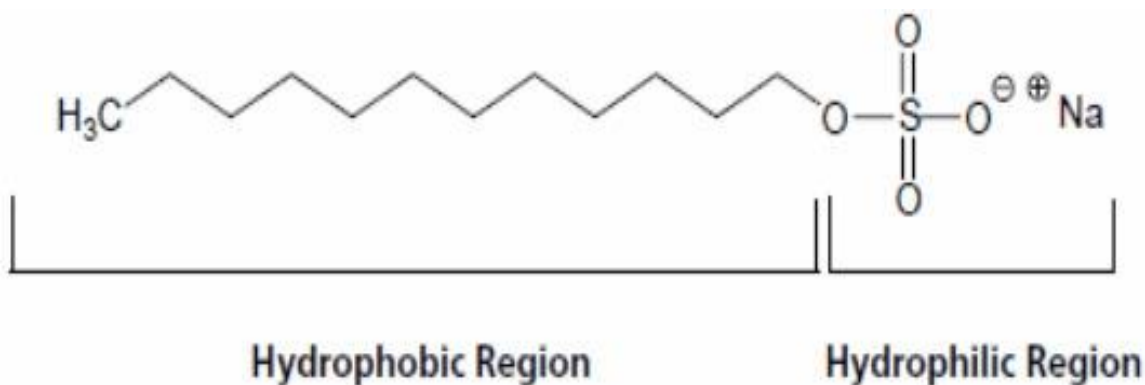
- The average cost for Pods can range anywhere from \$7.99 to \$24.99, depending on the size
- Some user finding using Pods in machines like HE very difficult to dissolved
- Other type of detergent

1.Phosphate-free detergent- Phosphates have low toxicity in the environment but cause nutrient pollution, a major water quality problem in many watersheds. Phosphates in water cause eutrophication of algae which creates conditions favourable to formation of harmful algae blooms. These blooms prevent light and oxygen from getting into the water, leading to the death of organisms in the ecosystem. Sodium tripolyphosphate was an excellent builder used in laundry detergent powders. However, due to issues of biodegradability many countries have banned the use of phosphates in detergents. In the 21st century phosphates began to be reduced in percentage terms as an ingredient, leading to a *New York Times* report that said low- or phosphate-free detergents it tested, including those from environmentally friendly product lines that have been on the market for years, none matched the performance of products with phosphates (Mireya, 2010).

2.Enzyme or Biological Detergent- Biological detergents contain enzymes that help break down the fatty, greasy, and starchy compounds that are found in some of the most common clothing stains such as pasta sauces, bike oil, and hamburger grease. These enzymes work to lift the stains out of fabrics, making them excellent stain removers and a very welcome addition to laundry detergents, turning stain removal into a quick and easy task. . **Detergent enzymes** are biological enzyme that are used with detergents. They catalyze the reaction between stains and the water solution, thus aiding stain removal and improving efficiency (Clause, 2002).

2.1.4.WORKING PRINCIPLE OF DETERGENT

A molecule of any detergent is made up of the following two parts: polar part consists of an anionic or cationic group and is called the polar end.A non-polar part consisting of a long chain of twelve to eighteen carbon atoms is called a hydrocarbon end (Martin, 2015).



CLEANSING ACTION OF DETERGENT

The polar end of a detergent molecule is water-soluble, whereas the hydrocarbon part is water repellent and oil soluble. When an oily piece of cloth is dipped into a detergent solution, the detergent's hydrocarbon end bonds to the oily drop and the polar end orients itself towards the water, resulting in the production of a micelle. The oily dirt is entrapped by the negatively charged micelle that has formed. The ions in the solution arrange themselves around the micelles. The negatively charged micelles repel each other due to the electrostatic repulsion. As a result, the tiny oily dirt particles do not come together and get washed away in the water (Nancy, 2003).

2.1.5.ADVANTAGE OF DETERGENT

1. Detergent powders are known to help extend the life of your clothes. When you use a detergent powder like surf excel easy wash, the powder eliminates the insoluble salts which could stay on your clothes. This helps in increasing the life of your clothes.
2. Detergents may be more cost effective compared to other options.
3. It can scrub off difficult stains. This does not leave behind stains or marks on your clothes.
4. Washing cloth in detergents is safer, because it does not contain any harsh chemical which causes skin to effect.
5. It contains certain water softening agents, which helps in using this powder in different water quality (Ryan, 2012).

2.1.6. DISADVANTAGE OF DETERGENT

1. The major disadvantage of detergents is that they are non-biodegradable, which is really bad for the environment.
2. They cause soil and water pollution. This means you are somewhere risking your life along with animals which live in soil.
3. Excessive alkali used in some detergent can damage the fabric.
4. Colour may run out if you use a cheaper quality of detergent.
5. More water rinses to remove foam, otherwise it will damage the fabric (Ryan, 2012).

2.2 .DENIM FABRIC

2.2.1. INTRODUCTION

Denim is a rugged and durable cotton fabric that has become a staple material in fashion and design. It is made using a twill weaving technique, in which the weft passes under two or more warp threads, resulting in a diagonal ribbing pattern that sets it apart from other types of cotton fabrics like cotton duck. The most common colour of denim is indigo, which is achieved through a dyeing process where the warp threads are dipped repeatedly in indigo dye while the weft threads remain undyed. This results in a distinctive appearance where one side of the fabric is blue-dominant, and the other side is white-dominant. Denim is versatile and can be used to create a wide range of garments, from jeans and jackets to skirts and dresses. It is also used in accessories like bags and hats, as well as in furniture upholstery and even wall coverings. Over the years, denim has become a symbol of rebellion and individuality, with its association with cowboys, rock stars, and other cultural icons. Today, it remains a popular material that has transcended its humble origins and become a fashion staple around the world (Mogahzy, 2009).

Denim fabric is created through a well-defined process that involves several steps: Cotton fibre are spun into yarns of different thickness and length .The warp yarns are traditionally dyed with indigo, a deep blue plant-based dye that has been used for centuries to colour textiles. The weft yarns, on the other hand, are usually left in their natural white or ecru

colour, although they can also be dyed with different colours for fashion purposes. The dyed warp and undyed weft yarns are then woven together on a shuttle loom or projectile loom, using a twill weave. This weave creates the characteristic diagonal pattern of the fabric, also known as the "warp-faced" side. After weaving, the fabric is often sanforized, a process that involves steaming and compressing it to reduce shrinkage and improve stability. This is particularly important for denim garments that are often washed and dried repeatedly, as it prevents them from losing their shape and size (Barbara, 2011).

Denim fabric now has too many variations to list, and it has been mixed with other fabric and weave styles *ad nauseam* as designers have worked feverishly to develop the latest trends in denim fashion. All the same, traditional Levi 501s remain incredibly popular around the world, and a niche industry has emerged that revolves around "raw denim," which is part of every hipster's lingo book. Global interest in denim remains strong, and it's likely that this weave will still be produced as long as cotton remains a major textile product (Dorraine, 2012).

Most indigo dye can transfer in the wash, wash denim with like colours or alone should be washed on the first wash. Wash denim in cool water on a medium to normal cycle. Denim can be put in the dryer and should be dried at medium heat. However, to extend the life of a denim item, it should hang to dry and only wash after several wears (Jacob, 2008).

2.2.2. HISTORY

In the late 17th century, weavers in Nimes, France, accidentally made the first modern denim, a coarse, sturdy, cotton fabric, while trying to replicate the process of producing another popular heavy duty fabric called serge. Textiles made during this time were often named based on where they were first manufactured. So, they called the new material "serge de Nimes" meaning literally "serge from Nimes." Legend has it, over time, as the fabric became more widely used, English and French merchants shortened the name to "denim. Meanwhile, Italian textile workers in Genoa had been producing a fabric made with indigo dyed wool and cotton. It was somewhat similar to denim fabric, and was favoured among sailors and other members of the working class. They made all types of clothes from this durable cloth, from trousers, to overcoats, to long dresses, and they called all of these items "blue jeans." The term "jean" is a shortened term for Genoa. So, technically speaking, jean and denim were two distinctive fabrics. In mid-19th century America, jean fabric was used for trousers and overcoats and was solid coloured, usually

indigo, olive, or brown. Denim, on the other hand, was always spun from both white and indigo yarn, and was used exclusively for work wear for miners, mechanics, cowboys, and farmers that required the toughest materials. Gold miners liked the durability of denim-weave cotton, and though other dye colours were widely available in the American West, manufacturers like Levi Strauss continued using the indigo blue dye that Genoan fabric merchants originally resorted to out of necessity (Maude, 2019).

2.2.3. PROPERTIES

- Denim is one of the highly demanding international commercial fabric
- Produce by 100% cotton yarn but there are a few denim fabric blended with spandex and polyester.
- Manufactured by Twill weave
- Warp yarn dyed by indigo/blue eye
- Weft yarn remains white/grey as its natural colour
- Denim jeans are very strong and do not tear easily that's why it is long-lasting.
- Denim can be ironed at a high temperature
- Denim is very long-lasting fabric but after a certain period it becomes fade
- Denim is durable, drape and flexible in nature
- Denim is a woven fabric made by interlacing warp and weft yarn
- To control shrinkage, wrinkling commonly blended with spandex
- The blended denim fabric has a very good stretchability, comfortable wear for a slim figure
- **Use of Denim:** Jacket, jeans, shirts, skirts, swimsuit, belts, handbags.... (Ozdil, 2008).

2.2.4. CARE INSTRUCTION

- Wash less.
- Use delicate gentle cycle in machines.
- Use less detergent
- Use cold to lukewarm water.
- Use air dry (Loverin, 2006).

2.3. POPLIN FABRIC

2.3.1. INTRODUCTION

Poplin fabric is a plain weave fabric, which means it is woven in a simple over-under pattern (as opposed to the more complex, texture weaves used to make satin and twill). Poplin, sometimes called a tabinet fabric, has a tight weave, with very fine warp yarns and coarser weft yarns. Poplin can come from a wide variety of materials like cotton fabric and cotton blends, silk poplin, polyester poplin and polyester blends, and lycra stretch. Poplin is a plain weave cotton fabric with very fine horizontal “ribs” that results in a strong, crisp fabric with a silky, lustrous surface. It is commonly used in men’s and women’s shirts, women’s dresses, and items like sportswear and raincoats. Since poplin is such a commonplace, staple fabric, in a variety of clothing items that you can wear throughout the year. Both women’s and men’s shirts are made with poplin, as well as women’s dresses and skirts, and men’s pants and jackets. It’s a versatile fabric with a subtle sheen that adds beauty as well as drape to any piece of clothing (Thames and Hudson, 2007).

Poplin, also called **tabinet** (or **tabbinet**), is a fine (but thick) wool, cotton or silk fabric that has a vertical warp and a horizontal weft. Nowadays, the name refers to a strong material in a plain weave of any fibre or blend, with crosswise ribs that typically give a corded surface. Poplin traditionally consisted of a silk warp with a weft of worsted yarn.. In this case, as the weft is in the form of a stout cord, the fabric has a ridged structure, like rep, which gives depth and softness to the lustre of the silky surface. The ribs run across the fabric from selvedge to selvedge. Poplin is now made with wool, cotton, silk, rayon, polyester or a mixture of these. Since it has a plain under/over weave, the fabric displays a plain woven surface with no ribbing if the weft and warp threads are of the same material and size. Shirts made from this material are easy to iron and do not wrinkle easily. Poplins are used for dress purposes, and for rich upholstery work which are formed by using coarse filling-yarns in a plain/hard weave (Jhonson, 2013).

2.3.2. HISTORY

Poplin has always been incredibly popular. This is not surprising given that it’s soft to touch, durable and has a smooth, lustrous surface. Back in the 15th Century, poplin was used for winter attire, and was made using silk and wool. The actual word ‘poplin’ derives from

‘papelaine’, and is based on the (now obsolete) French papal town of Avignon. Poplin is characteristically strong, and when it was originally made it was a fabric that used a silk warp and wool weft to create its distinctive weave. Modern poplin is a weave usually made with cotton, creating a light material. Weft and warp threads are woven under and over to create a crisscross pattern and a textured surface. Poplin often features in our summer collections as it is a light weight but high quality fabric, which takes dye and retains bright colours and intricate prints easily, whilst remaining biodegradable. Poplin was the primary material used for British and US military uniforms during World War II. It not only kept soldiers cool in warm weather, but it was also tough enough to withstand harsh conditions (Jhonson, 2013).

2.3.3. PROPERTIES

1. **Durable:** Although sturdy, this material has a soft feel. This is why the fabric is a popular choice for summer clothing. It’s also water-resistant, which is a big advantage.
2. **Smooth:** Poplin’s distinctive smooth texture make it easy to wash time and again. The fabric holds its shape and doesn’t crease or stain. It’s often used for home ware items such as tableware, quilts and light upholstery.
3. **Tight weave fabric:** Poplin fabric is a plain weave material characterized by crosswise ribs. This means we weave it in a simple over-under pattern (contrary to the complex texture of weaves that are used for fabrics such as satin and twill). This gives the fabric its signature versatility and flowy texture.
4. **Lightweight:** Thanks to this tight weave, poplin is lightweight, which is why it’s a popular choice for summer garments, especially shirts for men and women. Because it’s thin, it can be a little transparent, so it often needs a lining or undergarment.
5. **Affordable:** Manufacturing poplin is relatively inexpensive, compared to other natural materials. Obviously, the more luxurious fabrics like silk poplin will cost more.
6. **Ideal for warm climates:** It’s crisp and lightweight and has a natural drape, and all those reasons make poplin perfect for summer wear. Clothing made from poplin is cool, breathable and dries quickly.

7. **Great for printing:** This fabric is made for printing on! In fact, it's known for printing and dyeing extremely well. Its versatility makes it a great choice for a number of clothing and interior design products (Alexander, 2007).

2.3.4. CARE INSTRUCTION

- Use enzyme based detergent.
- Use bleach –free detergent.
- Wash in machine with cold water.
- Drip drying is preferable to machine drying.
- Use steam to remove wrinkles.
- Use less heated iron (Nigel, 2011).

2.4. KHADI FABRIC

2.4.1. INTRODUCTION

Khadi, one of the most popular fabrics of India, is now a daily clothing choice for most Indians. Every year September 19 is celebrated as Khadi Day in India. Khadi has historical and philosophical importance in India. It was introduced by Mahatma Gandhi, the father of the nation. He started the swadeshi movement to promote khadi fabric to make India self-reliant and independent. Khadi played a vital role in the freedom struggle of India. And now, it is one of the solutions for the environmental crisis the world is facing today. Many people are opening up to adopting this eco-friendly and sustainable fabric. Many designers have taken the initiative to give khadi fabric a makeover and make it a popular choice again. Khadi, the simple, eco-friendly fabric worn by millions of Indians, symbolises patriotism (Wpily, 2019).

Khadi is hand-spun and handwoven fabric using a spinning wheel called *a charkha*. Khadi fabric is also known as Khaddar. The cloth is usually handwoven using cotton, silk, and wool. It is produced in various states of India, and all of them make a unique type of khadi fabric. Firstly, the fibre is converted into yarn using *charkha*. Yarn is then weaved into fibre using looms. There are various other steps, such as dyeing and strengthening.

Traditionally, **khadi fabric** is manufactured without using any natural resources or energy. But with time, the manufacturer has changed. All the processes can be mechanised (Lexico, 2020).

After independence, the Government of India established the Khadi and Village Industries Commission (KVIC), an organisation that plans, promotes, and facilitates the development of khadi. Large scale apparel manufacturers are collaborating with KVIC to produce new khadi lines. Aditya Birla Group launched a menswear brand named 'Khadi by Peter England'. Raymond launched a collection called 'Khadi, the Story Re-Spun'. Arvind Ltd is producing khadi denim. Many designers are embracing the khadi and giving it a makeover. Sabyasachi Mukherjee uses khadi in most of his bridal clothes and gives it a royal look. Ritu Kumar is also in love with khadi for its matte texture and ability to dye beautifully. Other designers like Payal Jain, Rohit Bal, Anju Modi, Raghuvendra Rathore, Abu Jani & Sandeep Khosla have crafted beautiful apparel with khadi fabric (Peter, 2015).

The versatile khadi fabric has the unique property of keeping the wearer warm in winter and cool in summer. It has a coarse texture and gets easily crumpled, and therefore, is stretched to keep it firm and stiff. On washing, it is more enhanced; the more you wash it, the better is the look. Khadi does not easily wear out with a shelf life of at least four to five years. Attractive designer apparel is made by doing handwork on khadi garments. It's high time the world starts looking at khadi fabric more pleasingly and adopting sustainable fashion. Khadi fabric can help save the environment while being chic. It also helps build employment for rural regions in India. Thus, the government's support and designers and consumers' mindfulness will help India generate more revenue with khadi production (Tehelka, 2013).

2.4.2. HISTORY

Khadi derived from **khaddar**, is a hand-spun and woven natural fibre cloth promoted by Mahatma Gandhi as *swadeshi* (self-sufficiency) for the freedom struggle of the Indian subcontinent, and the term is used throughout India, Pakistan and Bangladesh. The first piece of the hand-woven cloth was manufactured in the Sabarmati Ashram during 1917–18. The coarseness of the cloth led Gandhi to call it *khadi*. The cloth is made from cotton, but it may also include silk or wool, which are all spun into yarn on a *charkha*. After the First Indian War of Independence in 1857, domestic textile production by mill or traditional methods

declined to its lowest levels before khadi emerged as a "silent economic revolution" as an outcome of a long and laborious evolutionary process (Islam, 2016).

The American Civil War (1861–1865) caused raw cotton crisis in Cottonopolis Britain. Indian cotton at cheap prices was sourced for them as the textile industry did not exist in India, and hand spinning was a dying art. During Victorian era (1837–1901), 47 mills existed in the 1870s but Indians still bought clothes at an artificially inflated price, since the colonial government exported the raw materials for cloth to British fabric mills, then re-imported the finished cloth to India. In the Edwardian era (1901–1914) the Swadeshi movement of boycotting foreign cloth remained prominent. During the first two decades of the 20th century it was backed by nationalist politicians and Indian mill owners (Carolyn, 2003).

In 1922, Mahatma Gandhi requested the Indian National Congress (INC) to start a khadi department. In 1924, due to a large amount of work, a semi-independent body All India Khadi Board (AIKB) was formed which cooperate with the INC's khadi department at the provincial and district levels. In 1925, the All India Spinner Association (AISA) was formed comprising the khadi department and AIKB. Mahatma Gandhi was the founder of AISA. He made it obligatory for all members of the INC to spin cotton themselves and pay their dues in yarn. Gandhi collected large sums of money to create grassroots-level khadi institutions to encourage spinning and weaving which were certified by AISA. Hand spun yarn was expensive and of poor quality, and weavers preferred yarn produced by mills because it was more robust and consistent in quality (Taylor, 2007).

Gandhi argued that the mill owners would deny handloom weavers an opportunity to buy yarn because they would prefer to create a monopoly for their own cloth (Sangita, 2017). When some people complained about the costliness of khadi to Gandhi, he only wore dhoti, though he used wool shawls when it got cold. Some were able to make a reasonable living by using high-quality mill yarn and catering to the luxury market. Gandhi tried to put an end to this practice by threatening to give up khadi altogether, but since the weavers would have starved if they listened to him, they ignored the threat. In 1919, Gandhi started spinning at Mani Bhawan Mumbai and encouraging others to do so. He invented Patti Charkha, using a double-wheel design to increase speed and control while reducing size. In 1946, when huge funds were being spent on development for more productive charkhas, he recommended takli over charkha (Mark, 2016).

In 1948, India recognized the role of rural cottage industries in its Industrial Policy Resolution. In 1949, Shri Ekambernathan invented amber *charkha*. The All India Khadi & Village Industries Board (AIKVIB) was set up in January 1953 by the Government of India. In 1955 it was decided that a statutory body, the Khadi and Village Industries Commission (KVIC), should replace the Board and the KVIC Act was passed in 1956, which brought the KVIC into existence as a statutory organisation the following year (Geetanjali, 2010) . After Independence, the government reserved some types of textile production, such as towel manufacturing for the handloom sector, which resulted in a deskilling of traditional weavers and a boost for the power loom sector. Private sector enterprises have been able to make handloom weaving somewhat remunerative and the government also continues to promote the use of Khadi through various initiatives (Mohhamed, 2017). Prime Minister Narendra Modi during Khadi Utsav (27 Aug 2022), said "Khadi was ignored after Independence due to which weavers in the country suffered" and asserted that khadi is a movement to help the poor, and further claimed that the KVIC is a statutory organisation engaged in promoting and developing khadi and village industries (Abdul, 2021).

2.4.3. PROPERTIES

- It has a rugged texture, starch is applied to it to keep it firm and stiff.
- The fabric is durable, strong and doesn't easily wear out.
- It is sustainable, organic and natural.
- With every wash quality of the fabric enhances.
- It keep the body warm in winter and cool in summer (Shairwal, 2021).

2.4.4. CARE INSTRUCTION

- For longer life it is best to hand wash khadi garments.
- If required, machine washes on a gentle cycle with mild detergent.
- Line drying works best.
- Tie and dye and Block printing khadi fabrics should wash separately as They may bleed colours.
- Use a warm iron (Lisa, 2007).

2.5. CARE AND MAINTENANCE OF FABRIC

2.5.1. INTRODUCTION

We all know that the clothes we wear get dirty. They have to be washed, dried and ironed regularly for a neater appearance, personal cleanliness and their longer life. Not only should the fabrics be carefully selected, but they should be properly cared for throughout their life. All fabrics are not washed by the same method. For some fabrics hot water should be used, while others washed only in cold water. Some fabrics are dried in the sun, others in the shade. Some are hung on the clothes line, others are dried flat on the ground and so on. This means, for different types of fabrics, there are different methods of washing (Calvin, 2005).

Care instructions are small solutions to big problems. Care labels provide guidelines to consumers about apparel care, and the best cleaning procedures to be used for a particular combination of fabric, thread decoration and construction techniques. Following the instructions on the care labels is an assurance that the appearance and fit of the garment will be maintained after repeated cleaning treatments. From a manufacturer's point of view,

damage to garments from incorrect cleaning methods can lead to complaints; costly customer returns and a bad image. Whereas accurate and clearly written care labels can prevent customer's dissatisfaction. From a consumer's point of view, accurate and clearly written care instructions serve as a cleaning guide and influence purchase. Garments with ease of care are often preferred over garments with complicated or difficult to understand care procedures. Many different care labelling systems have evolved over the world. Some have been established as a governmental regulation, while others are international standards. Not all of them however, are mandatory (Joseph, 2003).

2.5.2. CARE LABEL SYSTEM

2.5.2.1. INTRODUCTION

Care label means a permanent label or tag, containing regular care information and instructions, that is attached or affixed in such a manner that it will not become separated from the product and will remain legible during the useful life of the product. Care instructions are small solutions to big problems. Care labels provide guidelines to consumers about apparel care, and the best cleaning procedures to be used for a particular combination of fabric, thread decoration and construction techniques. Following the instructions on the care labels is an assurance that the appearance and fit of the garment will be maintained after repeated cleaning treatments (MOORE, 2009).

2.5.2.2. CLASSIFICATION

There are five care labelling systems which are generally used on care labels. These systems are:

1.The International Care Labelling System- The International Association for Textile Care Labelling (GINETEX) is the world body which governs care labels since 1975.Member nations of GINETEX are Belgium, France, Germany, England, Netherlands, Israel, Austria, Switzerland, and Spain. Its objectives are to:

- Inform consumers on the correct care labelling of textiles through a system of uniform and simple care labelling symbols, independent of language

- Achieve and promote voluntary care labelling on an international basis through the uniform symbols of GINETEX, thus avoiding the use of different systems.

Five basic symbols are used in the International care labelling system in this order:



Figure-1

Note: The symbols for the International Care Labelling System are the same as those listed in the European Care Labelling System.

2.The Japanese Care Labelling System- The Japanese system, like other care labelling systems must have symbols placed in a specified order. Labels should be designed based on the following convention:

- Symbols should be arranged from left to right according to the following sequence: 1) Washing, 2) Bleaching, 3) Ironing, 4) Dry-Cleaning, 5) Wringing & 6) Drying
- For coloured products which are not usually bleached, the symbol for possibility of chlorine bleached may be omitted
- For products which are not usually ironed, the symbols for ironing may be omitted. (Except 'cannot be ironed'.
- For products which can be washed with water, the symbols for dry-cleaning may be omitted. (Except 'cannot be dry-cleaned')
- The symbols should be either in black or dark blue whereas the prohibition symbols are in red and on a white background.

3.The Canadian Care Labelling System- Until July 1973 care labelling was not a legal requirement in Canada. After this date a new care labelling system was introduced. The new Canadian care symbol system used green (go ahead), amber (caution), and red (don't try) with five symbols which were wash tub, bleach triangle, square dryer, iron, and dry cleaning

circle. In 2003 the Canadian system was updated to harmonise with the North American Free Trade Agreement (NAFTA) and (ISO) standards, and the colour code was discontinued.

4.The European Care Labelling System- Individual committees of the European Union are reviewing existing care label standards by collaborating with other international bodies so that they can create a unified system under the ISO scheme.

The symbols used in Europe are trademarked by GENETEX and a trademark fee needs to be paid to GENETEX, the trademark holder, if the garments are to be sold in a GENETEX country. A correct care label for European countries is required to consist of at least four and sometimes five symbols in the following sequence: 1) Washing, 2) Bleaching, 3) Ironing, 4) Dry-Cleaning & 5) Drying.

5.The American Care Labelling System- According to the Federal Trade Commission's Care Label rule, care labels may be composed of either words or symbols. Irrespective of whether the content is words, symbols, or both, care instructions appear in the following order:

- Machine wash / hand wash / dry-clean
- Washing temperature (hot / warm / cold)
- Washing machine programme (delicate / permanent press / normal cycle)
- Bleaching instruction (do not bleach / non-chlorine bleach / chlorine bleach)
- Drying method (tumble dry / line dry / flat dry / drip dry)
- Ironing (do not iron / cool iron / warm iron / hot iron) (Calvin, 2005).

METHODOLOGY

3. METHODOLOGY

The Methodology adopted for the experiment '**Analysis and Evaluation of effects of detergents on the selected fabrics**' is discussed under the following headings.

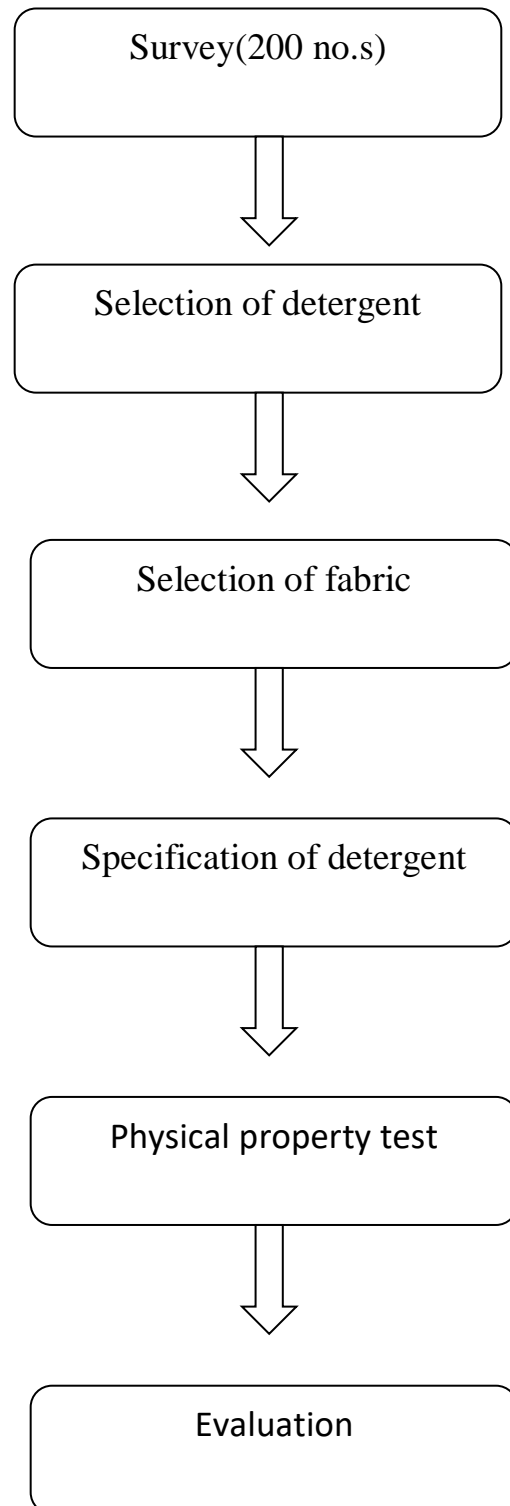


Figure-2

3.1. SURVEY

The steps involved for conducting the survey are as follows:

3.1.1. SELECTION OF SAMPLE FOR SURVEY

A survey was done among two hundred working and non-working women in the age group of (25-50) from Coimbatore. This age is more into the using and choosing detergents that work best for fabrics. They are intellect in selecting detergents for better performance (Dutta, 2013).

3.1.2. SELECTION OF TOOL

The survey was conducted in person. The questionnaire was formulated on the basis of usage of detergents and different types of detergents and different brands of detergents. The questionnaire displayed the details of using different form of detergents. It demonstrated the KAP form which consists of the Knowledge, Attitude, and Practice of detergents (Gupta, 2009). The questionnaire elicits information on the type of detergent, most used brand of detergent, quantity and frequency of detergent usage.

3.1.3. CONDUCT OF THE SURVEY

A good rapport was established with the subjects. Then the information was collected from the respondents with the help of the questionnaire and data was collected.

3.2. SELECTION OF DETERGENT

The data after collection had to be processed and analyzed in accordance to the most used type and brand of the detergent. Three detergents were selected on the basis of highest usage type and brand through the survey. The detergents are named as sample A, sample B, and sample C.

3.3. SELECTION OF FABRIC

Denim, Poplin and Khadi fabrics were selected to analysis the effects of detergents before and after washes. Denim, Poplin, and Khadi were selected as all three are derive from cotton and they are sustainable as well. As cotton fabric has good result in fabric test, denim, poplin and khadi also worked efficiently (Muler, 2013).

3.4. SPECIFICATION OF LAUNDRY DETERGENT

3.4.1. SCOPE

The standard prescribes requirement and methods of sampling and tests for laundry detergent powders for household use.

3.4.2. GRADE

The material shall be of the following three grades:

- Grade 1,
- Grade 2, and
- Grade 3

3.4.3. REQUIREMENT

3.4.3.1. DESCRIPTION

The material shall be in the form of a free flowing powder, free from unpleasant odour, and shall possess good lathering and cleaning properties. In addition to moisture, it may contain substances such as colouring matter, preservatives, powder conditioners, opacifiers and optical brightening agents.

3.4.3.2. ACTIVE INGREDIENT

The active ingredients used in the formulation of synthetic detergent powders shall comprise one or more of the surface active agents, namely, linear alkyl benzene sulphate, secondary alcohol sulphate, fatty alcohol sulphate, fatty alcohol ethoxylate sodium alpha sulpho fatty acid esters, alpha olefin sulphonate, sugar esters and other non-ionic detergents. If sodium alkyl benzene sulphonate is used as the active ingredient it shall be manufactured from alkyl benzene sulphonic acid conforming to IS 8401 for which linear alkyl benzene conforming to IS 12795 shall be the starting material.

3.4.3.3. FORMULATION

In addition to the active ingredients specified above, the formulation may contain one or more of conventional builders or additives. The synthetic detergent powders shall also be non injurious to the fabrics washed with it. The material shall pass the test when evaluated for

potential as per the method prescribed in IS 11601 and for skin sensitization potential when evaluated as per the method prescribed in IS11601 (Hanita, 2003).

3.4.A. DETERMINATION OF ACTIVE INGREDIENT BY CATION TITRATION

3.4.A.1. GENERAL

In the method prescribed the molecular mass of active matter has been taken as 342. In practice, the molecular mass of sodium alkyl benzene sulphonate varies from 337 to 347 depending on the molecular mass of alkyl benzene for sulphonication.

3.4.A.2. OUTLINE OF THE METHOD

A solution of ammoniac detergent with methylene blue IS shaken with chloroform, which dissolves the methylene blue salt of the detergent. The mixture is titrated with a cationic active agent which, after it has combined with all the free ammoniac detergent., begins to displace methylene blue from the salt. The end point IS taken when sufficient methylene blue has been displaced into the aqueous solution layer to produce phases of equal colour intensity. As the reaction is not stoichiometric it is essential to carry out standardization using a known anionic detergent similar in nature to the unknown.

3.4.A.3. APPARATUS USED

1. VOLUMETRIC FLASK- 1000 ml, 500 ml and 250 ml capacity,
2. STOPPERED GRADUATED CYLINDER- 100 ml capacity,
3. GRADUATED CYLINDER- 50 ml capacity,
4. BURETTE- 25 ml capacity,
5. PIPETTE- 10 ml capacity,
6. BEAKER- 250 ml capacity.

3.4.A.4. REAGENT USED

1. CHLOROFORM- chemically pure,
2. SULPHURIC ACID- 5 N,

3. STANDARD SULPHURIC ACID- 1.0 N,
4. SODIUM HYDROXIDE SOLUTION- 1.0 N,
5. SODIUM LAURYL SULPHATE SOLUTION- 0.004 M.

3.4.A.5. DETERMINATION OF PURITY OF SODIUM LAURYL SULPHATE

Weigh 1 mg of sodium lauryl sulphate into was weighed 250 ml round bottom flask with ground glass neck. Exactly 25 ml of standard sulphuric acid was added and reflux under water condense. During the first 5 to 10 mm, the solution will thicken and tend to foam strongly

This was controlled by removing the source of heat and swirling the content of the flask in order to avoid excessive foaming, instead of refluxing, the solution was left on a boiling water bath for 10 min. After the solution clarifies and foaming ceases, reflux for a further one and half hour. The source of heat was removed , cool the flask and carefully rinsed the condenser with 30 ml of ethanol followed by water. Few drops of phenolphthalein indicator solution was added and titrated with standard sodium hydroxide solution. A blank test was carried out by titrating 25 ml of standard sulphuric acid with standard sodium hydroxide solution.

Sodium lauryl sulphate content present by mass- $2884(V_1V_0)N/M_1$

Where,

V₀- Volume in ml of standard sodium hydroxide solution used for the blank,

V₁- Volume in ml of standard sodium hydroxide solution used for the sample,

N₁- Normality of standard sodium hydroxide solution,

M₁- Mass in gm of sodium lauryl sulphate taken for the test.

3.4.A.6. PROCEDURE

1mg, 1.14 to 1.16g of sodium lauryl sulphate was weighed and dissolved 200ml of water. Transfer to a ground glass stoppered 1 litre one mark volumetric flask and dilute to the mark with water. Calculate the molarity, m₁ of the solution by means of the formula.

$m_1 = M_2 * \text{sodium lauryl sulphate percent by mass} / 288.4 * 100$

where,

M₂- Mass in g of lauryl sulphate taken (Taylor, 2009).

3.4.B. PROCEDURE FOR DETERGENCY TEST

3.4.B.1. OUTLINE OF THE METHOD

The method prescribe here is based on the use of Terg-o-tometer Cloth is artificially soiled and the soil is removed by washing the soiled swatches of cloth with a solution of the detergent to be evaluated under standard conditions. The reflectance of the unsoiled, soiled and washed swatches is measured instrumentally using a standard photoelectric reflection meter. The detergency is expressed as percentage of soil removal.

3.4.B.2. APPARATUS USED

1. PHOTOELECTRIC REFLECTION METER,
2. TERG-O-TOMETER,
3. CLOTH SOILING MACHINE- Electrically operated mangle with variable pressure arrangements which can be recorded and variable speed drive with attached air drying chamber fitted with exhaust.

3.4.B.3. PREPARATION OF STANDARD SOILED CLOTH TEST SPECIMEN

Prepare soiled cloth swatches as per 6 of IS 5785.

3.4.B.4. WASHING PROCEDURE

The ratio of cloth (in g) to the volume of solution (in ml) shall be 1:100. 1 litre solution of 0.5 percent was prepared on as it is product basis in 300ppm water at which concentration the washing shall be carried out. Introduce 5 soiled swatches into beakers and agitate. The specimens for exactly 10mm at 27 degree Celcius was washed. The beaker from the water bath and decant the solution was removed and rinsed for 3 times in 300ppm water. Repeated with 5 more wash loads of 5 swatches each for each formulation. A total of six replicate washings is given so that at the end all the formulations are washed in all beakers. Keep all for drying and measure the reflectance of washed swatches.

3.4.B.5. EVALUATION OF SOIL REMOVAL

Fold the desized unsoiled cloth, soiled swatches and washed swatches into four folds so as to minimize the effect of colour of background and take reflectance measurements. Operate the reflectometer in accordance with the instruction supplied with the instrument.

3.4.B.6. CALCULATION AND REPORTING

The detergency value expressed as percentage soil removed is calculated from the following equation,

$$\text{Percentage of soil removal} = W_0/S_0 * 100$$

Where,

$$W_0 = (100 - R_w)^2 / 200R_w - (100 - R_s)^2 / 200R_s$$

$$S_0 = (100 - R_c)^2 / 200R_c - (100 - R_s)^2 / 200R_s$$

R_c - Reflectance of clean,

R_w - Washed fabric,

R_s – Soiled fabric pieces respectively (Jones, 2007).

3.5. PHYSICAL PROPERTY TEST

3.5.1. FABRIC WEIGHT

Fabric weight is the weight per square meter of the fabric. It may be expressed as grams per square meter. Fabric weight is the relative weight of the fabric. Electronic weighing balance was used to determine the fabric weight directly. The samples for weighing were cut using a GSM cutter (Saini, 2004). Three readings were observed and the mean weight was calculated and recorded.

3.5.2. FABRIC THICKNESS

The thickness of a textile material is the distance between the two plane parallel as the pressure foot and the other as the anvil (Jewel, 2005). Thickness is measured to an accuracy of at least 0.01mm under the prescribed pressure ranging from 0.05 psi depending on the type of fabric under test (Stocker, 2005). The Hungarian thickness tester was used to measure

the thickness. The tester was operated by hand. It has a broad anvil upon which a pressure foot is pressed by a spring. The dial has calibrations that indicate the thickness of the fabric in thousands of an inch between the anvil and the pressure foot. Each division of the dial reads 0.01mm. The fabric to be tested is placed on the anvil and the pressure foot is lowered onto it without excess pressure. The reading pointed in the dial was recorded. The readings were taken at three times on the same fabric as recorded.

3.5.3. WET AND DRY CROCKING

The colour fastness of a degree fabric is assessed by the samples of colour from dyed fabric to another piece of undyed fabric while the fabric is used. Crockmeter is used to test the fastness of dyed fabric under wet and dry conditions during rubbing it. Consist of two metal blocks, the box blocks it stationary while the upper blocks has an arrangement to move to and fro the base by means of rotating handle for 30-50 times. The colour transfer from the dyed fabric to the material that was assessed with AATCC greyscale for sustaining the procedure is following to to read the colour fastness of the dyed material to dry and wet crocking carefully (Williams, 2001).

3.6. EVALUATION

Statistical is the science of collecting, analyzing and making inference from data. Statistical methods and analyses are often used to communicate research findings and to support hypotheses and give creditability to research methodology and conclusion. The most common summary statistic for determining the central position of distribution is arithmetic mean, often simply called the average and the most common summary statistics for determining the dispersion of a distribution is the standard deviation. The arithmetic mean and the standard deviation can be thought of as the average distance of the observations from the arithmetic mean. The arithmetic mean and the standard deviation can be seen as sibling measures for describing a distribution (Kohler, 2005).

RESULT AND DISCUSSION

4. RESULT AND DISCUSSION

The results of the present investigation titled “Analysis and evaluation of effects of detergents after wash” are presented and discussed under the following headings:

1. Pre fabric test of the selected fabrics before wash.
2. Post fabric test of the selected fabrics after five washes.
3. Post fabric test of the selected fabrics after ten washes.
4. Comparison between before and after tests of the fabric.

4.1. FABRIC WEIGHT TEST OF DENIM

4.1.1. PRE –ANALYSIS

TABLE I
PRE-ANALYSIS OF FABRIC WEIGHT OF DENIM

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 3.590*100=359 |
| 2. | 3.600*100=360 |
| 3. | 3.590*100=359 |
| AVERAGE | =359 GSM |

4.1.2. POST- ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE II
POST-ANALYSIS OF FABRIC WEIGHT OF DENIM

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 3.620*100=362 |
| 2. | 3.610*100=361 |
| 3. | 3.590*100=359 |
| AVERAGE | =360 GSM |

From table I and table II, the pre analysis of fabric weight to the post analysis after five washes with sample A, of denim ,it has increased by 1 GSM.

- **SAMPLE B**

TABLE III
POST-ANALYSIS OF FABRIC WEIGHT OF DENIM

| S.No. | Fabric weight(GSM) |
|----------------|----------------------|
| 1. | 3.540*100=354 |
| 2. | 3.550*100=355 |
| 3. | 3.540*100=354 |
| AVERAGE | =354 GSM |

From table I and table III the pre analysis of fabric weight to the post analysis after five washes with sample B, it has decreased by 5 GSM.

- **SAMPLE C**

TABLE IV
POST-ANALYSIS OF FABRIC WEIGHT OF DENIM

| S.No. | Fabric weight(GSM) |
|----------------|----------------------|
| 1. | 3.520*!00=352 |
| 2. | 3.520*100=352 |
| 3. | 3.500*100=350 |
| AVERAGE | =351 GSM |

From pre analysis of fabric weight to the post analysis after five washes with sample C , it has increased by 8 GSM.

4.1.3. POST- ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE V
POST-ANALYSIS OF DENIM

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 3.630*100=363 |
| 2. | 3.640*100=364 |
| 3. | 3.630*100=363 |
| AVERAGE | =363 GSM |

From pre analysis of fabric weight to the post analysis after ten washes with sample A, it has increased by 4 GSM and comparison between post analysis of denim fabric after five washes and ten washes has increased by 3 GSM.

- **SAMPLE B**

TABLE VI
POST-ANALYSIS OF DENIM

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 3.560*100=356 |
| 2. | 3.550*100=355 |
| 3. | 3.550*!00=355 |
| AVERAGE | =355 GSM |

From pre analysis of fabric weight to the post analysis with sample B ,it has decreased by 4 GSM and comparison between post analysis of denim fabric after five washes and ten washes has increased by 1 GSM.

- **SAMPLE C**

**TABLE VII
POST-ANALYSIS OF DENIM**

| S.No. | Fabric weight(GSM) |
|-------------------------|----------------------|
| 1. | 3.520*100=352 |
| 2. | 3.530*100=353 |
| 3. | 3.520*100=352 |
| AVERAGE =352 GSM | |

From pre analysis weight to the post analysis with sample C, it has decreased by 7 GSM and comparison between post analysis of denim fabric after five washes and ten washes has increased by 1 GSM.

TABLE VIII

T-VALUE FOR PRE-AND POST-ANALYSIS OF DENIM

| S.No. | Pre/post | Mean | Loss/Gain | Percentage | t-value |
|-----------|----------|---------------|---------------|--------------|-----------------------------|
| 1. | O | 3.5933 | | | |
| 2. | W | 3.633 | 0.0397 | 1.104 | -896.367^S |

The t- value is less than 0.05, so the result is significant.

4.2. FABRIC WEIGHT TEST OF POPLIN

4.2.1. PRE-ANALYSIS

TABLE IX
FABRIC WEIGHT OF POPLIN

| S.No. | Fabric weight(GSM) |
|----------------|--------------------|
| 1. | $1.020*100=102$ |
| 2. | $1.010*100=101$ |
| 3. | $1.020*100=102$ |
| AVERAGE | =101 GSM |

4.2.2. POST- ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE X
FABRIC WEIGHT OF POPLIN

| S.No. | Fabric weight(GSM) |
|----------------|--------------------|
| 1. | $1.030*100=103$ |
| 2. | $1.030*100=103$ |
| 3. | $1.030*100=103$ |
| AVERAGE | =103 GSM |

From pre analysis of fabric weight to the post analysis with sample A, it has increased by 2 GSM.

- **SAMPLE B**

TABLE XI

FABRIC WEIGHT OF POPLIN

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 0.980*100=98 |
| 2. | 0.990*100=99 |
| 3. | 0.980*100=98 |
| AVERAGE | =98 GSM |

From pre analysis weight to the post analysis with sample B, it has decreased by 3 GSM

- **SAMPLE C**

TABLE XII

FABRIC WEIGHT OF POPLIN

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.10*100=110 |
| 2. | 1.00*100=100 |
| 3. | 1.10*100=110 |
| AVERAGE | =100 GSM |

From pre analysis weight to the post analysis with sample C, it has decreased by 1 GSM.

4.2.3. POST- ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

FABRIC WEIGHT OF POPLIN

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.040*100=104 |
| 2. | 1.050*100=105 |
| 3. | 1.050*100=105 |
| AVERAGE | =105 GSM |

From pre analysis weight to the post analysis weight with sample A, it has increased by 4 GSM and comparison between post analysis of poplin fabric after five washes and ten washes has increased by 2 GSM.

- **SAMPLE B**

TABLE XIV
FABRIC WEIGHT OF POPLIN

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 0.990*100=99 |
| 2. | 0.990*100=99 |
| 3. | 1.00*100=100 |
| AVERAGE | =99 GSM |

From pre analysis weight to the post analysis weight with sample B, it has decreased by 2 GSM and comparison between post analysis of poplin fabric after five washes and ten washes has increased by 1 GSM.

- **SAMPLE C**

TABLE XV
FABRIC WEIGHT OF POPLIN

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.020*100=102 |
| 2. | 1.020*100=102 |
| 3. | 1.010*100=101 |
| AVERAGE | =102 GSM |

From pre analysis weight to the post analysis weight with sample C it has increased by 1 GSM and comparison between post analysis of poplin fabric after five washes with sample C and ten washes with sample C has increased by 2 GSM.

TABLE XVI
T-VALUE FOR PRE-AND POST-ANANLYSIS OF POPLIN

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|--------------|-----------------|--------------|------------------|-------------------|--|
| 1. | O | 1.016 | | | |
| 2. | W | 1.046 | 0.03 | 2.952 | - 298.953^S |

The result is significant as the value is less than 0.05.

4.3. FABRIC WEIGHT TEST OF KHADI

4.3.1. PRE-ANALYSIS

TABLE XVII
FABRIC WEIGHT OF KHADI

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.490*100=149 |
| 2. | 1.450*100=145 |
| 3. | 1.460*100=146 |
| AVERAGE | =146 GSM |

4.3.2. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE XVIII
FABRIC WEIGHT OF KHADI

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.510*100=151 |
| 2. | 1.520*100=152 |
| 3. | 1.510*100=151 |
| AVERAGE | =151 GSM |

The comparison between pre-analysis of weight of the khadi fabric and the post- analysis of weight o the f khadi fabric after five washes with sample A has increased by 5 GSM.

- **SAMPLE B**

TABLE XIX
FABRIC WEIGHT OF KHADI

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.505*100=150.5 |
| 2. | 1.510*100=151 |
| 3. | 1.505*100=150.5 |
| AVERAGE | =150.5 GSM |

The comparison between pre-analysis of weight of the khadi fabric and the post-analysis of weight of the khadi fabric after five washes with sample B has increased by 4.5 GSM.

- **SAMPLE C**

TABLE XX
FABRIC WEIGHT OF KHADI

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.510*100=151 |
| 2. | 1.500*100=150 |
| 3. | 1.500*100=150 |
| AVERAGE | =150 GSM |

The comparison between pre-analysis of weight of the khadi fabric and the post-analysis of weight of the khadi fabric after five washes with sample C has increased by 4 GSM.

4.3.3. POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE XXI
FABRIC WEIGHT OF KHADI

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.530*100=153 |
| 2. | 1.530*100=153 |
| 3. | 1.530*100=153 |
| AVERAGE | =153 GSM |

The comparison between pre-analysis of weight of the khadi fabric and post-analysis of weight of khadi fabric after ten washes with sample A has increased by 7 GSM. If compare between post- analysis of weight of the khadi fabric after five washes with sample A and post-analysis of weight of the khadi fabric after ten washes with sample A, it has increased by 2 GSM.

- **SAMPLE B**

TABLE XX11
FABRIC WEIGHT OF KHADI

| S.No. | Fabric weight(GSM) |
|----------------|---------------------------|
| 1. | 1.500*100=150 |
| 2. | 1.500*100=150 |
| 3. | 1.500*100=150 |
| AVERAGE | =150 GSM |

The comparison between pre-analysis of weight of the khadi fabric and post-analysis of weight of the khadi fabric after ten washes with sample B has increased by 4 GSM. If compare between post-analysis of weight of the khadi fabric after five washes with sample B and post- analysis of weight of the khadi fabric after ten washes with sample B, it has decreased by 0.5 GSM.

- **SAMPLE C**

TABLE XXIII

| S.No. | Fabric weight(GSM |
|----------------|--------------------------|
| 1. | 1.520*100=152 |
| 2. | 1.530*100=153 |
| 3. | 1.540*100=154 |
| AVERAGE | =153 GSM |

The comparison between pre- analysis of weight of the khadi fabric and the post –analysis of weight of the khadi fabric after ten washes with sample C is 7 GSM. The differentiate between weight of the khadi fabric after five washes with sample C and the weight of the khadi fabric after ten washes with sample C is 3 GSM.

The difference between the three fabrics that are denim, poplin and khadi , the heaviest fabric is denim, khadi is the second heaviest fabric and the poplin is the lightest fabric. If we compare weight gain after washes than denim gained the most weight . If we compare with sample A, sample B, and sample C than sample A increases the weight of the fabric whereas sample B and sample C decreases the fabrics weight.

TABLE XXIV
T-VALUE FOR PRE-AND POST-ANALYSIS OF KHADI

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|-------|----------|-------|-----------|------------|----------------|
| 1. | O | 1.466 | 0.064 | 4.3656 | 0 ^s |
| 2. | W | 1.53 | | | |

Hence, the t- value is significant.

4.4 FABRIC THICKNESS TEST OF DENIM

4.4.1. PRE-ANALYSIS

TABLE XXV
THE THICKNESS OF DENIM

| S.No. | Fabric thickness(mm) |
|-------|----------------------|
| 1. | 0.65 |
| 2. | 0.66 |
| 3. | 0.66 |

AVERAGE =0.66 mm

4.4.2. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE XXVI

| S.No. | Fabric thickness(mm) |
|-------|----------------------|
| 1. | 0.71 |
| 2. | 0.70 |
| 3. | 0.70 |

AVERAGE =0.70 mm

The thickness has increased by 0.04 mm when compare between the pre-analysis and post-analysis after five washes with sample A.

- **SAMPLE B**

TABLE XXVII

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.69 |
| 2. | 0.69 |
| 3. | 0.68 |
| AVERAGE | =0.69 mm |

The thickness has increased by 0.03mm when compare between the pre-analysis and post-analysis after five washes with sample B.

- **SAMPLE C**

TABLE XXVIII

THE THICKNESS OF DENIM

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.68 |
| 2. | 0.69\ |
| 3. | 0.71 |
| AVERAGE | =0.69 mm |

The thickness has increased by 0.03mm when compare between the pre-analysis and post-analysis after five washes with sample C.

4.4.3. POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE XXIX
THE THICKNESS OF DENIM

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.75 |
| 2. | 0.74 |
| 3. | 0.75 |
| AVERAGE | =0.75 mm |

The thickness has increased by 0.09mm when compared with pre-analysis and post-analysis after ten washes with sample A. The thickness 0.05mm has increased when compared between post –analysis after five washes with sample A and post-analysis after ten washes with sample A.

- **SAMPLE B**

TABLE XXX
THE THICKNESS OF DENIM

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.72 |
| 2. | 0.72 |
| 3. | 0.72 |
| AVERAGE | =0.72 mm |

The thickness has increased by 0.06mm when compared with pre-analysis and post-analysis after ten washes with sample B. The thickness 0.03mm has increased when compared between post-analysis after five washes with sample B and post-analysis after ten washes with sample B.

- **SAMPLE C**

TABLE XXXI
THE THICKNESS OF DENIM

| S.No. | Fabric thickness(mm) |
|----------------|----------------------|
| 1. | 0.70 |
| 2. | 0.70 |
| 3. | 0.70 |
| AVERAGE | =0.70 mm |

The thickness has increased by 0.04 mm when compared with pre-analysis and post-analysis after ten washes with sample C. The thickness 0.01mm has increased when compared between post-analysis after five washes with sample C and post-analysis after ten washes with sample B.

TABLE XXXII
T-VALUE FOR PRE-AND POST-ANALYSIS OF DENIM

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|-------|----------|---------|-----------|------------|-----------------------|
| 1. | O | 0.6566 | 0.09 | 13.7069 | -299.253 ^S |
| 2. | W | 0.74667 | | | |

The t-value is significant.

4.5. FABRIC THICKNESS TEST OF POPLIN

4.5.1. PRE-ANALYSIS

TABLE XXXIII
THE THICKNESS OF POPLIN

| S.No. | Fabric thickness(mm) |
|----------------|----------------------|
| 1. | 0.21 |
| 2. | 0.20 |
| 3. | 0.21 |
| AVERAGE | =0.21 mm |

4.5.2. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE XXXIV
THE THICKNESS OF POPLIN

| S.No. | Fabric thickness(mm) |
|----------------|----------------------|
| 1. | 0.24 |
| 2. | 0.25 |
| 3. | 0.25 |
| AVERAGE | =0.25 mm |

The thickness has increased by 0.04mm when compared with pre-analysis and post-analysis after five washes with sample A.

- **SAMPLE B**

TABLE XXXV
THE THICKNESS OF POPLIN

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.25 |
| 2. | 0.25 |
| 3. | 0.25 |
| AVERAGE | =0.25 mm |

The thickness has increased by 0.04mm when compared with pre-analysis and post-analysis after five washes with sample B.

- **SAMPLE C**

TABLE XXXVI
THE THICKNESS OF POPLIN

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.24 |
| 2. | 0.25 |
| 3. | 0.24 |
| AVERAGE | =0.24 mm |

The thickness has increased by 0.03mm when compared with pre-analysis and post- analysis after five washes with sample C.

4.5.3.POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

**TABLE XXXVII
THE THICKNESS OF POPLIN**

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.26 |
| 2. | 0.27 |
| 3. | 0.27 |
| AVERAGE | =0.27 mm |

The thickness has increased by 0.06mm when compared with pre-analysis and post-analysis after ten washes with sample A. It has increased by 0.02mm between the post-analysis with five and ten washes with sample A.

- **SAMPLE B**

TABLE XXXVIII
THE THICKNESS OF POPLIN

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.26 |
| 2. | 0.26 |
| 3. | 0.26 |
| Average | =0.26 mm |

The thickness has increased by 0.05mm when compared between pre and post-analysis after ten washes with sample B. It has increased by 0.01mm between the post-analysis with five and ten washes with sample B.

- **SAMPLE C**

TABLE XXXIX
THE THICKNESS OF POPLIN

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.26 |
| 2. | 0.25 |
| 3. | 0.25 |
| AVERAGE | =0.25 mm |

The thickness has increased by 0.04mm when compared with pre and post-analysis after ten washes with sample C. It has increased by 0.01mm with the post-analysis between five and ten washes with sample C.

TABLE XL
T-VALUE FOR PRE-AND POST ANALYSIS OFF KHADI

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|-------|----------|---------|-----------|------------|-----------------------|
| 1. | O | 0.2066 | 0.06 | 29.0416 | -149.733 ^S |
| 2. | V | 0.26667 | | | |

The t-value is significant.

4.6. FABRIC THICKNESS TEST OF KHADI

4.6.1. PRE-ANALYSIS

TABLE XLI
THE THICKNESS OF KHADI

| S.No. | Fabric thickness(mm) |
|-------|----------------------|
| 1. | 0.28 |
| 2. | 0.27 |
| 3. | 0.27 |

AVERAGE =0.27 mm

4.6.2. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE XLII
THE THICKNESS OF KHADI

| S.No. | Fabric thickness(mm) |
|-------|----------------------|
| 1. | 0.28 |
| 2. | 0.27 |
| 3. | 0.28 |

AVERAGE =0.28 mm

The thickness has increased by 0.01mm from pre-and post-analysis.

- **SAMPLE B**

TABLE XLIII
THE THICKNESS OF KHADI

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.26 |
| 2. | 0.26 |
| 3. | 0.26 |
| AVERAGE | =0.26 mm |

The thickness has decreased by 0.01mm from pre-and post-analysis.

- **SAMPLE C**

TABLE XLIV
THE THICKNESS OF KHADI

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.25 |
| 2. | 0.26 |
| 3. | 0.26 |
| AVERAGE | =0.26 mm |

The thickness has decreased by 0.01mm from pre-and post-analysis.

4.6.3.POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE XLV
THE THICKNESS OF KHADI

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.30 |
| 2. | 0.30 |
| 3. | 0.30 |
| AVERAGE | =0.30 mm |

The thickness is increased by 0.03mm when compared between the pre and post analysis after ten washes. The thickness is increased by 0.02mm when compared between post-analysis between five washes and ten washes with sample A.

- **SAMPLE B**

TABLE XLVI
THE THICKNESS OF KHADI

| S.No. | Fabric thickness(mm) |
|----------------|-----------------------------|
| 1. | 0.26 |
| 2. | 0.26 |
| 3. | 0.26 |
| AVERAGE | =0.26 mm |

The thickness is decreased by 0.01mm when compared between pre-and post analysis. The thickness is equal when compared with table pre and post analysis after five washes and ten washes.

- **SAMPLE C**

**TABLE XLVII
THE THICKNESS OF KHADI**

| S.No. | Fabric thickness(mm) |
|----------------|----------------------|
| 1. | 0.26 |
| 2. | 0.26 |
| 3. | 0.26 |
| AVERAGE | =0.26 mm |

The thickness is decreased by 0.01mm when compared between pre and post analysis after ten washes. The thickness is equal when compared post analysis after five washes and ten washes.

Hence, we can conclude that the thickest fabric is denim , khadi is second thickest fabric and the thinnest fabric is poplin. If we compare pre- analysis and post-analysis after washes denim gained slight thickness while khadi and poplin gained less thickness. When we compare the sample A, sample B and sample C, sample A increases the thickness of the fabrics whereas sample B and sample C decreases or equify the thickness of the fabrics.

TABLE XLVIII
T-VALUE FOR PRE-AND POST-ANALYSIS OF KHADI

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|-------|----------|--------|-----------|------------|----------------|
| 1. | O | 0.2733 | 0.0267 | 9.7694 | 0 ^s |
| 2. | W | 0.3 | | | |

Hence, the t-value is significant.

4.7. DRY CROCKING TEST FOR DENIM

4.7.1. PRE-ANALYSIS

TABLE XLIX
DRY CROCKING TEST FOR DENIM

| S.No | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

The fabric is compared with grey scale and it has very good colour fastness.

4.7.2. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE L
DRY CROCKING TEST FOR DENIM

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

- **SAMPLE B**

TABLE LI
DRY CROCKING TEST FOR DENIM

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

- **SAMPLE C**

TABLE LII
DRY CROCKING TEST FOR DENIM

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3 (VERY GOOD)

4.7.3. POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE LIII
DRY CROCKING TEST FOR DENIM

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

- **SAMPLE B**

TABLE LIV
DRY CROCKING TEST FOR DENIM

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

- **SAMPLE C**

TABLE LV
DRY CROCKING TEST FOR DENIM

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

Hence denim fabric has very good colour fastness to dry crocking

TABLE LVI

T-VALUE FOR PRE AND POST ANALYSIS OF DENIM

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|--------------|-----------------|-------------|------------------|-------------------|----------------------|
| 1. | O | 3 | | | |
| 2. | W | 3 | 0 | 0 | 0^S |

The value of the table VII is significant.

4.8.DRY CROCKING TEST FOR POPLIN

4.7.4. PRE-ANALYSIS

TABLE LVII

DRY-CROCKING FOR POPLIN

| S.No. | GRADE |
|--------------|--------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE

=3 (VERY GOOD)

It has very good colour fastness when compared with grey scale.

4.7.5. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE LVIII
DRY-CROCKING FOR POPLIN

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

- **SAMPLE B**

TABLE LIX
DRY-CROCKING FOR POPLIN

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3 (VERY GOOD)

- **SAMPLE C**

TABLE LX
DRY-CROCKING FOR POPLIN

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3 (VERY GOOD)

4.7.3.POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE LXI
DRY-CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|-----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3 (VERY GOOD) |

- **SAMPLE B**

TABLE LXII
DRY-CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

- **SAMPLE C**

TABLE LXIII
DRY-CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|--------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3 |

TABLE LXIV
T-VALUE FOR PRE-AND POST ANALYSIS FOR POPLIN

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|-------|----------|------|-----------|------------|----------------|
| 1. | O | 3 | 0 | 0 | 0 ^s |
| 2. | W | 3 | | | |

Hence, the t-value is significant.

4.8. DRY CROCKING TEST FOR KHADI

4.8.1. PRE-ANALYSIS

TABLE LXV
DRY CROCKING FOR KHADI

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

4.8.2. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE LXVI
DRY CROCKING FOR KHADI

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

The value is equal for table 57 and table 58.

- **SAMPLE B**

**TABLE LXVII
DRY CROCKING FOR KHADI**

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

- **SAMPLE C**

**TABLE LXVIII
DRY CROCKING FOR KHADI**

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

4.8.3. POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

**TABLE LXIX
DRY CROCKING FOR KHADI**

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

- **SAMPLE B**

TABLE LXX
DRY CRCOKING FOR KHADI

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

- **SAMPLE C**

TABLE LXXI
DRY CROCKING FOR KHADI

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

TABLE LXXII
T-VALUE FOR PRE AND POST ANALYSIS OF KHADI

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|-------|----------|------|-----------|------------|----------------|
| 1. | O | 3 | 0 | 0 | 0 ^s |
| 2. | W | 3 | | | |

Hence, the table LXXII is significant.

4.10.WET CROCKING FOR DENIM

4.10.1.PRE-ANALYSIS

**TABLE LXXIII
WET CROCKING FOR DENIM**

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

4.10.2.POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

**TABLE LXXIV
WET CROCKING FOR DENIM**

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

- **SAMPLE B**

**TABLE LXXV
WET CROCKING FOR DENIM**

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

- **SAMPLE C**

**TABLE LXXVI
WET CROCKING FOR DENIM**

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

4.10.3. POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

**TABLE LXXVII
WET CROCKING FOR DENIM**

| S.No. | GRADE |
|-------|-------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |

AVERAGE =2(GOOD)

- **SAMPLE B**

**TABLE LXXVIII
WET CROCKING FOR DENIM**

| S.No. | GRADE |
|-------|-------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |

AVERAGE =2(GOOD)

- **SAMPLE C**

**TABLE LXXIX
WET CROCKING FOR DENIM**

| S.No. | GRADE |
|-------|-------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |

AVERAGE =2(GOOD)

**TABLE LXXX
T-VALUE FOR PRE AND POST ANALYSIS OF DENIM**

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|-------|----------|------|-----------|------------|----------------|
| 1. | O | 3 | 1 | 33.33 | 0 ^s |
| 2. | W | 2 | | | |

Hence, the t value is significant

4.11 WET CROCKING TEST FOR POPLIN

4.11.1 PRE-ANALYSIS

TABLE LXXI
WET CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

4.11.2. POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE LXXXII
WET CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

- **SAMPLE B**

TABLE LXXXIII
WET CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

- **SAMPLE C**

TABLE LXXXIV
WET CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

4.11.3. POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE LXXXV
WET CROCKING FOR POPLIN

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

- **SAMPLE B**

**TABLE LXXXVI
WET CROCKING FOR POPLIN**

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

- **SAMPLE C**

**TABLE LXXXVII
WET CROCKING FOR POPLIN**

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

**TABLE LXXXVIII
T VALUE FOR PRE AND POST ANALYSIS FOR POPLIN**

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|--------------|-----------------|-------------|------------------|-------------------|----------------------|
| 1. | O | 3 | 1 | 33.33 | 0^S |
| 2. | W | 2 | | | |

The t-value for the table LXXXVIII is significant.

4.9. WET CROCKING TEST FOR KHADI

4.12.1.PRE-ANALYSIS

TABLE LXXXIX
WET CROCKING FOR KHADI

| S.No. | GRADE |
|----------------|-----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

4.12.2.POST-ANALYSIS AFTER FIVE WASHES

- **SAMPLE A**

TABLE XC
WET CROCKING FOR KHADI

| S.No. | GRADE |
|----------------|----------------------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |
| AVERAGE | =3(VERY GOOD) |

- **SAMPLE B**

TABLE XCI
WET CROCKING FOR KHADI

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

- **SAMPLE C**

TABLE XCII
WET CROCKING FOR KHADI

| S.No. | GRADE |
|-------|-------|
| 1. | 3 |
| 2. | 3 |
| 3. | 3 |

AVERAGE =3(VERY GOOD)

4.12.3. POST-ANALYSIS AFTER TEN WASHES

- **SAMPLE A**

TABLE XCIII
WET CROCKING FOR KHADI

| S.No. | GRADE |
|-------|-------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |

AVERAGE =2(VERY GOOD)

- **SAMPLE B**

**TABLE XCIV
WET CROCKING FOR KHADI**

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

- **SAMPLE C**

**TABLE XCV
WET CROCKING FOR KHADI**

| S.No. | GRADE |
|----------------|-----------------|
| 1. | 2 |
| 2. | 2 |
| 3. | 2 |
| AVERAGE | =2(GOOD) |

The test shows that denim has good colour fastness to wet crocking as compared to poplin and khadi. Whereas sample A, sample B, and sample C gave very slight difference to the fabrics after wash.

TABLE XCVI
T VALUE FOR PRE AND POST ANALYSIS FOR KHADI

| S.No. | Pre/Post | Mean | Loss/Gain | Percentage | t-value |
|--------------|-----------------|-------------|------------------|-------------------|----------------------|
| 1. | O | 3 | 1 | 33.33 | 0^s |
| 2. | W | 2 | | | |

The table XCVI has significant t-value.

SUMMARY AND CONCLUSION

5. SUMMARY AND CONCLUSION

The textile industries are growing fast day by day and today the textile sector is the second largest provider of employment after agriculture. The textiles industry has an overwhelming presence in the economic life of the country. As consumer buys more textile materials, it needs to be care properly using care label system that are provide by the manufacturers for particular material. It is the responsibility of the suppliers to convey with the consumer by showing them proper guidelines of the fabric. The details of the fabric care is given in the form of tag as written as well as symbols, so that it can be easily understand by the consumers. Care labels depicts how to clean ,for example, hand wash or machine wash , quantity of detergents to be use, ironing instructions ,etc. It is very much necessary to follow the care instructions to keep the fabric good for long time.

Detergents are a class of surfactants with cleaning properties when diluted in water. Most detergents are alkyl benzene sulphonates. Detergents are classified according to the electrical charge they carry as anionic ,cationic, or non-ionic .Synthetic detergents were developed in Germany in World War 1 with alkyl sulphate as surfactant. The word “ detergent” comes from the Latin word “detergere”, which means “to wipe away .”Detergents are better cleansing because they do not form insoluble calcium and magnesium salt in hard water. The polar end of a detergent molecule is water soluble, whereas the hydrocarbon part is water repellent and oil soluble . When an oily piece of cloth is dipped into a detergent solution , the detergent’s hydrocarbon end bonds to the oily drop and the polar end orients itself towards the water , resulting in the production of a micelle. The oily dirt is entrapped by the negatively charged micelle that has formed. The ions in the solution arrange themselves around the micelles .The negatively charged micelles repel each other due to the electrostatic repulsion . As a result, the tiny oily dirt particles do not come together and get washed away in the water.

Detergents can be used even in hard water. It can be even used in an acidic medium as they are the salts of strong acids and are not decomposed in an acidic medium . Detergents have a stronger cleansing action and are more soluble in water . Detergents may be in many forms , for example , powder , liquid , pods and tablets that comes in a range of variants to meet consumers needs on cleaning, fabric care and fragrances. However, liquid detergents dissolve more easily in water as compared than powder detergents. Liquid detergent contains alcohol ,ethoxylates among their ingredients , which are effective in challenging oily

stains . Liquid detergents are used in lesser amount as compared to powder detergents. Unlike powder detergents , liquid detergents comes in a plastic bottle which can be easily recycled.

Denim is a sturdy cotton warp-faced material in which the weft passes under two or more warp threads. This twill weaving produces a diagonal ribbing that distinguishes it from cotton. Denim is available in a range of colours, but the most common denim is indigo in which the warp thread is dyed while the weft thread is left white. As a result of the warp-faced twill weaving, one side of the textile is dominated by the blue warp threads and the other side is dominated by the white weft threads. Denim is used to create a wide variety of garments, accessories, and footwear.

Poplin is a plain weave cotton fabric with very fine horizontal ribs that results in a strong, crisp fabric with a silky, lustrous surface. Though poplin is sometimes conflated with twill, poplin and twill are not woven in the same way. While twill is also a plain weave fabric, poplin is woven with a fine warp yarn and thicker weft yarn. While both are strong materials, poplin is often softer than twill. Poplin is also more breathable. Since poplin is such a common, staple fabric, it is used in variety of clothing items. Both women's and men's shirts are made with poplin, as well as women's dresses and skirts, and men's pants and jackets. It's a versatile fabric with a subtle sheen that adds beauty as well as drape to any piece of clothing.

The khadi fabric is naturally hand-woven fabric. Commonly khadi is woven with cotton which is spun on a charkha. The fabric has a rugged texture, starch is applied to keep it firm and stiff. The fabric is very strong and does not easily tear out. It is organic, natural and fashionable fabric. With every wash, the quality of the fabric is enhanced, and as keep washing it with use, the fabric enriches more and more. The versatile khadi fabric has the unique property of keeping the body warm in winters and cool in summer. Many suits, sarees, shirts , handbags, handkerchiefs, cushion covers, bed sheets, etc are made from khadi fabric.

METHODOLOGY

The methodology pertaining to the study’” **Analysis and Evaluation of effects of detergents on the selected fabrics**” is presented in the following steps.

- The investigator prepared a questionnaire to conduct the survey. The survey was done to collect information regarding the usage of detergents.

- The three detergents were selected on the basis of highest used brands.
- Denim, Poplin, and Khadi were selected for properties such as eco-friendly, biodegradable, and skin friendly.
- The detergent samples were given for active ingredient and detergency percentage.
- The investigator analysed the physical test of the three selected fabrics before and after the washes with the selected detergents.
- The investigator evaluated and differentiated the pre-analysis and post-analysis of the fabric test.

FINDING STUDY

- In survey 75% of women preferred powdered detergents for better cleansing performance.
- In survey 21% of women preferred liquid detergents for easy cleaning effect of the detergent.
- In survey 3% of women preferred pod detergents for machine wash.
- In survey only 1% of women preferred table detergent for its quick dissolving formulation.
- The denim fabric gained more weight as compared to poplin and khadi with all the three samples of detergents after washes.
- The denim also gains more thickness as compared to poplin and khadi with all the three samples of detergents after washes.
- All the three fabrics had very good colour fastness to the dry-crocking test.
- The denim fabric had very good colour fastness to the wet-crocking with the all three samples of detergents as compared to poplin and khadi.

CONCLUSION

The denim fabric showed good result after washes as it gained weight, thickness as well as it had very good colour fastness even after ten washes, whereas the quality of khadi and poplin was distorted and it had average colour fastness after washes. The sample A had increased the weight, thickness and it showed very good colour fastness to the fabric after post-analysis, whereas the sample B and sample C had decreased the weight, thickness and it showed average colour fastness to the fabric after post-analysis. The active ingredient and detergency test of the detergents showed that sample A had highest percentile as compared to sample B and sample C. Hence the sample A has a very good performance in easy cleaning without effect the quality of the fabric.

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APPENDIX

APPENDIX –I

QUESTIONNAIRE TO ELICIT INFORMATION REGARDING USAGE OF DETERGENT

NAME:

AGE:

ADDRESS:

1.Do you use Laundry Detergent?

Yes No

2.If yes, What type of Laundry Detergent you use?

Powder Liquid

Pods Tablet

3.Which brand do you use often?

Surf Excel Ariel Rin

Tide Ghadi Nirma

Henko Wheel Others (Specify).....

4.Why do you choose the above mentioned detergent?

Easy cleaning Fragrance

Eco-Friendly Others (Specify).....

5.Is it applicable for all the fabrics?

Yes

6.If Yes, Is it good for Machine wash?

Yes

7.What is the mode of purchase of your detergent?

Online Offline Both Others (Specify).....

8. Is your detergent Eco-Friendly?

Yes No

9. Are you aware of natural laundry detergent?

Yes No

10. If Yes, which brand are you aware of?

Mother sparsh Rustic art

Koparo clean Puer intense

Others (Specify).....

11. Have you ever used natural detergent?

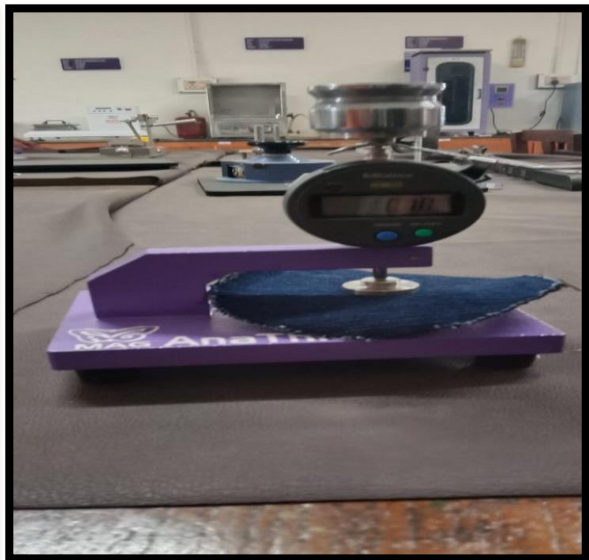
Yes No

12. If yes, Is that 100% Eco-friendly?

Yes No

APPENDIX-II

PHYSICAL TEST OF THE FABRIC



APPENDIX-III

PRE-ANALYSIS OF FABRICS

APPENDIX-IV

POST-ANALYSIS OF FABRICS



SPECIALIZED TESTING SERVICES

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Phone : +91 422 4980402, E-mail : stslabcbe@gmail.com, Web : www.stslab.in

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REPORT NUMBER: STS/RE/2022-23/2301

DATE: 21.02.2023

TEST REPORT

Issued To : **MS.AFIDA NAZA KHAN,**
M.SC, DEPARTMENT TEXTILES AND CLOTHING,
AVINASHILINGAM UNIVERSITY,
COIMBATORE.

Sample Description : **DETERGENT POWDER - A**
Sample Quantity Received : **50gm (approx.)**
Date of Receipt of Sample : **18.02.2023**
Date of Start of Analysis : **18.02.2023**
Date of Completion of Analysis : **21.02.2023**
Sampling Done by : **Customer**

| CHEMICAL ANALYSIS | | | | |
|-------------------|-------------------|---------------|--------|-------------|
| Sl.No | PARAMETER | SPECIFICATION | RESULT | TEST METHOD |
| 1. | Active Ingredient | Min 10% | 19.1% | IS 4955 |
| 2. | Detergency | Min 45% | 64.2% | |

Analyzed By: Abirami.A

Important Note:

**The given results reflect our findings of the submitted sample only. Reports shall not be reproduced except in full without the written permission from the laboratory.*

**The report/results should not be used as evidence in the court cases and also forbidden to use for any kind of advertisements.*

**If you have any queries on this report please contact us within 15days from the report date. Strictly we won't entertain any queries received after 15days from the report date.*

For SPECIALIZED TESTING SERVICES

Authorized Signatory



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REPORT NUMBER: STS/RE/2022-23/2302

DATE: 21.02.2023

TEST REPORT

Issued To : **MS.AFIDA NAZA KHAN,**
M.SC, DEPARTMENT TEXTILES AND CLOTHING,
AVINASHILINGAM UNIVERSITY,
COIMBATORE.

Sample Description : **DETERGENT POWDER - B**
Sample Quantity Received : **50gm (approx.)**
Date of Receipt of Sample : **18.02.2023**
Date of Start of Analysis : **18.02.2023**
Date of Completion of Analysis : **21.02.2023**
Sampling Done by : **Customer**

| CHEMICAL ANALYSIS | | | | |
|-------------------|-------------------|---------------|--------|-------------|
| Sl.No | PARAMETER | SPECIFICATION | RESULT | TEST METHOD |
| 1. | Active Ingredient | Min 10% | 17.5% | IS 4955 |
| 2. | Detergency | Min 45% | 58% | |

Analyzed By: Abirami.A

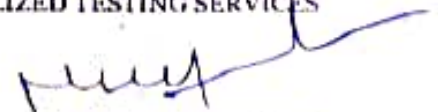
Important Note:

*The given results reflect our findings of the submitted sample only. Reports shall not be reproduced except in full without the written permission from the laboratory.

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REPORT NUMBER: STS/RE/2022-23/2304

DATE: 21.02.2023

TEST REPORT

Issued To : **MS.AFIDA NAZA KHAN,**
M.SC, DEPARTMENT TEXTILES AND CLOTHING,
AVINASHILINGAM UNIVERSITY,
COIMBATORE.

Sample Description : **DETERGENT LIQUID - C**
Sample Quantity Received : 50ml (approx.)
Date of Receipt of Sample : 18.02.2023
Date of Start of Analysis : 18.02.2023
Date of Completion of Analysis : 21.02.2023
Sampling Done by : Customer

CHEMICAL ANALYSIS

| Sl.No | PARAMETER | SPECIFICATION | RESULT | TEST METHOD |
|-------|-------------------|---------------|--------|-------------|
| 1. | Active Ingredient | Min 10% | 11.2% | IS 4955 |
| 2. | Detergency | Min 45% | 50.5% | |

Analyzed By: Abirami.A

Important Note:

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For SPECIALIZED TESTING SERVICES

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