ASSESSING ANTI-BACTERIAL ACTIVITY OF *Bougainvillea glabra* LEAF EXTRACT AND ITS APPLICATION ON SANITARY PADS

By

C.B. SNEGHA

(Reg. No. 14PTF010)

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN
COIMBATORE – 641 043

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE
IN
TEXTILES AND FASHION APPAREL

APRIL, 2016

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SIGNATURE OF THE HEAD OF THE DEPARTMENT

SIGNATURE OF THE GUIDE

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1. INTRODUCTION

Textiles are developing into interdisciplinary high tech products. It has become an integral part of everyone's life as it is associated with as around the clock. These are used to envelop human body, thus protecting it from dust, sunlight, wind and other foreign matter present in the environment (Stephens, 2014). Hence, textile in apparel has retained an importance place in human life starting from historical era to today's modern world. In the past textiles were considered primarily for economical and functional point of view (Brown, 2015). But now some end users in particular demands on the safety of textiles for the health. The consumers are demanding more and more additional in the products (Manickan et al., 2016).

It is interesting to reflect on how textile has affected cultivation and culture, although it is improbable we could adequately its influence. The story of textile beings from recording of human culture with regards to earlier civilization. We have little idea what the psychological, spiritual or social impact of fabric (Chaudhuri, 2013). The use of the fibres for textile process is one of the mankind's oldest arts. The study of textile fibres has become a very interesting and challenging science (Mishra, 2014).

Fibres are found in nature. Since time immemorial human beings have been increasingly dependent on fibres and fibrous material for shelter and housing, coverage, packaging, protection and warmth. In the prehistoric times, for protection and warmth man depended on animal hides, skins and furs (Gleason, 2015). Frings (2013) describes as he looked around the world for practical elegant are comfortable fibres man found short staple length and long filament fibres produced by plants, animals and insects.

There has been great interest in textile and garments that offer enhanced comfort as well protection to the wearer. Environment consciousness also rank high on the selection criteria of consumers with high buying potential. Moreover, the trend towards increasing hygienic standards and the consumer's desire for greater comfort as result to avoid unpleasant odours generated by bacterial growth are the driving forces behind the development of textiles with antibacterial properties. In addition, microorganism's growth in another factor that has resulted in development of antimicrobial finish (Patel et al., 2014).

Non woven fabrics are broadly defined as web structures bonded together by entangling fibres mechanically, thermally fusing the fibres or chemically bonding the fibres (Lpfia, 2012).

An average person is unlikely to be familiar with the term non woven and a few decades back there were no expert in this field. When the consumers hears the term non wovens it makes him to think something, which is not like traditional woven fabrics, something modern, advanced, hygienic, but he is not aware of any specific types of materials among those which carry the same name (Dahiya et al., 2014). But not the precise meaning of the term is somewhat clear to the experts. According to the experts non wovens is a class of textiles / sheet products, unique in industry, which is defined in negative i.e., they are defined in what they are not (Drelich, 2015). Nonwoven fabrics are different than the conventional textile fabrics and paper. Non woven are mat based on yarns and do not contain yarns. They are based on webs of individual fibres (Lunenscholss et al., 2013).

Non wovens are unique, high-tech, engineered fabrics made from fibres and which are used across a wide range of applications and products. Non wovens are innovative, versatile and indispensable. Modern life would be quite literally impossible without them (Muller et al., 2015).

In combination with other materials or used alone, non wovens are used in a wide range of consumers and industrial products with diverse properties including absorbent hygiene products, apparel, health care, wipes to name but a few. They may be limited life, single-use, fabrics or a very durable fabrics. Non woven fabrics contains good properties such as abrasion resistance, absorbent, antistatic, biodegradable, breathable, colour fast, drapeable, durable, ironable, kind to skin, lint free, liquid repellent, porous, protective (bacterial barrier), smooth, soft, strong, tear resistance, etc. (Xiang et al., 2011).

Polypropylene is a thermoplastic polymer, prepared by the chemical manufacturing and used in an extensive variety of applications. Polypropylene are widely used in large scale industries because they offers low capital and maintenance cost, high production rate, high heat removal, and maintain homogeneous temperature, pressure and catalyst distribution (Sun et al., 2011).

In the world of textile and garment, finishing plays a vital role for quality and value. In the abundance of various finishes, importance is given to antimicrobial finish since people take much care about health and hygiene. Hygiene has acquired more importance in recent years (Clemo, 2010). Natural fibres are more susceptible to bacterial attack than the other synthetic fibres due to their porous and hydrolytic nature. The structure of these fibres retains water and oxygen along with nutrients, thereby offering optimal enrichment culture for rapid multiplication of micro organisms (Seong et al., 2014).

On the other hand, direct contact with human body supplies warmth, humidity and nutrients. i.e., provides a perfect environment and optimal conditions for bacteria growth. The most troublesome organisms are fungi and bacteria (Rekha et al., 2015). Bacteria creates multiple problems to textile including discolouration, stains and fibre damage, unpleasant odour and a stick, slimy feel. Besides, structure of the substrate and the chemical processes may include growth of microbes. Humid and warm environment further aggravates the problem (Rajkumar et al., 2013).

Anti-microbial finish causes a fabric to be inhibit the growth of microbes. The humid and warm environment found in textile fibres encourages the growth of the microbes. Infection by microbes can cause cross-infection by pathogens and the development of skin allergy, rashes, odour, where the fabric is worn next to sin. With an aim to protect the skin of the wearer and the textile substrate itself, an anti-microbial finish is applied to textile materials (Menezes, 2012).

The use of antimicrobials dates back to ancient Egypt, where there were used in the treatment of mummies. The first antimicrobial textile material in modern history was developed by Listen in 1867. Over the last few years there has been increased interest in antimicrobial finishes (Chakraborthy et al., 2010). The main reason for this increased interest include : the promotion of healthier and physically active lifestyle ; an increased awareness of the harmful effects of organisms on textiles as well as on human hygiene and freshness, and the greater use of synthetic fibres an blends in items such as shirts, hosiery, blouses and underwear which tend to cause greater skin 'allergy and rashes' because of poor moisture transport properties as compared to natural fibres (Gurkan et al., 2010).

Millions of women worldwide use disposable menstrual pads and panty liners for feminine hygiene protection which was invented in 1896, disposable sanitary pads were first commercialized in the United States in 1921. Most sanitary pads employed to have some basic design. A cellulose-based absorbent core placed between a fluid permeable surface (top sheet) and a moisture impermeable backing (back sheet) (Api et al., 2016). Innovations was slow to this product category, the 1970s bought the first substantive improvement, adding a panty-fastening adhesive to the backing to replace traditional pins and belts (Berger, 2013).

Over the next 25 years, significant innovations included film top sheets to keep the surface of the pad cleaner and drier ; warp around, side panty-shields ("wings") to reduce undergarment soiling ; cellulosic cores with superabsorbent get particles for better protection in substantially thinner pads ; and the use of cloth like perforated top sheets for improved comfort and dryness. After the innovations, the fundamental model has been applied to the human safety assessment of a variety of personal products including absorbent products sanitary pads infant diapers as well as skin care products and fragrances (Api et al., 2016). As a result, the study was made with the medicinal herb treated with sanitary pads, which has a high antibacterial property.

Plant based medicines have been a part of traditional health care in most parts of the world for thousands of years (Charushila et al., 2015). *Bougainvillea glabra* has about 18 species and generally used in the landscapes for beautification, horticulture, pharmaceutical industries, agriculture and environment industries (Suxia et al., 2015). The genus *Bougainvillea glabra* in the Nyctaginaceae family of plants has 18 species, with three that are horticultural important *Bougainvillea spectabilis, B. glabra* and *B. peruviana*. *Bougainvillea glabra* have been traditional used disorders like diarrhea, reduce stomach acidity, obesity, cough and sore throat, decoction of the stem in hepatitis (Garg et al., 2015).

Considering the above facts an attempt has been made to study the **"ASSESSING THE ANTI-BACTERIAL ACTIVITY OF *Bougainvillea glabra* LEAF EXTRACT AND ITS APPLICATION ON SANITARY PADS"**. The objective of the study are :

- Selection of anti bacterial source
- Extraction of solution for herbal treatment
- Optimization for extraction and antibacterial property
- Preparation and evaluation of sanitary pads.

2. REVIEW OF LITERATURE

The review of literature pertaining the research on the **"ASSESSING THE ANTI-BACTERIAL ACTIVITY OF *Bougainvillea glabra* LEAF EXTRACT AND ITS APPLICATION ON SANITARY PADS"** is discussed under the following headings :

- 2.1 Plant Name
  - 2.1.1 Origin and Plant Description
  - 2.1.2 Physical, Chemical and Anti-Bacterial Properties
- 2.2 Finishes – Types
  - 2.2.1 Classification of Finishes
  - 2.2.2 Anti-Bacterial Finishing
  - 2.2.3 Finishing Techniques
- 2.3 Sanitary Pads – Introduction
  - 2.3.1 Types and Uses of Sanitary Pads
  - 2.3.2 Problems
- 2.4 Non Woven
  - 2.4.1 Polypropylene
  - 2.4.2 Properties and Uses

2.1 PLANT NAME

The native of Bougainvillea genus is of South America and resulting its name from Louis Antione de Bougainville (1729-1811), who come across the plant in Brazil in 1768 and primary introduced it to the rest of the world (Hafare et al., 2015).

The genus Bougainvillea in the Nyctaginaceae (4'O'Clock) family of plants has 18 species, with three that remain horticulturally important *B. spectabilis, B. glabra* and *B. peruviana* (Suxia et al., 2015).

The genus Bougainvillea has 14 species, with three that are horticulturally important : *B. spectabilis* Willdenow, *B. glabra* Choisy and

B. peruviana Humboldt and Bonpland. Many crosses among the various circle species have produced new hybrid species and important horticulture cultivars. Bougainvillea is native to South America (Kobayashi et al., 2007).

The name comes from Louis Antane de Bougainvillea, a fresh navigator and military commander who was the first European to take note of the plant, in Brazil, in 1768 (Giley, 1997).

2.1.1 Origin and Plant Description

Origin

B. spectabilis was the first member of the genus to be identified from Brazil in 1798. German botanist Carl Ludwing Willdenow is credited with this identification. The *B. spectabilis* species appears to have its hairy leaves and stems. *B. glabra* is the climbing, evergreen member of the genus, also from Brazil, was first identified by Swiss botanish Jacques Denys Choisy in 1850. The elliptical leaves are green or variegated, with a glossy sheen (Warron, 2015). *B peruviana* is climbing, evergreen member from Peru was first identified by German naturalist and explorer Alexander Von Humboldt in 1810. The species is noted for its green bark (Kent, 2007).

The leaves of *B. spectabilis* are large and ovate, with rippling along the edges and hairs on the underside. The bracts are red, dark pink or purple, while the small flowers are cream coloured. Its thorns are large and may be curved. The bloom cycle is seasonal, with plants blooming after the dry season or after a cool spell which may trigger plants to bloom *B. spectabilis* is Gunm’s territorial flower (Giley, 1997).

In *B. glabra* are smooth with less hairs. Its bracts some in many shapes and sizes. This species blooms several times in a year. The growth habit is spreading, and the green leaf types are growing fast. *B. glabra* and *B. spectabilis* are a like in general appearance, the main differences being the bloom cycle, and *B. glabra* being hairless whereas *B. spectabilis* is hairy (Phillis, 2013).

The species of *B. peruviana* is noted for its green bark. The long thin leaves are strongly ovate and glabrous. The growth habit is lanky (Bradley, 2005).

Bougainvillea species comprising *B. glabra* are native to South America from Brazil to Peru and to Southern Argentina. It has been familiarized pan tropically and is a general ornamental plant in the warm areas of Asia, Southeast Asia, Australia, the Pacific Island, the Mediterranean region, the Caribbean, Mexico, South Africa and the United States in Arizona, California, Florida, Hawaii and Southern Texas.

Bougainvilleas grow and bloom in cycles. The bloom cycle is usually about 5 – 6 weeks long, then all the bracts fall off. The plants then goes into a 6 – 8 weeks periods when no bracts are produced. During this cycle new leaves / stems grown. If the plant has been grown properly then you can expect a new flush of bloom after this “vegetative” growth cycle. However, in North America, bougainvilleas bloom best in spring, fall and winter – long day lengths in summer retard bract formations. In area close to the equator where day / night lengths are equal, bougainvilleas tend to be ever blooming (Giley, 1997).

‘Bougainvilleas’ natural habit is equatorial where day and night lengths are almost equal. Bougainvilleas in these areas tend to bloom year round, but in North America, best blooming occurs when the night length and day length are almost equal (in spring or fall). In winter, blooming is better than in the dog days of August because of night length. Also, some cultivars are triggered to bloom after a rainy season followed by a dry season (Warron, 2015).

Plant Description

Bougainvillea glabra is a woody climber with thorny thin stems and long branches, also it has papery bracts and smooth leaves, which grows to more than 10 meters of height (Rajkumar, 2013). *Bougainvillea spectabilis* grows as a shrub or thorny, woody vein reaching upwards of 12 meters tall and 7 meters wide. The leaves are simple and alternate, oval in shape, tapering to a point. Leaf size ranges from 4 – 13 cm long and 2 – 6 cm wide. The hermaphroditic flowers are small, tubular and white, flowers typically in clusters of three, surrounded by three papery bracts. These bracts vary in colour from magenta and purple to orange, white and yellow. The plant is evergreen where rainfall occurs all year, and deciduous where a dry season occurs (Rodrigues, 2012).

2.1.2 Physical, Chemical and Anti-Bacterial Properties

The *Bougaivillea spectabilis* designated to have medicinal properties viz. anti-diabetic, owing to the occurrence of dpinitol (3-O-methylchiroinositol), antiviral, anti-inflammatory (Koop et al., 2009), anti-oxidant and anti-fertility potential. Likewise, *Bougainvillea glabra* is described to have antiulcer, antidiarrhoeal and anti microbial properties. Leaves and inflorescence of *Bougainvillea glabra* have been used in Mexican outdated medicine as a remedy for minor upper and lower respiratory tract infections, such as cough, cold, bronchitis. Its antimicrobial effect can be related with the presence of betalains pigments, as well as steroidal compounds with anti-inflammatory activity (Hajare et al., 2015).

Bougainvillea spectabilis leaves extract inhibited tomato spotted with tospovirus on *Capsicum annum* and ground water in laboratory tests. *Bougainvillea spectabilis* were highly effective in reducing Okra yellow vien mosaic virus infection of okra. Antiviral protein was characterized and anti-inflammatory activities were also observed *Bougainvillea spectabilis*.

Plants yield vibrant blooms almost year round and essentially it is pest free and diseases resistant. *B. spectabilis* leaves extract inhibited tomato spotted with to spurious on *Capsicum annum* and ground water in laboratory test (Bradley, 2005).

B. spectabilis was highly effective in reducing okra yellow vien mosaic virus infection of okra (Pun, 2011). Antiviral protein was characterized by

Bradley (2005) and inflammatory activities were also observed by Joshi et al. (2007) in *B. spectabilis*. *B. spectabilis* Wild (Nyctaginaceae) have been identified to be of prime importance in controlling and preventing diabetes. *In vitro* antibacterial activity of *Bougainvillea spectabilis* leaves extracts is been reported by Garg et al. (2015). The effect of the ethanolic extract of *B. spectabilis* leaves on some liver and kidney function indices in rats. Traditional practitioners in Mandsaur use the leaves for a variety of disorders, for diarrhea, and to reduce stomach acidity, used for cough and sore throat for blood vessel and leucorrhea for hepatitis.

The aqueous extract of *B. spectabilis* leaves showed anti-fertility potential in Swiss Albino mice (Alagiruswamy et al., 2008).

Recent research has shown *B. spectabilis* to possess some potentially useful antiviral and antibacterial compounds (Bradley, 2005) and Garg et al., 2015) as well as anti-diabetic properties (Adivarekar et al., 2011).

2.2 FINISHES – TYPES

Finishes means that any modification of fabric / fabric surface to meet certain desired heads or specification (Sampath, 2003). Finishes is done to fibre, yarn or fabric either before or after weaving or knitting to change the appearance, the hand or the performance. It also adds to change the cost of the end product (Hussain, 2011). In a broader sense "finishing" includes dry and wet processing operation carried out on the fabric function properties (Raghav, 2012). Textile materials are made of natural, synthetic or blended fabrics which are sensitive to contamination of growth of microorganism. Antibacterial finish is the special finishes offered to the textile, where the scope to control the growth of the microbes is high (Tarafder, 2012). The term finishing indicates those final operations which are necessary to bring the textile into a presentable attractive condition (Hall, 2006). Finishing is a term used to encompass all the process used to enhance a fabric (usually after dyeing or printing). Finishing can be accomplished by chemical or physical change (Frings, 2013). Textile finishes enhances the fall and drape of fabrics involve the addition of sizing, weighing, falling and softening agents which may be either temporary or permanent. Finishing is a series of operation by which clothes taken from the loom are made fit for safe use (Murphy, 2000). It also indicates that these final operations which are necessary to bring the textile into a presentable attractive condition (Hall, 2004). The process of finishing is many their suitability for a particular type of fabric is determined by the nature of the fibre, the type of yarn and weaves (Yadav, 2007). In general finishing is the last stage of treatment given to textile material (Rao, 2008). Finishing is one of the most ecologically critical processes. It involves a wide range of chemical part of textile production that is harmful to the environment. But recently two main trends in the industries have come up. The first includes the demand for improving quality product and production control. The second trend is simultaneous demand for more ecological and toxicologically beneficial process and products (Jahagirdar et al., 2001).

Types of Finish

Finishing mainly falls into three groups namely, temporary finish, permanent finish and semi-permanent finish.

Temporary Finish : A finish which is not stable and goes off after the first wash is known as temporary finish. If the finishing effect in the fabric disappears during subsequent washing and usage then it is called temporary finish.

Permanent Finish : If the finishing effect in the fabric does not disappear and remains unaffected through all the conditions of wear and washing treatments, then the finish is said to be a permanent finish.

Semi-Permanent Finish : A finishing on the fabric said to be semi permanent finish if it is stable to more than 5 to 10 washes and not afterwards. Modern finishing methods include Antimicrobial Finish, Fire Retardant Finish, Moisture Management Finish, Bio-Finish, Magical Finish and Silicon Finish.

Antimicrobial finish on fabrics can minimize the transfer of microorganisms onto the wearer by creating a physical barrier. It prevents the skin diseases caused by the microorganisms. The application of antimicrobial textile finish includes a wide range of textile products for medical, industrial, home finishing and apparel sectors. Though a number of commercial antimicrobial agents have been introduced in the market (Nalankilli, 2005).

Fire proofing is achieved by the application of a finish that will cut off the oxygen supply around the flame. Fire resistance finishes cause fabrics to resist the spread of flame. Fire retardant fabrics does not propagate flame, although it may burn or char when subjected to sufficient heat (Phillis et al., 2013). Finishes are not durable in nature are more likely to cause health problems. Such finishes may allow slow release of FR agents and other chemicals and cause undesirable health hazards. Finishing of synthetic and cellulosic blends for obtaining sufficient flame retardant with acceptable aesthetic properties is a challenging task, since both cotton and polyester fibres have different thermal properties. The interaction with FR chemicals may, therefore, greatly differ (Visakh et al., 2015).

Moisture management finish is done to controlled movement of water vapour and liquid water (perspiration) from the surface of the skin to the atmosphere through the fabric. Wetting, wicking and moisture vapour transmission (MVT) properties are the critical aspects for evaluating the comfort performance of textiles (Sampath et al., 2012). The moisture management finish is the action which prevents perspiration from remaining next to the skin. In hot conditions, trapped moisture may heat up and lead to fatigue or diminished performance. In cold conditions, trapped moisture will drop in temperature and cause chilling and hypothermia (Ayodyakavitha et al., 2007).

The newest method of handle modification for cellulosic fibres is treatment with specific enzymes. As this is a biological process names such as “bio-finish” and “bio-polishing are used for this process (Laga et al., 2012).

However one should not expect too much from bio-finish. The assertion that seconds due to hairiness can be made into first class goods by this process clearly goes beyond the realities of this process allow static changes to build up on the polyester (Raghav Bhala et al., 2012).

Fashion has been a driving force for introduction of innovative finishes on various types of garments one such finish has been the “Acid / Frost Wash”. There have been a number of theories concerning the development of the basic techniques (Gulrajani et al., 2011). The ocean magic technology is much operator-friendly vis-à-vis the traditional technique. The salient advantages are no stones required, no need of making solutions – saves time and effort, consistent results – within and between garments, easier neutralization and reduction of processes time – upto 50% (Thilagavathi et al., 2005).

Silicones have wide application in textile processing and finishing. Through the silicones are mainly used in textile industry as softeness, wetting agents and water repellents. They also find use as lubricants in spinning and winding of yarns and serving lubricants. In pretreatment, dyeing and washing off bath, silicones are used as an antifoaming agent (Aravin Prince, 2007).

2.2.1 Classification of Finishes

Finishing processes are categorized in several ways. Those concerned with textile processing many classify them as wet and dry finishes. They are also referred to chemical and mechanical finishes (Kurlagai, 2009).

Finishes are also been classified as functional and aesthetical finishes. Based on the degree of performance the finishes are classified. A permanent finish generally involves a chemical process that changes the fibre structure that will not subsequently alter throughout the life of the fabric. A temporary finish will be removed subsequently or substantially reduced when the fabric is laundered or dry cleaned (Indian Textile Journal, 2009). A durable finish may lost throughout the life of the fabric but its effectiveness diminishes. A semi durable finish will last through several launderings or dry cleaning some are renewable (www.edana.org).

Functional finishes represent the next generation of finishing industry, which makes textile material act by themselves. The term finishing are used in the section of the handbook refers to a wide variety of processes used to generate surface with specific geometrices, tolerances and surface tolerance and characteristics.

On the basis of enduses many new terms have emerged including functional textiles and specialty textiles. Specialty textiles use some specific technologies to the conventional technologies so that the product would add value to the fabric (Gupta, 2007). Some of the common functional finishes are antimicrobial, deodorant finishes, wrinkle resistance, easy care finish, stone wash, bio-finishing, water proof, stain repellency, breathable finish, moisture management flame retardant finishes mosquito repellent finish (Adivarekar, 2008).

The wide range of functional finishes are available in the flat configuration fabrics, out limited options are due to complexity added in structure of the garment (Saravanan et al., 2013).

2.2.2 Anti-Bacterial Finishing

Antibacterial finish is being considered to be an important and inevitable parameter for garments which are in direct contact with the human body (Linozhang et al., 2001). Consumer attitude towards hygiene and active like style has created a rapidly increasing market for a wide range of antimicrobial textiles (Mudnoor and Laga, 2012). The need for antibacterial textile is increasing now-a-days due to the detrimental effect of micro organisms on textiles as well as human hygiene (Villas, 2011). As a means to reduce bacterial population in health care facilities is considered to be a potential solution (Qian and Sun, 2003). The finish must not be harmful to the environment both when the fabric is treated and during the life span of the finish second the finish should be effective until the wearers is finished using the textile and if necessary, enduse repeated laundering. Third and most importantly the finish must not be harmful to the wearer (Ramachandran et al., 2004).

In recent years, antimicrobial finishing of textiles has become extremely important in the production of products. This has provided opportunities to expand the use of such textiles to different application in the textile, pharmaceutical, medical, engineering, agricultural and food industries (Samonic and Tomic, 2010). There are various inorganic and organic antimicrobial agents suitable for textile application on the market. Antimicrobial agents should be chosen as the mechanism of antimicrobial activity and its effectiveness (Onar et al., 2011). But recently there are lots of attractions towards natural based herbs as an antibacterial agent because of their eco-friendly and health hazardless nature (Rathinamoorthy and Thilagavathi, 2013).

2.2.3 Finishing Techniques

Conventional methods of finish application such as pad-dry-cure or coating that are currently being used to impact antimicrobial, UV, self cleaning and other finish on the fabric (Gulrajani and Gupta, 2011)

Padding Mangle : The process consists of passing the fabric open width through a trough containing aqueous solution or dispersion of chemical and squeezing out the excess liquor using a pad mangle and drying by passing the fabric on stream roller (Fung, 2002).

Nanotechnology : Nanotechnology is a modern sector of natural scientific research between physics, chemistry and molecular biology which deals with exploration and manipulation of devices with dimensions measured in nanometers (Geisler, 2012). Textile manufacturers have begun to use nanotechnology for finishing. The fundamentals of nanotechnology lie in the fact that when a bulk material is divided into small size particles with one or more dimension in the nanometer range or even smaller, the individual particles exhibit unexpected enhanced properties, different from those of the bulk material (Hinestroza, 2004).

Micro Encapsulation : Micro encapsulation is a technique in which chemicals are released in a controlled manner over a long period. It is a micro packaging process that has traditionally involved the deposition of thin polymeric coatings on small particles of solids, droplets of liquids (Shishoo, 2010). Hence the core material is isolated from hostile environment and can be released either slowly. These micro capsules can then be attached to textiles, conferring various properties (Deopura et al., 2008).

Plasma Technology : The coupling of electromagnetic power into a process gas volume generates the plasma medium compressing a dynamic mix of ions. The system overall being at room temperature. This allows the surface fictionalization of fibres and textiles without affecting their bulk properties (Shishoo, 2007).

2.3 SANITARY PADS - INTRODUCTION

Millions of women worldwide rely on disposable menstrual pads and panty liners for feminine hygiene protection. Invented in 1896, disposable sanitary pads were first successfully commercialized in the United States in 1921 (Woellen, 2015).

The development of the sanitary napkins in the west has a long history that takes advantage of a number of innovations in material processing. Prior to the 1920s, American women hand produced napkins from cotton, gauze, flannel or rags to be pinned to undergarments and hand laundered (Vostral, 2008).

Limited attention has been paid to the role of menstrual hygiene as a barrier to women’s health and participation in society in the developing world. Moreover, the effects on quality of living are substantial. Inadequate access to sanitation has been linked to school absenteeism, productivity declines, rashes and infection and seclusion and embarrassment (Bharadwaj et al., 2004).

After the production in 1921, a number of patents highlight the characteristics (and disadvantages) of modern pad design. Traditionally filled pads use hydrophilic wood pulp and rayon, through on their own. These materials are slow to absorb fluids. Recently super absorbent polymers (SAPs) have been incorporated into designs which are lightly cross linked polymers that swell lithen method. non-woven pads containing SAP fibre absorb fluid fasten while minimizing thickness (Zohuriaan-Mehr et al., 2010).

Superabsorbent materials are subject to failure on their own and many resilient materials are abrasive (Cadieuse and Levesque, 1995). Several designs focus on combining materials and structures that increases quick and high capacity absorption. For example, in coupled with a cavernous structure to increase surface area, using a transverse rubber in the molding process (Hinestrozo, 2004). A utilized sanitary napkin achieves absorbance through a lower density cover layer, a higher density transfer layer, a very high density reservoir layer, and then finally an imperable barrier layer (Cadieux and Leusque, 1995).

In a more basic design, a primary absorbent layer of uncreped cellulose is layered with an embossed blend of conform fibres (David, 2013). Feminine hygiene (lady napkins) are hygiene absorbent products engineered to absorb and retain body fluid without causing any leakage. The user should always feel dry and comfortable. It consists of an absorbent pad sandwiched between two sheets of nonwoven fabric (Pancholi et al., 2008).

Sanitary napkins are pads classified as absorbent articles are designed to be worn by female to absorb menstrual fluids and other excrements discharged by the body during a menstrual period. A lot of these articles (both disposable and reusable) such as diapers, napkins and sanitary pads, can be used for menstrual collection (Sarthak Lohia, 2012).

2.3.1 Types and Uses of Sanitary Pads

There are two major types of sanitary pads namely, disposable sanitary napkins includes thick sanitary napkins, ultra thin sanitary napkins and panty liners being used in the market.

The size of each and their content vary from market to market. The disposable sanitary napkin may vary range from the short slender panty liner to the larger and the longer over night. Extra protection is given for long pads or larger women, in which their under garments may not be fully protected by regular length napkins, and also for overnight use (Pancholi et al., 2008).

Disposable sanitary pads made from cellulosic material such as wood pulp fluff have relatively good absorbency and some shape recovery when dry but unfortunately not when wet. The cellulosic material collapses when wet resulting in loss of shape, thus leading discomfort (Rodrigues et al., 2012).

Reusable sanitary pads (or) cloth sanitary pads are made of different materials such as cotton, silk, bamboo and hemp, that offer a good absorbency (Pinho et al., 2010). Most of the designs are similar to those of disposable napkins with a bottom layer and an absorbent core. New designs may be made with wings that secure around the underpants or without, and just help in place between the body and the underpants with the help of only an underlying adhesive on the bottom layer whilst the older styles are available in belt styles.

Washable disposable pads do not need to be disposed of after use and therefore offer a more economical alternative for women. Womens can feel more comfortable who suffer from irritations as a result of using disposable napkins (Maygaj et al., 2006).

2.3.2 Problems

It is always frustrating when something that is really convenient and time saves ends up being really unhealthy. From an environmental perspective, a large amount of these pads end up in landfills and water treatment facilities. An average women will use over 16,000 pads (upto 300 pounds) in the course of her lifetime, sometimes more. So the practice of using unclean sanitary pads will leads to health risk in the formation of bacteria may cause local infections or travel up the vagina and outer the uterine cavity (Sandeep R Naik, 2008). And changing the pads in frequently, the wet pads can cause skin irritation when can then become infected if the skin becomes broken (Pancholi, 2008).

The labia and vaginal area is highly vascular, meaning that a lot of small blood vessels run to this area. The skin is also especially thin down there, making it easier for plastic chemicals to enter the body that way. And using the highly absorbent pads during a time of light. Blood loss may leads to high toxic sheets syndrome. The use of sanitary pads when not menstruating (e.g., to absorb vaginal secretions). The unsafe disposal of used sanitary materials or blood may cause health risk of infecting others, especially with Hepatitis B. And frequent douching (forcing liquid into the vagina) which facilitate the introduction of bacteria into the uterine cavity (Anand et al., 2012).

Both can be a problem. The pads are made up of entirely soft pillary cotton from pristine white fields. But unfortunately these pads do not contain cotton, but most contain rayon, a synthetic material. And there is some evidence that synthetic fibres can pull too much moisture from the vaginal walls and stick to the soft skin there, leaving tiny synthetic fibres that may increase the risk of TSS, toxic shock syndrome. The pads that are actually made of cotton are usually bleached with chlorine or other chemicals. Additionally, cotton is one of the world's driest crops and is often sprayed with a variety of pesticides (David Mikkelson, 2013).

2.4 NON WOVEN

Non women is a name stands for textile equipments 'not woven' comprising of various fibres which are not related to spinning (Nair and Pandian, 2003).

It is the oldest and the simplest fabrics. Its best example is felt. The discovery of felt was first well documented dates back 3500 – 3000 BC (Patel and Bhrambhatt, 2001). The term non woven is very peculiar definition, as it describes the material in a negative way, instead of describing its real, positive essence. Such meaning is not much appreciated also by producers, where they considered the negation "non" as an obstacle to selling and would like to have it replaced with other term, such as shaped fabrics" or "yarn-free fabrics", but up to now these definitions are not yet much in use (Martin et al., 2008).

According to ISO Standard 9092 and CEN EN 29292, as well as proposed by EDANA and INDA, 'A non woven is a sheet of fibres continuous filaments or chopped yarns of any natured or origin, that have been formed into a web by any means, with the exception of weaving and knitting" (Hall, 2006). A strict definition of the non woven can be drawn from the international norm ISO 9092 or from the equivalent European norm UNI EN 29092. According to the norm ISO 9092 : 1988 (off print), the definition for "non woven" is the following. A manufactured sheet, web or bat of directionally or randomly orientated fibres, bonded by friction and or adhesion, excluding paper and products which are woven, knitted, tufted, stitch bonded incorporating binding yarns or filaments, or fitted by wet milling, whether or not additionally needed (Martin et al., 2008).

Non woven fabrics are limited in life, it is a single use fabric, or a very durable fabric. Some of the specific functions of non woven fabrics are

Absorbency : Flame Retardancy,
Liquid Repellency : Washability,

Resilience : Cushioning,

Stretch : Filtering,

Softness : Bacterial barriers and

Strength : Stability

with the combination of all these properties the fabrics create a great job while achieving a good balance between product use life and cost (Choudhary, 2013). Non wovens is a sheet or web structures which is formed by a randomly dispersed fibres or filaments, excluding paper, which are been bonded or entangled by mechanical, thermal or chemical means and can be modified by additional chemical treatments referred to as finishing (Justinger et al., 2009)

Most disposable hygiene products and proportion of medical textiles are mainly produced by the use of non woven processes. The non woven industry was started in the year 1950s when paper, textile and chemical technologies all these were combined and resulting in the production of new fabrics and products for the development of textiles but at a significantly lower cost. Due to the low cost and superior functionality, the non wovens are consumed wide variety of consumers and industrial products (Kamath et al., 2011). It is in general, depends on high volume of manufacture which is highly engineered and because of inexpensive pressures, there is a endless need to modernize (or) innovate to ensure high quality, in specification products are produced at the least possible cost (Balasubramanian, 2009).

The non woven market in the global level is valued at US$ 14.5 billion a year with an annual sales 7 per cent of its growth rate is expected over each of next five years. The substantial improvements in technology made the non woven industry more benefited over the past several years, and the number of new applications were increased for non woven and these demand (Kamath et al., 2011). The structure of new fabrics are random microstructure in which they are manufactured from a set of disordered fibres consolidated by bonds of different nature, such as simple entanglement, local thermal fusion or chemical binders. A best example of this kind is paper, in which it is made up of cellulose fibres linked with hydrogen bonds. In recent years the industrial application of these materials has grown rapidly with the incorporation of new fibres and consolidation processes (Malik and Joshi, 2012).

Non wovens are categorized as disposable (57% of global industry sales with an average annual growth rate of 7.5%) or durable (43% of sales and growth rate of 6.5%). The most widest enduse of disposable non wovens are diapers, feminine sanitary production, baby wipes, adult incontinence products and health care applications. Some of the health care application are surgical gowns, drapes and wound care sponges and dressings. Wipes, filtration media, protective apparel and fabric softness sheets are other disposable end uses (Kamath et al., 2011).

Non Woven Fabrics

The absorbent pad is at the core of the sanitary pads. It is held in place by the use of non woven fabric sheets that form the body of the sanitary pads. The production of the non woven fabrics differ from traditional fabrics. And the non woven fabrics are made from plastic resins, such as nylon, polyester, polypropylene, polyethylene and they are been accumulated by mechanically, chemically or thermal interlocking the plastic fibres (Tjon, 2007).

Non woven are not woven together into a fabric. They start life as a whole of fibre that come together through anyone of a number of bonding methods. It is generally recognized that most consumers prefer cotton personal core items, whereas non woven product that funds extensive usage in day to day life without getting noticed to our knowledge. The non woven are common man product today (Viju et al., 2007). A non woven textile represents a unique way of forming a fabric and has many advantages over woven fabric (Balasubramanian, 2009). They are used in the fields of technical textiles like readymade filters, geotextiles, insulating materials, labour protection devices, protective clothing and sanitary goods (Albrecht et al., 2006).

Non woven products are taking the place of many woven and knot materials because of their low cost and lighter weight. Non woven has two important steps in manufacturing. The first step is the formation of fibre web and the second step is the bonding methods. The non woven composites can be produced from the combination of any of the webs of spun bond, melt blown, wet laid, dry laid and other webs, produced from non woven manufacturing process (Joshi et al., 2012).

2.4.1 Polypropylene

Polypropylene is easy one of those materials which have high demand in all spheres of life (Mukherjee, 2012). Polypropylene is one of the most successful commodity fibres. Polypropylene belong to the newest generation of manufactured chemical fibres after polyester, polyamides and acrylic. Poly-olefinis (Low Density Polyethene (LDPE), High Density Polyethene (HDPE) and polypropylene (PP) are a major type of thermoplastic used throughout the world for many applications (Vishwanath, 2010).

2.4.2 Properties and Uses

Weight : Polypropylene is a light weight material.

Tensile Strength : Tensile strength is quite high. It shows strong resistance towards stress and cracking.

Shape : It is crystalline in nature and possesses a regular geometric shape.

Insulation : It acts as an excellent insulation. That means, it prevents flow of electricity through it.

Moisture Absorption : Polypropylene does not get damaged by water exposure because its moisture absorption is very low.

Melting Point : Melting point of polypropylene is 160°C. Therefore, unlike other polymers like polyethylene, it is capable of being operational at very high temperature.

Corrosion : Polypropylene is resistance to corrosion.

Other Useful Properties of polypropylene are as follows : It is a non-toxic substance, it does not get stained very easily, it can be easily fabricated and it can remain its stiffness and flexibility intact even at very high temperature (Pal, 2009).

In our daily life we are surrounded by more and more articles produced by synthetic polymers rather than traditional materials such as wood, metals or ceramics. Polypropylene fabrics are most widely used now-a-days because of its good properties. Polypropylene fibre has excellent chemical resistance to acids and alkalis, his abrasion resistance and resistance to insects and pests (Richard et al., 1999). Polypropylene fibres is also easy to process and inexpensive compared to other synthetic fibres. It has low absorption of moisture and aid the quick transport of moisture.

Polypropylene is a light fibre and its density (0.91 gm / cm^3) is the lowest of all synthetic fibres (Gilmore et al., 1995). It does not absorb moisture which means the wet and dry properties of the fibre are identical. It has excellent chemical resistance (Mukherjee, 2012).

Because of its superior characteristics and low-cost, this polypropylene fibres are extensively used in non woven industry as a highly absorbent product. The absorbent products are very important in the field of non woven. The absorbent product applications, the baby diaper is used largely, however, applications in adult incontinence currently show the highest growth in recent years (Pancholi et al., 2008).

3. EXPERIMENTAL PROCEDURE

Experimental procedure pertaining to the study, **"ASSESSING THE ANTI-BACTERIAL ACTIVITY OF *Bougainvillea glabra* LEAF EXTRACT AND ITS APPLICATION ON SANITARY PADS"** is discussed below.

3.1 Selection of Finish

3.2 Selection of Fabric

  3.2.1 Polypropylene

3.3 Selection of Fabric Structure

  3.3.1 Non Woven

3.4 Selection of Antibacterial Source

3.5 Pilot Study

  3.5.1 Extraction of *Bougainvillea glabra*

    3.5.1.1 Optimization of the Process

    3.5.1.2 Optimization of Time

    3.5.1.3 Optimization of Temperature

    3.5.1.4 Optimization of Concentration

3.6 Selection of Finishing Method

  3.6.1 Padding Mangle

3.7 Actual Finishing

3.8 Selection of Antibacterial Test Method

  3.8.1 Agar Diffusion Method

3.9 Nomenclature of Finished Sample

3.10 Preparation of Sanitary Pads

  3.10.1 Materials Required

  3.10.2 Manufacturing Process

    3.10.2.1 Defibration

    3.10.2.2 Core-Formation

    3.10.2.3 Soft-Touch Sealing

  3.10.3 Post Production

3.11 Evaluation
3.11.1 Objective Evaluation
3.11.1.1 Physical Properties Test
3.11.1.1.1 Fabric Thickness
3.11.1.1.2 Fabric Weight
3.11.1.2 Mechanical Properties Test
3.11.1.2.1 Tensile Strength and Elongation
3.11.1.3 Comfort Properties
3.11.1.3.1 Fabric Stiffness
3.11.2 Physical Test for Sanitary Pads
3.11.2.1 Disposability
3.11.2.2 Liquid Strike Through Time
3.11.2.3 Wet Back
3.11.2.4 Run-Off
3.11.2.5 Free Swell Absorptive Capacity
3,11.2.6 Centrifuge Retention Capacity
3.11.2.7 Absorbency Under Pressure
3.11.2.8 pH
3.12 Statistical Analysis

3.1 SELECTION OF FINISH

The inherent properties of textile fibres provide room for the growth of microorganism. The structure and the chemical process may include the growth of bacterial in humid and warm environment that aggravate the problem. But today there is an increased interest for the proportion of healthier and physically active lifestyle and an awareness of the harmful effects of organisms on textiles as well as on human hygiene and freshness (Hussain, 2001).

Therefore a number of attempts has been made by researches and academicians to create a fabric to withstand infection and protect mankind. The result of such studies has driven the market towards special or functional finishes. Each of these finish focuses on one or two particular function amongst these functional finish, antibacterial finish is the most popular especially in concern with health care products. Antibacterial finishes been the need of hour. Antibacterial finish provide various benefit of involving the infection and quality deterioration and prevents the odour formation (Parthiban et al., 2007). Considering the above facts antibacterial finish was selected for the study.

3.2 SELECTION OF FABRIC

The fabric selected for the study was polypropylene fabric as it has excellent properties.

3.2.1 Polypropylene

Polypropylene is easy one of those materials which have high demand in all spheres of life. Polypropylene can be easily fabricated, its tensile strength is very high as compared to other fibres, and a light weight material and because of its good properties the polypropylene fabric is used to make sanitary pads for the selected study (Mukherjee, 2012).

3.3 SELECTION OF FABRIC STRUCTURE

3.3.1 Non Woven

Non woven fabrics are the oldest and the simplest textile fabrics. Its best example is felt (Patel and Bhrambhatt, 2001). Non woven is not like traditional woven fabrics, something modern, advanced, hygienic. Non wovens fabrics are different than the conventional textile fabrics and paper. Non wovens are not based on yarns and (with frequent exceptions) do not contain yarns. They are based on webs of individual fibres. Non wovens are different than paper in that non wovens usually consist entirely or at least contain a sizeable properties of long fibres and / or they are bonded intermittently along the length of the fibres (Dahiya et al., 2005).

Non woven fabrics are flat, flexible, porous sheet structures that are produced by interlocking layers or networks of fibres, filaments, or film-like filamentary structures (Pal, 2009). Thus considering the above factors a spun bonded non woven fabric was selected for the study.

3.4 SELECTION OF ANTIBACTERIAL SOURCE

Shrubs are abundantly available in nature. They play the major role in the primary health care (Usha et al., 2006). Plant source are eco-friendly in nature. Plants are the great importance to the quality of an environment conditions order which it is grown. The selected natural herb is *Bougainvillea glabra*. The *Bougainvillea glabra* leaf and its constituents have been demonstrated to exhibit medicinal properties such as antidiabetic, antiviral, antibacterial, antiinflammatory, antioxidant, antifertility potential (Hajare et al., 2015).

Hence the selected natural plant source is *Bougainvillea glabra* because its known to have antibacterial property. The leaves of *Bougainvillea glabra* was collected around the Race Course area of Coimbatore.

3.5 PILOT STUDY

3.5.1 Extraction of *Bougainvillea glabra*

The *Bougainvillea glabra* plant was selected and the best part of the plant which has antibacterial property. The fresh leaves of *Bougainvillea glabra* (Plate – I) were collected, washed with fresh water and the leaves were grounded to paste using mortar and pestle (Plate – II).

Ten grams of the *Bougainvillea glabra* leaf extract was taken in a conical flask and mixed with 100 ml ethanol (Plate – III). The conical flask was kept in shaker incubator at 40°C for overnight. Then the solution was filtered using filter paper (Christie et al., 2001). Thus the filter extraction serves as the antibacterial application solution (Thilagavathi et al., 2006) (Plate – IV).

3.5.1.1 Optimization of the Process

Time, temperature and concentration are the three major factors influencing the antibacterial activity against microorganism. Hence a pilot study was carried to optimize the process conditions.

3.5.1.2 Optimization of Time

The fabric was treated with *Bougainvillea glabra* leaf extract of different concentration for optimization at different time interval 1, 3 and 5 hours respectively in room temperature. After treating the fabric was taken out and dried. Then its antibacterial activity was noted. The time shows the maximum zone of inhibition as selected for the final finishing process.

3.5.1.3 Optimization of Temperature

The fabric was treated with *Bougainvillea glabra* leaf extract of different concentration for optimization at different temperature of 40°C, 50°C and 60°C respectively. After treating the fabric was taken out and dried. Then its antibacterial activity was noted and the temperature which shows the maximum zone of inhibition was selected for the final study.

3.5.1.4 Optimization of Concentration

The fabric was treated with *Bougainvillea glabra* leaf extract of different concentration for optimization at 20, 40 and 60 grams / 100 ml respectively in room temperature. After treating the fabric was taken out and dried. Then its antibacterial activity was noted and the concentration which shows the maximum zone of inhibition was selected for the final study.

3.6 SELECTION OF FINISHING METHOD

There are different methods of finishing a fabric like dip and dry method, padding mangle method, ultrasonic spray technique, plasma treatment, nano spray technique and microencapsulation method (Sampath, 2003). Amongst these the most common method is padding mangle method. Hence padding mangle method of finishing the fabric was selected.

3.6.1 Padding Mangle

The extracted solution was poured inside the padding mangle and the fabric was passed inside the machine (Plate – V). The temperature was set at 60°C and the fabric was cured for 15 minutes for the good penetration of the finishing agent. Then the fabric was removed and used as top sheet for sanitary pads development (Plate – VI).

3.7 ACTUAL FINISHING

Sixty grams of *Bougainvillea glabra* extract was poured into the extract basin of the padding mangle. The fabric was passed through it at 50°C.

3.8 SELECTION OF ANTIBACTERIAL TEST METHOD

The antibacterial activity of finished and unfinished samples were evaluated by qualitative method (AATCC 147 – 1998) of agar diffusion test for bacteria.

3.8.1 Agar Diffusion Method (AATCC 147 – 1998)

The 50 ml of nutrient agar was prepared and sterilized in autoclave for 30 minutes. The petri plates were sterilized in hot air oven at 100°C for 10 minutes. 25 ml of nutrient agar was poured into each of the plates and were allowed to solidify. After solidification the plates were incubated with *Staphylococcus aureus* and *Eschericheria coli* bacteria which was previously suspended in the both solution. Then a small piece of fabric treated was placed in the agar plates. The petri plates were incubated at 37°C for 24 hours, after incubation, the diameter of the zone formed around each was measured and recorded (Plates – VII and VIII).

PLATE – I

FRESH LEAVES OF *Bougainvillea glabra*

PLATE – II

LEAF EXTRACT OF *Bougainvillea glabra*

PLATE – III

ETHANOLIC SOLUTION OF *Bougainvillea glabra* LEAF EXTRACT

PLATE – IV

EXTRACTION THROUGH SHAKER INCUBATOR

PLATE – V

PADDING MANGLE

PLATE – VI

***Bougainvillea glabra* TREATED FABRIC**

PLATE – VII

***Escherichia coli* FOR *Bougainvillea glabra* TREATED FABRIC**

PLATE – VIII

***Staphylococcus aureus* FOR *Bougainvillea glabra* TREATED FABRIC**

From the result of antibacterial tests, it was clear that the zone of incubation was present. Among the samples tested for bacteria, the zone of formation for bacteria was 0.7 mm for *S. aureus* and 0.5 mm for *E. coli*. Hence the final study antibacterial activity was carried out using padding mangle method.

3.9 NOMENCLATURE OF HERBAL FINISHED SAMPLE

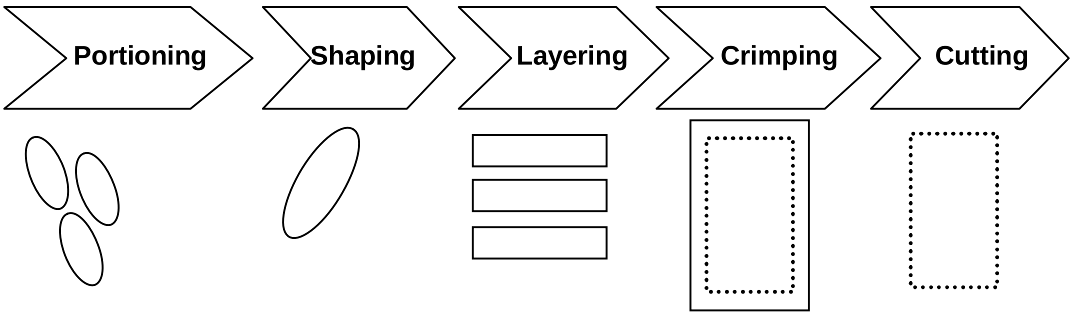
In order to test the fabrics they were named after the source used. The details are presented in the table below.

TABLE - I

NOMENCLATURE OF FINISHED SAMPLE

S.No.	Sample	Nomenclature
1.	Original fabric	OF
2.	*Bougainvillea glabra* treated fabric	BTF

3.10 PREPARATION OF SANITARY PADS



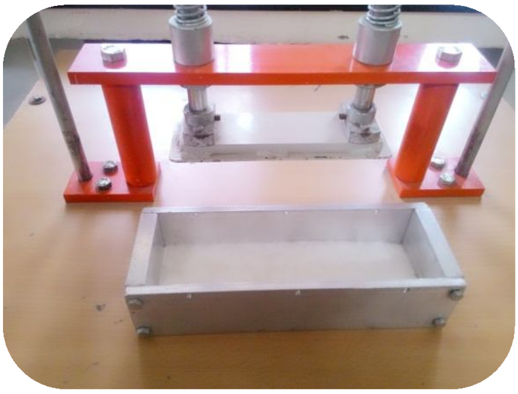
3.10.1 Materials Required

Pulp, top layer, back layer, release paper, gum and packing cover. These are the materials required for the preparation of sanitary pads (Kamath, 2011).

PLATE – IX

DE-FIBRATION

PLATE - X



CORE FORMATION

PLATE – XI

SOFT-TOUCH SEALING

PLATE - XII

ATTACHMENT OF BOTTOM SHEET

PLATE – XIII

POST-PRODUCTION

PLATE – XIV

***Bougainvillea glabra* TREATED SANITARY PADS**

3.10.2 Manufacturing Process

The process of manufacturing sanitary pads consists of three stages. They are

- De-fibration
- Core formation
- Soft-touch sealing

3.10.2.1. De-fibration

The first stage of preparation of sanitary pads is done by a stainless steel container with a lid, a small motor which works like a “mixie”. The pulp is put into the container and the lid is closed in which the motor runs for one-two minutes. The pulp core material becomes fluffy and uniform (Tjon, 2007) (Plate – IX).

3.10.2.2. Core Formation

For the preparation of core formation a napkin shaped mould is used. The core material is spread within the mould by hand. Then the mould is properly positioned, the liver is pulled manually with legs and this compresses the core material. Finally the mould is removed and the core of the sanitary pads is formed and which is done for 0.5 minute (Nirmal, 2011) (Plate – X).

3.10.2.3. Soft-Touch Sealing

Soft-touch sealing is done by placing the core material, which is warped in an outer treated fabric and sealed along its length by pulling the heat sealing press and hence the end of sanitary pads are sealed. It takes 0.5 minute to seal the sanitary pads (Martin et al., 2007) (Plates – XI, XII and XIII).

3.10.3 Post Production

UV Sterilization

The finished sanitary pads are placed within the UV unit to ensure utmost hygiene. The UV strerilization is done for one minute (Justinger et al., 2008) (Plate – XIV).

3.11 EVALUATION

“Evaluation is defined as the making of judgement about the value of some purpose, idea, work, solutions, method and materials” (Bhatia, 2014). Textile testing is necessary to measure the properties of fabric and finishes developed in it (Taylor, 2002). Therefore all the samples were evaluated both subjectively and objectively.

3.11.1 Objective Evaluation

The fabric was evaluated objectively for physical, mechanical, comfort, absorbency and antibacterial properties.

3.11.1.1 Physical Property Test

3.11.1.1.1 Fabric Thickness

The fabric thickness is measured to an accuracy of atleast 0.01 mm under the prescribed ranging from 0.05 psi, depending on the type of fabric under test (Stoker, 2005) (Plate – XV). The Hungarian Thickness Tester are used. It has two parts, the anvil and the pressure foot which works under a lever spring action. On the top a dial indicated the thickness of the sample in the thousand of an inch. Each division on the dial indicated the thickness of the sample was placed on the presser foot pressed the sample. The dial indicate the thickness of the sample. Five readings were taken from different places of the fabric samples and then mean was calculated.

3.11.1.1.2 Fabric Weight

The fabric weight was found according to ASTM test method D 3776-2002. The samples were preconditioned as directed in practice ASTM D 1776 (Plate – XVI). The fabric samples were cut with GSM die cutter which is 100 cm^2. The samples were weighed in an electronic balance. The weight of the samples was measured in grams and multiplied with 100 to get grams per square meter value. The samples were tested for each fabric and the average was calculated. The same procedure was followed for all the samples.

3.11.1.2 Mechanical Property Test

3.11.1.2.1 Tensile Strength and Elongation

The breaking force is defined as the maximum force applied to a material carried to rupture. Elongation is the ratio of the extension of the material to the length of the material prior to strengthening (ASTN, 2005). Breaking test was tested as per ASTM D 5035-2003. For preconditioning the samples method ASTM D 1776 was followed.

The tensile properties of fabrics also helps in predicting the sustainability of both raw materials used and to end product. The analysis of tensile behavior of the fabric is therefore extremely important (Kothari et al., 2003).

The Eureka Pendulum Type Tensile Strength Tester was used to determine the breaking strength and elongation of the samples. Five samples of each were cut from the directions. Each samples was 35.5 cm length and 3.8 cm in width. Each samples were placed perpendicular to the load. The load was applied until the samples was broken. The dial readings in kilograms and elongation in centimeters were noted. Five readings were taken for each material and the mean value was calculated. The elongation percentage was found out (Plate – XVII).

3.11.1.3 Comfort Property

3.11.1.3.1 Fabric Stiffness

Basu (2006) is of the opinion that the bending length is a measure of the interaction between fabric weight and fabric stiffness as shown was in which the fabric bends under its own weight.

Stiffness is an important characteristic of the fabric. The principle behind the stiffness test is to measure the length of the fabric specimen of specified dimensions which when used as a cantilever bends to a constant angle under its own weight (BIS, 2000).

The Shirly Stiffness Tester (Plate – XVIII) was used to find out the stiffness or blending length of the samples. The specimen are each 25 mm wide and 200 mm long. Three are cut parallel to the warp and 3 parallel to the weft so that no two weft specimens contain the same weft threads. The specimens should not be creased and those that tend to twist should be flattened.

Before the test specimens are preconditioned. Five readings are taken from each specimen, one face up and one face down on the first end and then the same for the second end.

The mean bending length for warp and weft is calculated. The higher the bending length, the stiffness is the fabric.

3.11.2 Physical Test

3.11.2.1 Disposability

A disposable sanitary pads with the covering removed, should be immersed in 15 litres of water and stirred. The pad shall disintegrate in the water in not more than 5 minutes. Disposability in water was seen in less than 5 minutes for almost all regular type pads, with fluff pulp as the middle layer.

PLATE – XV

FABRIC THICKNESS

PLATE – XVI

GSM CUTTER

PLATE – XVII

FABRIC TENSILE STRENGTH AND ELONGATION

PLATE – XVIII

FABRIC STIFFNESS TESTER

3.11.2.2 Liquid Strike Through Time

A specified quantity of simulated urine is discharged at a specified rate under specified conditions onto a test piece of nonwoven which is placed on a reference absorbent pad. The time taken for all the liquid to penetrate the nonwoven is measured electronically.

3.11.2.3 Wet Back

A coverstock is placed over a standard absorbent medium which is then loaded with a specific quantity of simulated urine. A standard weight is placed onto the coverstock and absorbent medium to ensure even spreading of the liquid. A pre-weighed pick up (blotter) paper is then placed on the coverstock and the weight is again placed on top. The mass of absorbed liquid by the pick up (blotter) paper is weighed and defined as wetback.

3.11.2.4 Run-off

A specified quantity of simulated urine is discharged at a prescribed rate under specified conditions on to a test piece of nonwoven that is superimposed on a standard absorbent media and placed on an inclined table. Any excess liquid that runs down the test piece is collected by a standard receiver pad placed below the lower end of the nonwoven test piece. The run-off measures the mass of liquid collected by the standard receiver pad.

3.11.2.5 Free Swell Absorptive Capacity

The sample is weighed and placed in a bag. The bag is submerged in the fluid to be absorbed and allowed to soak for a defined soaking period, after which the bag is removed. Excess fluid is allowed to drip away and the sample is weighed to determine the amount of fluid absorbed.

3.11.2.6 Centrifuge Retention Capacity

The sample is weighed and placed in a bag. The bag is submerged in the fluid to be absorbed and afterwards centrifuged or a specific time, at a specified centrifugal force, to determine the amount of fluid retained.

3.11.2.7 Absorbency Under Pressure

The sanitary pads should absorb 30 ml of coloured water or oxalated sheep or goat blood or test fluid when flowed on to the centre of the pad (at the rate of 15 ml per minute) and it should not stain through / leak through at the bottom sides of the sanitary pad. The time taken for the fluid to get completely absorbed is ranging from 5 seconds to 30 seconds among the various brands.

3.11.2.8 pH

The sanitary pads should be free from acids and alkali and the pH of the absorbent material should be within 6 to 8.5.

3.12 STATISTICAL ANALYSIS

Statistical method of analysis are intended to aid the interpretation of data that are subjected to appreciable haphazard variability. The theory of statistics might then be expected to give a comprehensive basis for the analysis of such data, excluding only considerations specific to particular subject matter fields (Cox and Hinkley, 2000). Every scientific data has to be analysed statistical to confirm the results for further use. Considering this the results obtained from the tests were statistically analysed. The most common analysis like mean, mode, standard deviation and ‘t’ values were calculated and its significance was note and presented in the Chapter IV : Results and Discussion.

4. RESULTS AND DISCUSSION

The result of the study **"ASSESSING THE ANTI-BACTEIRAL ACTIVITY OF *Bougainvillea glabra* LEAF EXTRACT AND ITS APPLICATION ON SANITARY PADS"** is discussed under the following headings :

4.1 Objective Evaluation

- 4.1.1 Physical Properties
  - 4.1.1.1. Fabric Thickness
  - 4.1.1.2. Fabric Weight
- 4.1.2 Mechanical Properties
  - 4.1.2.1. Tensile Strength
  - 4.1.2.2. Fabric Elongation
- 4.1.3 Comfort Properties
  - 4.1.3.1. Fabric Stiffness
- 4.1.4 Physical Test for Sanitary Pads
  - 4.1.4.1 Disposability
  - 4.1.4.2 Liquid Strike Through Time
  - 4.1.4.3 Wet Back
  - 4.1.4.4 Run-off
  - 4.1.4.5 Free Swell Absorptive Capacity
  - 4.1.4.6 Centrifuge Retention Capacity
  - 4.1.4.7 Absorbency Under Pressure
  - 4.1.4.8 pH

4.2 Antibacterial Test

4.1 OBJECTIVE EVALUATION

4.1.1 Physical Properties

The physical properties of the fabric were analyzed for the thickness and weight.

4.1.1.1. Fabric Thickness

The result of the fabric thickness and the ‘T’ value of the original fabric (OF) and the *Bougainvillea glabra* treated samples (BTS) are discussed below in Table – II and Figure – 1.

TABLE – II

FABRIC THICKNESS

Samples	Mean (mm)	SD	Loss/Gain Value	Loss / Gain Percentage	‘T’ Value
OF	0.42	0.011	-0.28	-1.40	0.307^{NS}
BTF	0.14	0.007			

NS – Not Significant

It is clear from the Table – II and Figure – 1, that the thickness of the *Bougainvillea glabra* treated fabric has decreased in mean value by 1.4 per cent when compared to the original fabric. From the statistical analysis, it is evident that BTS had no significant difference with ‘T’ test value of 0.307. This might be due to the expansion of yarns.

Hence it could be concluded that thickness decreased after the *Bougainvillea glabra* treatment.

4.1.1.2. Fabric Weight

The result of the fabric weight and the ‘T’ value of the original fabric (OF) and the *Bougainvillea glabra* treated samples (BTS) are discussed below in Table – III and Figure – 2.

TABLE – III

FABRIC WEIGHT

Samples	Mean (GSM)	SD	Loss/Gain Value	Loss / Gain Percentage	'T' Value
OF	0.246	0.005	0.020	8.130	3.16*
BTF	0.266	0.010			

* – Significant at 5% level.

It is clear from the Table – III and Figure – 2, that the weight of the *Bougainvillea glabra* treated fabric has increased in mean value by 8.13 per cent when compared to the original fabric. Kurlagai (2009) has also found in his study that in general all the finished samples increase in weight. From the statistical analysis, it is evident that BTS had significant difference with 'T' test value of 3.16 at 1 per cent level. This clearly proves the deposition of the *Bougainvillea glabra* extract on the fabric.

Hence it could be concluded that weight increased after the *Bougainvillea glabra* treatment.

4.1.2 Mechanical Properties

The salient mechanical properties of the untreated and treated fabrics were analysed.

4.1.2.1. Tensile Strength

The result of the tensile strength and the 'T' value of the original fabric (OF) and the *Bougainvillea glabra* treated samples (BTS) are discussed below in Table – IV and Figure – 3.

FIGURE – 1

FABRIC THICKNESS

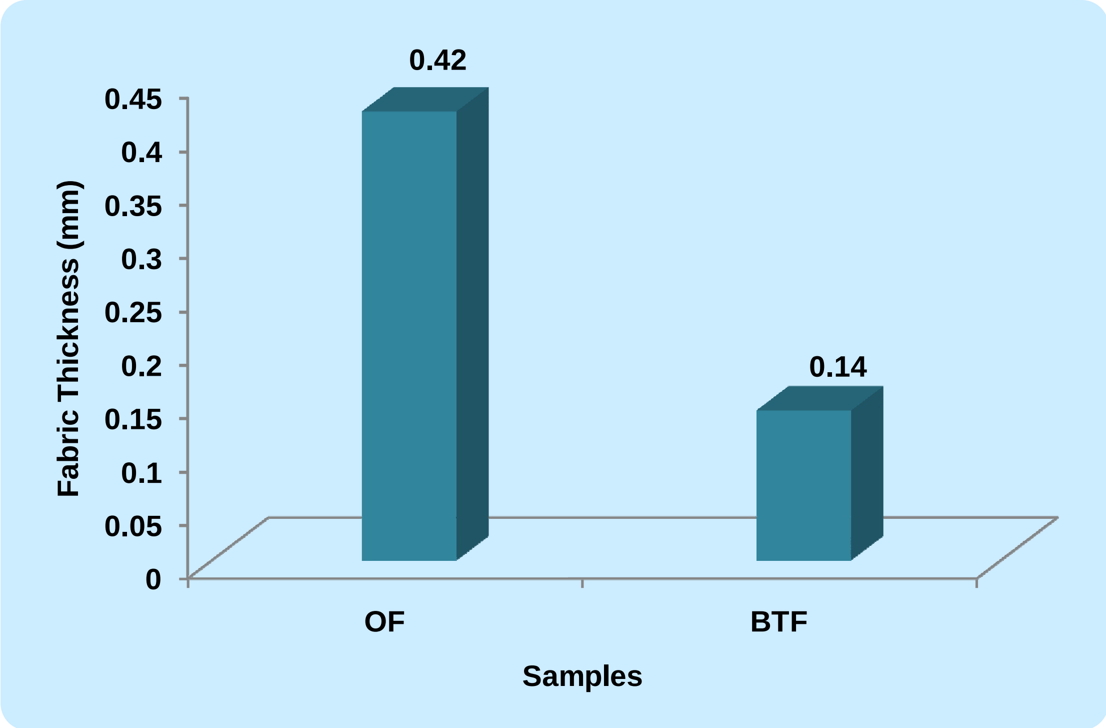


FIGURE – 2

FABRIC WEIGHT

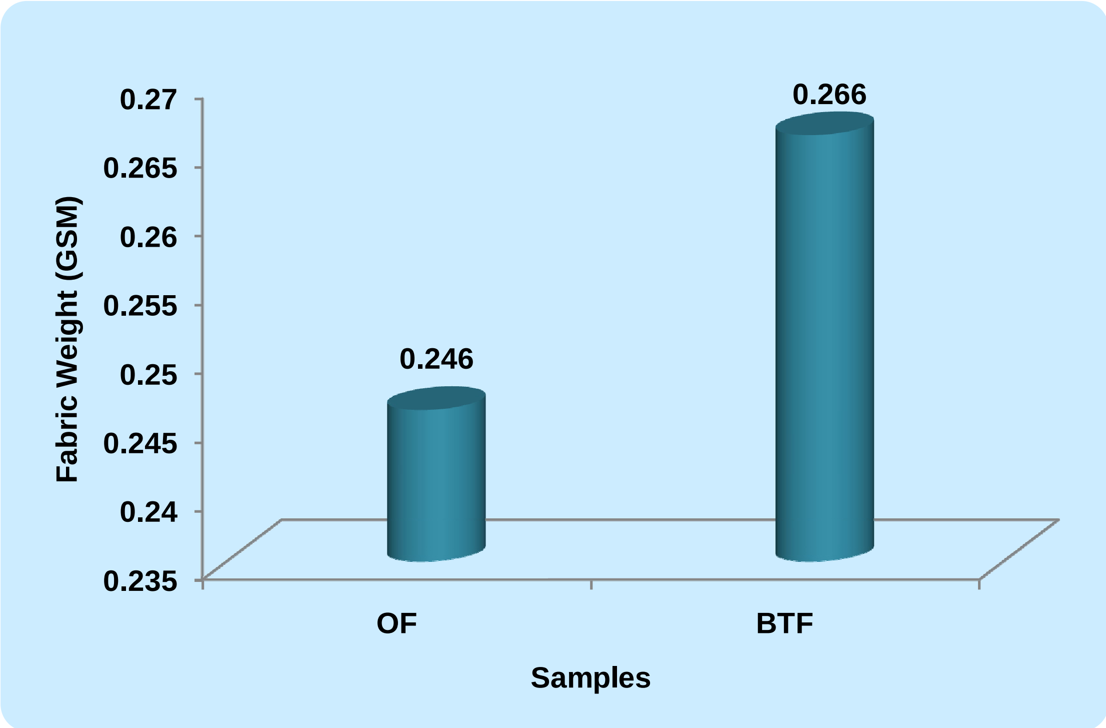


TABLE – IV

TENSILE STRENGTH

Samples	Mean (kg)	SD	Loss/Gain Value	Loss / Gain Percentage	'T' Value
OF	6.6	0.54	0.536	8.043	1.076^{NS}
BTF	7.2	0.83			

NS – Not Significant.

It is clear from the Table – IV and Figure – 3, that the tensile strength of the *Bougainvillea glabra* treated fabric has increased in mean value by 8.04 per cent when compared to the original fabric. From the statistical analysis, it is evident that BTS had no significant difference with 'T' test value of 1.07 per cent. The result proves the fabric to have better strength due to the absorption of the herbal extracts.

Hence it could be concluded that the tensile strength has increased after the *Bougainville glabra* treatment.

4.1.2.2. Fabric Elongation

The result of the fabric elongation and the 'T' value of the original fabric (OF) and the *Bougainvillea glabra* treated samples (BTS) are discussed below in Table – V and Figure – 4.

TABLE – V

FABRIC ELONGATION

Samples	Mean (inches)	SD	Loss/Gain Value	Loss / Gain Percentage	'T' Value
OF	23.2	0.83	1.80	7.75	3.28*
BTF	25	0.70			

* – Significant at 5% level.

FIGURE – 3

TENSILE STRENGTH

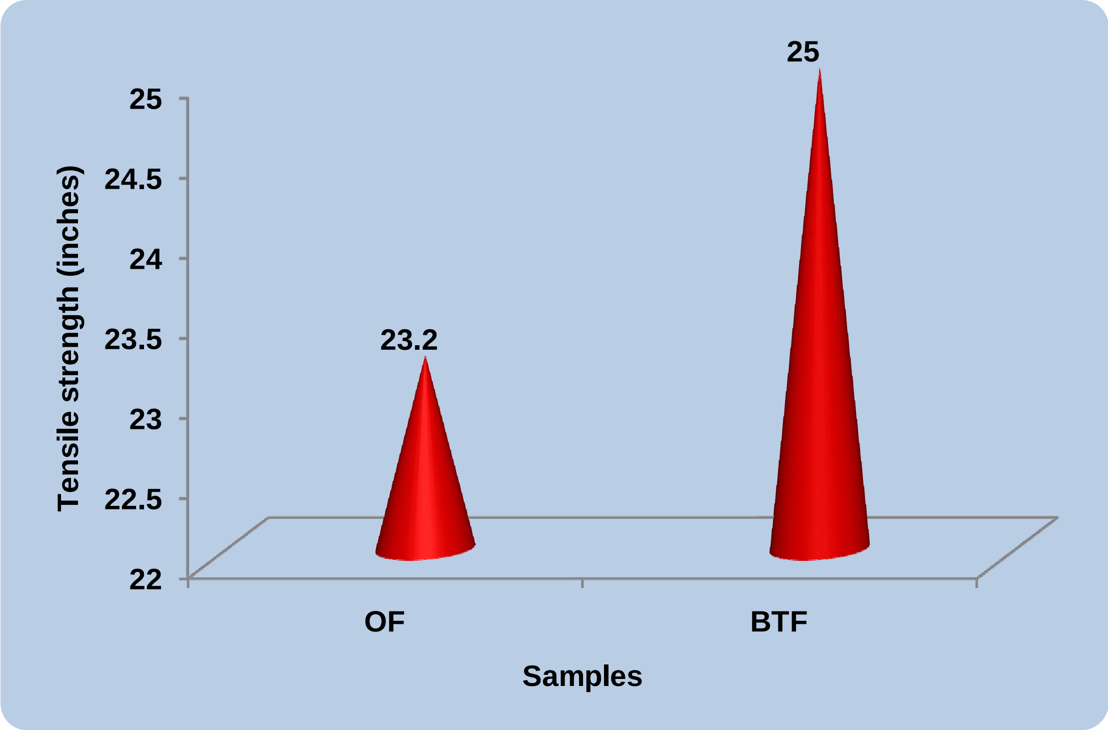
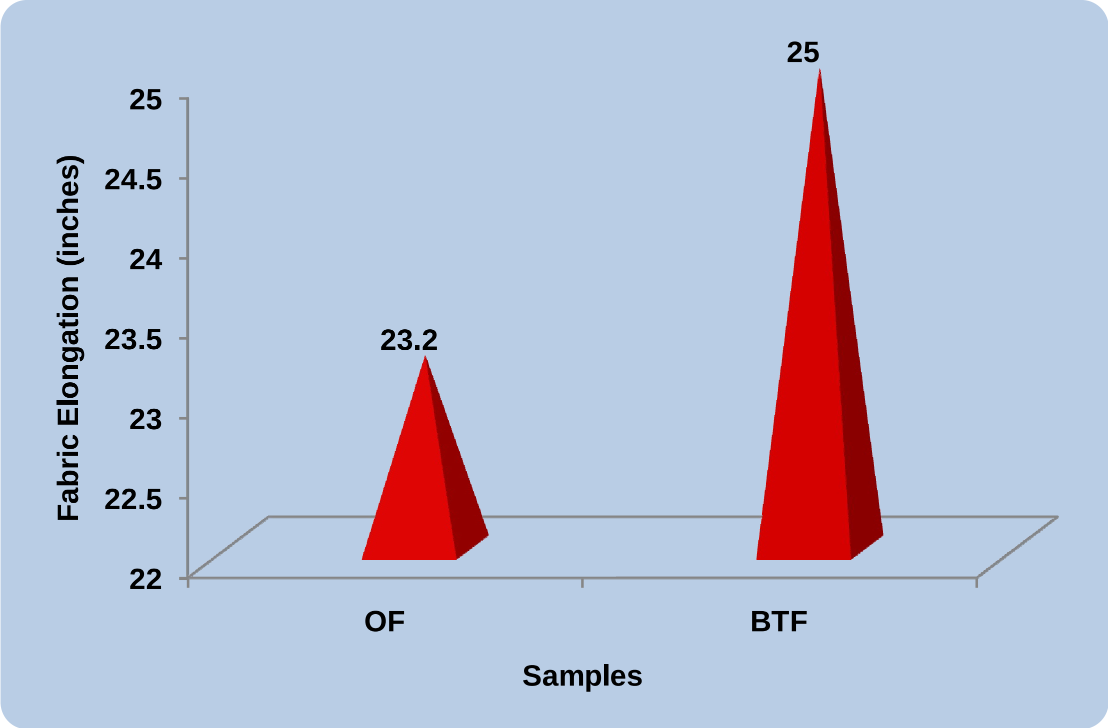


FIGURE – 4

FABRIC ELONGATION



It is clear from the Table – V and Figure – 4, that the fabric elongation of the *Bougainvillea glabra* treated fabric has increased in mean value by 7.7 per cent when compared to the original fabric.

From the statistical analysis, it is evident that BTS had significant difference with 'T' test value of 3.28 at 5 per cent level.

Hence it could be concluded that the fabric elongation has increased after the *Bougainvillea glabra* treatment.

4.1.3 Comfort Properties

4.1.3.1. Fabric Stiffness

The result of the fabric stiffness and the 'T' value of the original fabric (OF) and the *Bougainvillea glabra* treated samples (BTS) are discussed below in Table – VI and Figure – 5.

TABLE – VI

FABRIC STIFFNESS

Samples	Mean (per cent)	SD	Loss/Gain Value	Loss / Gain Percentage	'T' Value
OF	2.49	0.084	0.150	6.024	2.449*
BTF	2.62	0.089			

* – Significant at 5% level.

It is clear from the Table – VI and Figure – 5, that the stiffness of the *Bougainvillea glabra* treated fabric has increased in mean value by 6.02 per cent when compared to the original fabric. Chaudhary (2013) has also found in his study that in general all the treated samples increases its stiffness property. From the statistical analysis, it is evident that BTS had significant difference with 'T' test value of 2.44 and 5 per cent level.

Hence it could be concluded that the stiffness has increased after the *Bougainvillea glabra* treatment, which clearly indicates the deposition of the *Bougainvillea glabra* extract on to the fabric making it more stiffness.

4.1.4 Physical Test for Sanitary Pads

4.1.4.1 Disposability

The disposability test of the original and the treated samples of sanitary pads are discussed below in Table – VII.

TABLE – VII

DISPOSABILITY (IS 5405)

S.No.	Original / Standard Sanitary Pad	Treated Sanitary Pad
1.	PASS	PASS (designated in 50 seconds

Table – VII portray that disposability of both the original and the treated sanitary pads to be good. In case of treated sanitary pads the disintegration was within 50 seconds which reveal the fact that *Bougainvillea glabra* extract treatment did not reduce the disposability property.

Hence it could be concluded that BTS have good disposable property.

4.1.4.2 Liquid Strike Through Time

The Liquid Strike through Time of the original and the treated samples of sanitary pads are discussed below in Table – VIII and Figure – 6.

TABLE – VIII

LIQUID STRIKE THROUGH TIME (ISO 9073-8)

S.No.	Original / Standard Sanitary Pad (seconds)	Treated Sanitary Pad (seconds)	Loss / Gain value	Loss / Gain Percentage
1.	2.46	5.37	2.91	54.18

The above Table – VIII and Figure – 6 illustrate an increase of 54.18 per cent in the liquid strike through time of the treated pads proving the treated pad to have better absorbency, liquid holding capacity.

FIGURE – 5

FABRIC STIFFNESS

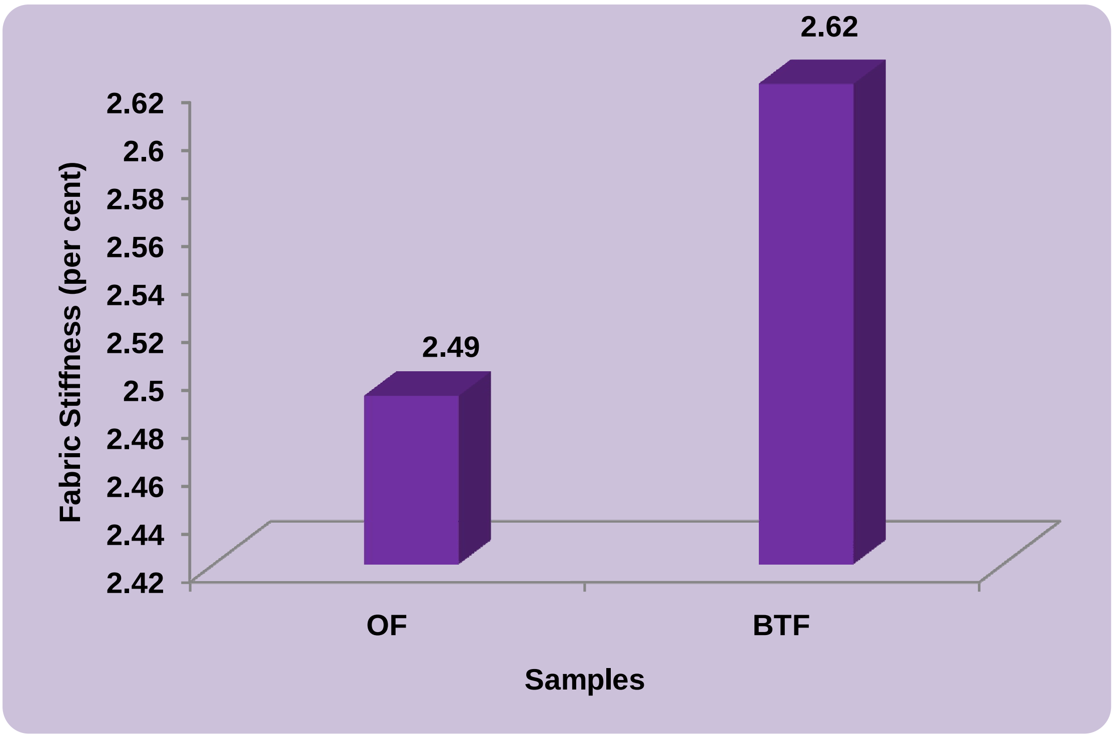
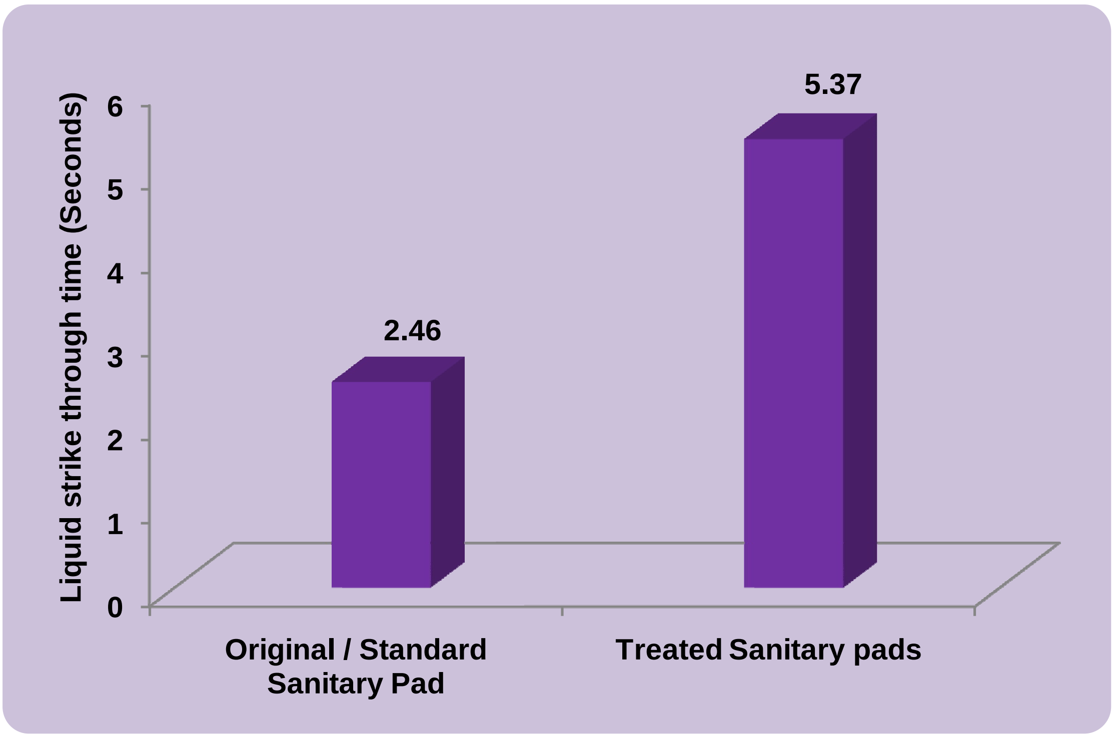


FIGURE – 6

LIQUID STRIKE THROUGH TIME



Hence it could be concluded that there is an increase in liquid strike through time value in the *Bougainvillea glabra* treatment.

4.1.4.3 Wet Back

The wet back of the original and the treated samples of sanitary pads are discussed below in Table – IX and Figure – 7.

TABLE – IX

WET BACK

S.No.	Original / Standard Sanitary Pad (grams)	Treated Sanitary Pad (grams)	Loss / Gain value	Loss / Gain Percentage
1.	3.56	1.62	-1.94	-54.59

The above Table – IX and Figure – 7 depict the wet back of the treated sample has decreased by 54.49 per cent, proving weight loss in the pick up (blotter paper). This proves slower spreading capacity of the liquid due to extract treatment of *Bougainvillea glabra*.

Hence it could be concluded that treating with *Bougainvillea glabra* extract reduces the wet back capacity of the sanitary pads.

4.1.4.4 Run-off

The run-off of the original and the treated samples of sanitary pads are discussed below in Table – X and Figure – 8.

TABLE – X

RUN-OFF

S.No.	Original / Standard Sanitary Pad (grams)	Treated Sanitary Pad (grams)	Loss / Gain value	Loss / Gain Percentage
1.	1.10	6.5627	5.46	83.23

FIGURE – 7

WET BACK

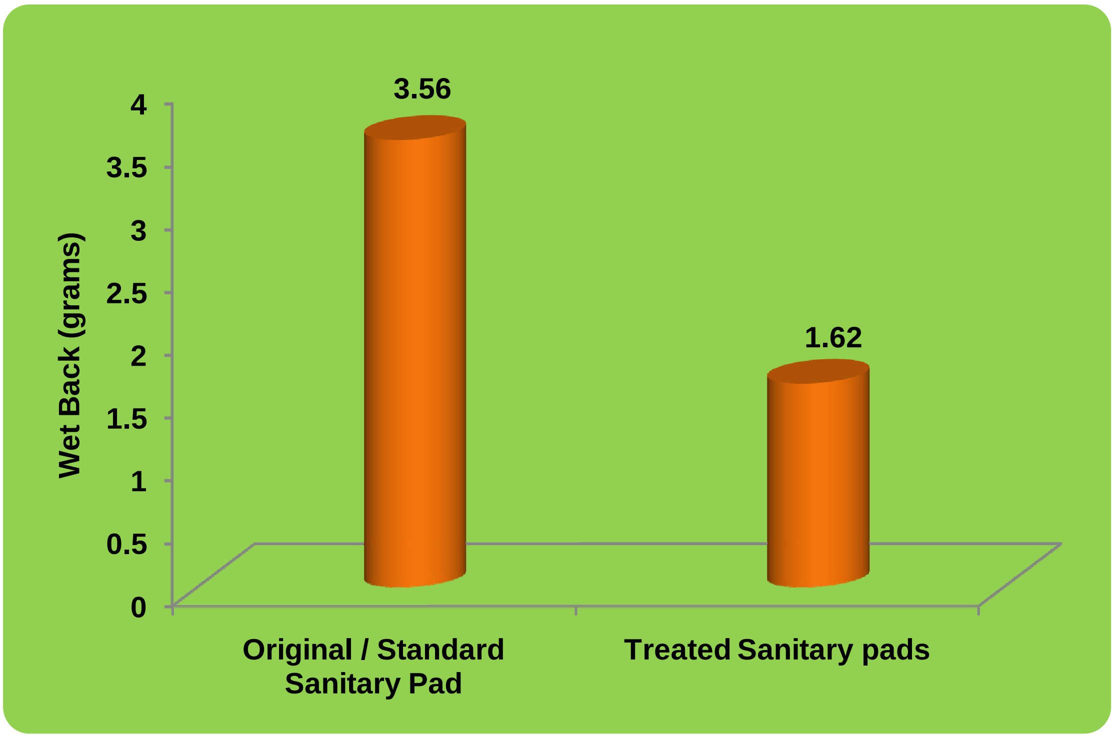
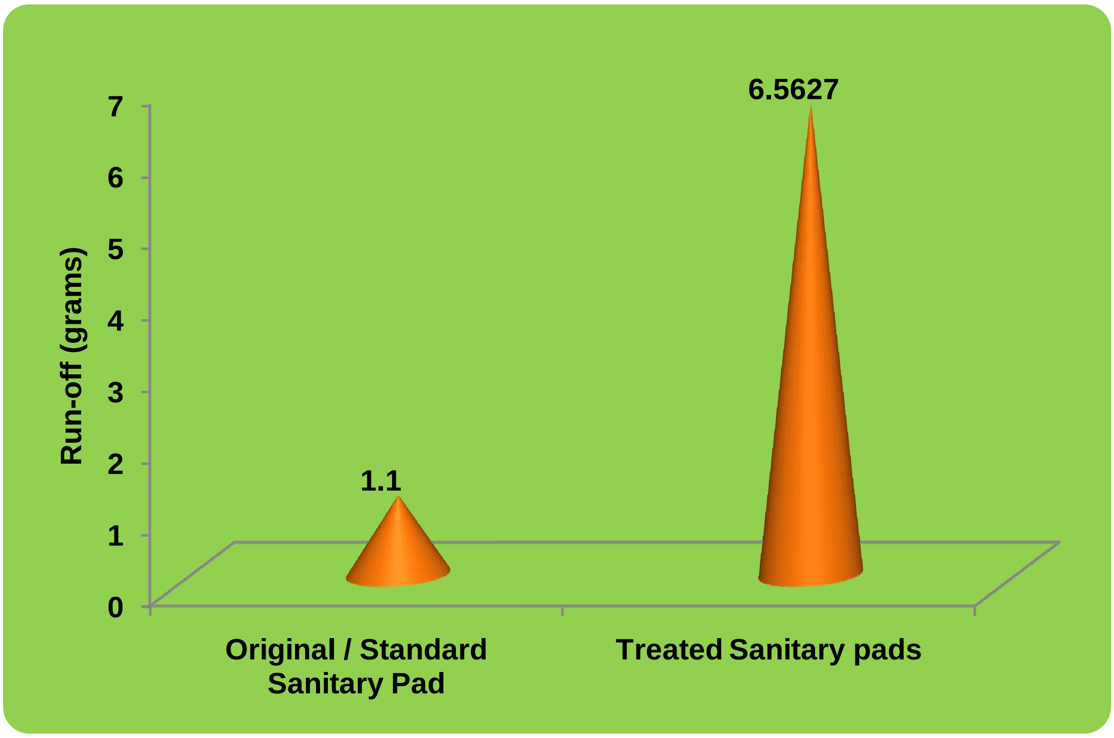


FIGURE – 8

RUN-OFF



The above Table – X and Figure – 8 revealed that the treated sanitary pads shows the increase in the run-off value by 83.23 percentage. The increase in the run-off value proves quick flow of liquid through the layers of the sanitary pads.

Hence it could be concluded that there is an increase in the run-off value for the *Bougainvillea glabra* treatment.

4.1.4.5 Free Swell Absorptive Capacity

The free swell absorptive capacity of the original and the treated samples of sanitary pads are discussed below in Table – XI and Figure – 9.

TABLE – XI

FREE SWELL ABSORPTIVE CAPACITY

S.No.	Original / Standard Sanitary Pad (grams per gram)	Treated Sanitary Pad (grams per gram)	Loss / Gain value	Loss / Gain Percentage
1.	23.38	26.94	-1.44	-5.07

From the above Table – XI and Figure – 9 portrays that the treated pads has decreased in the free swelling absorption capacity by 5.07 per cent. This proves that the amount of fluid absorption has decreased. This may be due to the coating of *Bougainvillea glabra* extract on the top sheet.

Hence it could be concluded that the free swell absorptive capacity has decreased after *Bougainvillea glabra* treatment.

4.1.4.6 Centrifuge Retention Capacity

The centrifuge retention capacity of the original and the treated samples of sanitary pads are discussed below in Table – XII and Figure – 10.

TABLE – XII

CENTRIFUGE RETENTION CAPACITY

S.No.	Original / Standard Sanitary Pad (grams per gram)	Treated Sanitary Pad (grams per gram)	Loss / Gain value	Loss / Gain Percentage
1.	11.78	21.96	10.18	46.35

The above Table – XII and Figure – 10 it is clear that the centrifuge retention capacity has increased by 46.35 per cent. This proves that the liquid retention of the prepared sanitary pad is better.

Hence it could be concluded that the *Bougainvillea glabra* treated polypropylene fabric could be an ideal top sheet for sanitary pads.

4.1.4.7 Absorbency Under Pressure

The absorbency under pressure of the original and the treated samples of sanitary pads are discussed below in Table – XIII.

TABLE – XIII

ABSORBENCY UNDER PRESSURE

S.No.	Original / Standard Sanitary Pad	Treated Sanitary Pad
1.	PASS	PASS

Table – XIII gives a clear picture that the original and treated sanitary pad has good absorption of liquid under pressure. This reveals that the treated pads could be ideal for usage with reference to day to day activities and heavy flow.

Hence, could be concluded that the *Bougainvilla glabra* treated sanitary pad has good absorbency under pressure.

FIGURE – 9

FREE SWELL ABSORPTIVE CAPACITY

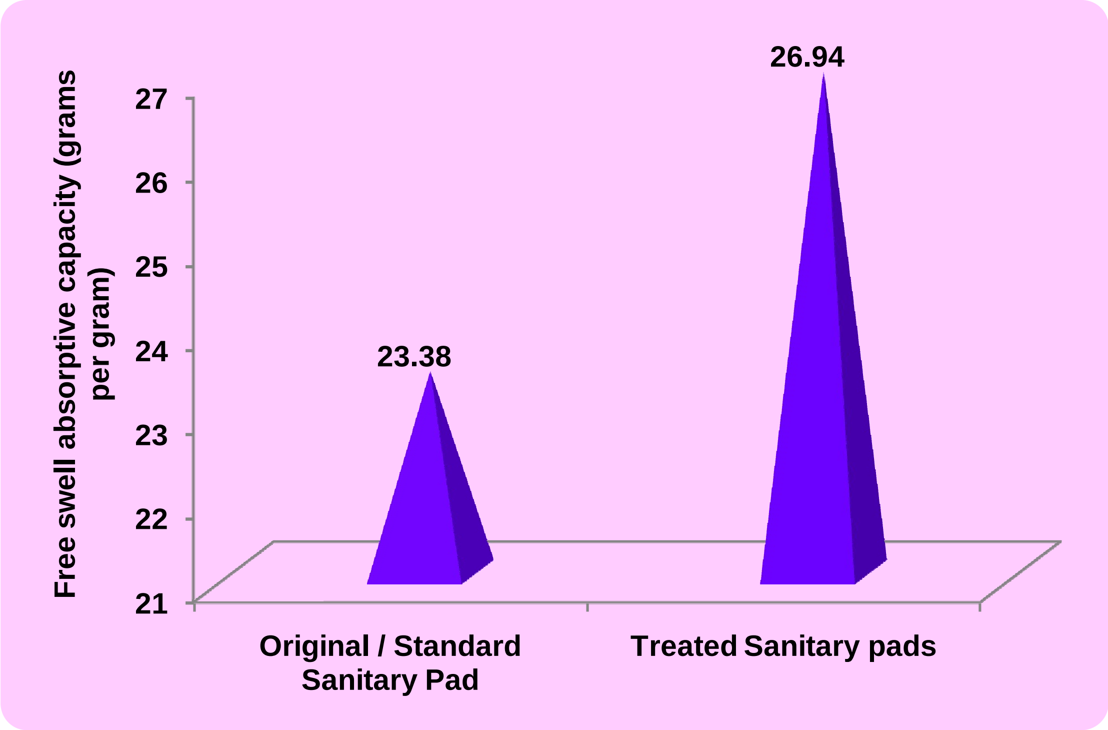
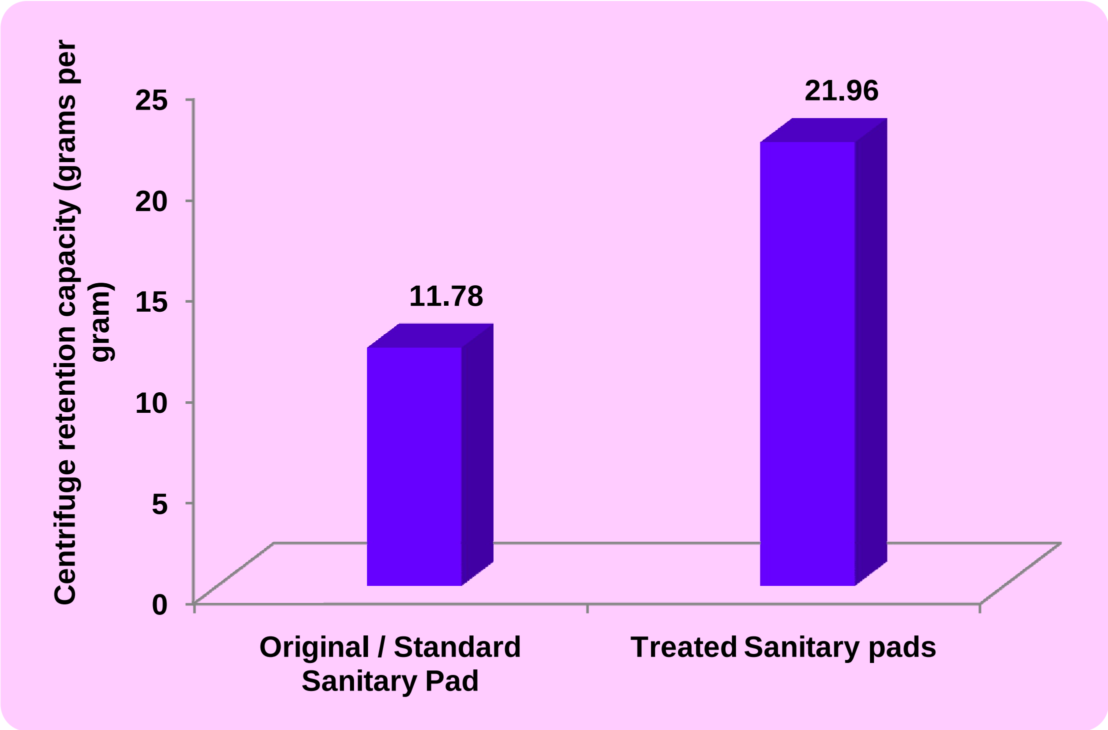


FIGURE – 10

CENTRIFUGE RETENTION CAPACITY



4.1.4.8 pH

The pH of the original and the treated samples of sanitary pads are discussed below in Table – XIV.

TABLE – XIV

pH

S.No.	Original / Standard Sanitary Pad	Treated Sanitary Pad
1.	6.5	6.5

The above Table – XIV depicts that the pH of the original and treated sample which is 6.5. Since there is no change and the value is within the standard, it could be concluded that the *Bougainvillea glabra* treated extract did not affect the sample.

4.2 ANTI-BACTERIAL ACTIVITY

The anti-microbial effect of various concentrations of the *Bougainvillea glabra* sources was tested by agar diffusion test method. The zone of inhibition is given in Table – XV and Figure – 11.

TABLE – XV

ANTI-BACTERIAL TEST

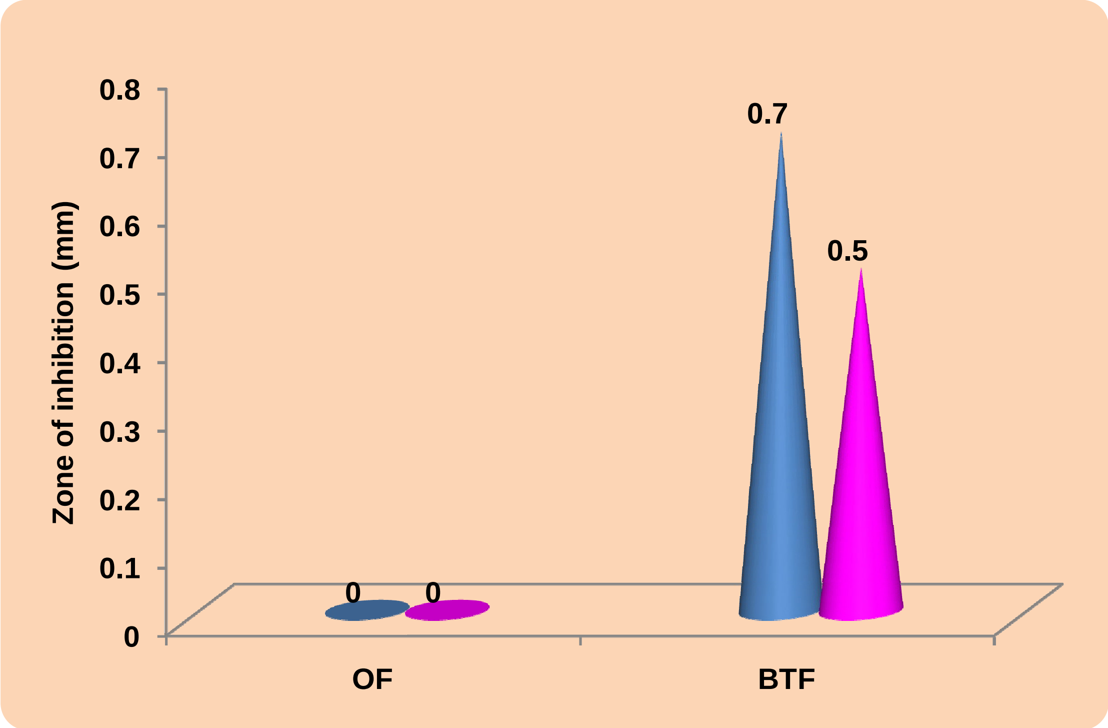
S.No.	Sample	Zone of Inhibition (mm)	
		S. aureus	***E. coli***
1.	OF	0	0
2.	BTF	0.7	0.5

From the Table – XIV and Figure – 11 it is clear that the zone of inhibition was found to be 0.7 mm and 0.5 mm for *Staphylococcus aureus* and *Escherichia coli*, respectively. This is shown in Plates – VII and VIII. The above zone of inhibition shows *Bougainvillea glabra* to have antibacterial activity especially against *Staphylococcus aureus* and *Escherichia coli*.

Hence it could be concluded that the herb *Bougainvillea glabra* has antibacterial property, which could be incorporated in polypropylene fabric which could be used as top sheets for sanitary pads.

FIGURE – 11

ANTI-BACTERIAL TEST



5. SUMMARY AND CONCLUSION

INTRODUCTION

Puberty is a vital change that every girl child experience between ten and seventeen years. They undergo menstruation, it is a periodic flow of blood and cells from the uterus forever 28 days. So people use huge number of sanitary pads at the time of menstruation. These sanitary pads were mainly made up of rayon, viscose and cellulose blood fluff pulp and organic cotton. In which rayon and viscose present a potential danger cause because they are highly absorbent fibres, which can stick to the virginal wall. Similarly in cotton many chemicals are been used because for the white appearance on the sanitary pads and some different fragrance are also been used which may cause harm to our skin. Sanitary pads contain plastics, scents and chemicals that leads to the development of irritation, redness, rashes as a result of skin to skin exposure. Therefore plant extract finished sanitary pads is more important. Considering the above points a study entitle **"ASSESSING THE ANTI-BACTEIRAL ACTIVITY OF *Bougainvillea glabra* LEAF EXTRACT AND ITS APPLICATION ON SANITARY PADS"** was planned with the following objective :

OBJECTIVES

- Selection of the anti-bacterial source.
- Extraction of solution for herbal treatment.
- Optimization for extraction and anti-bacterial property.
- Preparation and evaluation of sanitary pads.

METHODOLOGY

Selection of Fabric

Polypropylene spun bond nonwoven fabric was selected for the study because it can be easily fabricated, very high tensile strength and good properties as compared with other fibres.

Preparation of Leaf Extract

The leaves of *Bougainvillea glabra* were collected around the Race Course Area of Coimbatore. The leaves were cleaned with water as to remove the external particles and the extract was prepared using ethanol.

Ten grams of leaf extract was taken in conical flask and mixed with 100 ml of ethanol. The conical flask was kept in shaker incubator at 40°C for overnight. Then the solution was filtered using filter paper.

Optimization of Various Parameters

In order to optimize the time, temperature and concentration pilot study was carried out. The optimum range were 20, 40 and 60 gm / 100 ml, 40, 50 and 60°C and 1, 3 and 5 hours. Once the samples were finished with the above mentioned conditions, the polypropylene fabrics were subjected to antibacterial test by agar diffusion test. Bsed on the zone of incubation the selected parameters for *Bougainvillea glabra* are 60 grams / 100 ml, 60°C and 5 hours.

Finishing of the Fabric

Following the above selected conditions the herbal extract were applied on the selected polypropylene spun bond nonwoven fabric by padding mangle technique. The extract solution was poured inside the padding mangle and the fabric was passed inside the machine. The temperature was set at 60°C and the fabric was cured for 15 minutes for the good penetration of the finding agent. Then the fabric was removed from the curing chamber washed thoroughly and was dried under the shade. The finished fabric was tested for their properties. With the use of finished fabric the sanitary pads was prepared and its performance was also analysed.

Preparation of Sanitary Pads

Sanitary pads were produced using the prepared finished polypropylene spun bond nonwoven fabric. Sanitary pads were prepared by ongoing three stages namely : Defibration, core formation, and soft touch seating. In the defibration process the cellulose material is grained for 1 – 2 minutes. With the compression the core material becomes fluffy. In the core formation, the core material is mould in position and compression is done manually. In soft touch sealing, the core is wrapped in the treated fabric and sealed along its length by putting the heat-sealing press. Finally, the post-production is done by the use of UV sterilization and the sanitary pad is prepared.

Fabric Evaluation

The prepared polypropylene spun bond nonwoven fabric were analysed for its thickness, weight, tensile strength, elongation and stiffness.

Product Evaluation

The prepared sanitary pads was evaluated for disposability, liquid strike through time, wet back, run-off, free swell absorptive capacity, centrifuge retention capacity, absorbency under pressure and pH.

Findings of the Study

- Thickness of the *Bougainvillea glabra* treated fabric has decreased in the mean value by 1.4 per cent. The loss in the thickness may be due to the expansion of the fibres.

- There was 8.13 per cent increase in the weight of the treated sample when compared to the original sample which might be due to the deposition of *Bougainvillea glabra* extract treatment.

- The result of the tensile strength test reveals that there is increase in strength of the treated fabric by 8.043 per cent. The absorption of the herbal extract improved the strength of the fabric.

- There is a increase in the elongation of the TF with 1.80 inches comparatively. The value of proves that there is significant at 5 per cent level.

- Due to the deposition of the *Bougainvillea glabra* extract the stiffness of the fabric have increased 6.024 per cent.

- The disposability test reveals that the *Bougainvillea glabra* treated sanitary pads have disintegrated in 50 seconds proving that the sanitary pads have good disposability.

- There was an increase in liquid strike through test of the treated sanitary pads by 54.18 per cent, when compared with original sanitary pads.

- The wet back test shows that there was a decrease in weight of the treated sanitary pad by 54.49 per cent proving weight loss in the pickup paper (blotter paper).

- There was an increase in the run-off value which proves a quick flow of liquid through the layers of the treated sanitary pads.

- The BTS has decreased in the free swell absorptive capacity by 5.07 per cent due to the coating of *Bougainvillea glabra* extract on the top sheet.

- The centrifuge retention capacity of the treated sanitary pads increased by 46.35 per cent proving that there was a better liquid retention capacity.

- The treated sanitary pads have good absorption under pressure making it ideal for day-to-day activities.

- The pH value of the TS has no change. Since the pH values of both original pad and the treated pad was 6.5 which falls within the standard.

Conclusion

In the modern scenario, human beings has to protect their body from germs and bacterias at the time of puberty. The use of normal sanitary pads creates many problems in our skin such as reddishness and rashes. To protect and avoid skin problems. This research has thus focused on antibacterial skin friendly herbal treated sanitary pads are produced. The results of the study has focused on the use of natural source, *Bougainvillea glabra* extract for anti-bacterial activity. The study has proved to have an excellent property in the herbal treated sanitary pads.

Limitations

- Toxicity test was not carried out due to time constrain.
- The investigator was unable to get the approval for the research from the human ethical committee and hence test the prepared sanitary pads against humans.

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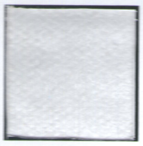
APPENDIX – I

DETAILS OF THE SAMPLE



ORIGINAL FABRIC

Bougainvillea glabra TREATED FABRIC

APPENDIX – II

SANITARY PADS TEST REPORT

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

P.B.No.3205, 13/37, Avinashi Road, Aerodrome P.O., Coimbatore - 641 014, INDIA

Ph: (0422) 2574367-9, 6544188, 4215333 Fax : (0422) 2571896, 4215300

E-mail : info@sitra.org.in Website : http://www.sitra.org.in

Address all correspondence to the Director

Fabric Report No. : 469 The Registrar

Samples Tested at : R.H. 65% +/- 2% and Temp. 21 Degree C +/- 1 Degree C

Sample No.	C_1785			
Sample Particulars	2nd Sample BOUGAINVILLEA TREATED S.N			
Disposability *IS 5405* Pass/Fail	**Pass** : The sample is disintegrated into several pieces in 50 seconds			
Liquid Strike Through Time *ISO 9073-8* Seconds	5.37			
Wetback *ISO 9073-14* Grams	1.62			
Run-off *ISO 9073-11* Grams	6.5627			
Free Swell Absorptive Capacity *WSP 240.2* Grams per Gram	26.94			
Centrifuge Retention Capacity *WSP 241.2* Grams per Gram	21.96			
Absorbency Under Pressure *WSP 243.2* Pass/Fail	**Pass** : 30ml of Coloured liquid is absorbed in 2 minutes, there is no leakage at the bottom and sides of the napkin			
pH pH	6.5			

End of Report