WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

DEVELOPMENT OF COOLING EFFECT AND ANTI-ODOUR FINISH FOR SPORTSWEAR APPLICATION.

Dr. Janarthanan[1], Dharani Dharan S[2], Manojkumar V[2], Kavinkumar E[2]

Assistant Professor[1] Department of Textile Technology, Bannari Amman Institute of Technology, Erode, India.
Janarthanan@bitsathy.ac.in
Students[2], Department of Textile Technology, Bannari Amman Institute of Technology, Erode, India.
dharanidharan.tx20@bitsathy.ac.in

ABSTRACT :

Athletes highly value sportswear that provides breathability, controls odors, and wicks away moisture. These features are crucial for ensuring they stay comfortable and perform at their best during workouts. By wearing sportswear athletes can stay cooler, drier, and more comfortable, which can help them to perform at their best. Sportswear is evolving to combat unpleasant odors caused by sweat. Textile innovations now include cooling and odor-neutralizing properties. These advancements enhance freshness and sustainability, benefiting both athletes and active individuals. Over the years, nanotechnology in the textile industry has become increasingly popular in the commercial market. This involves using the unique properties of Nano-materials to enhance the performance of textiles. Combining the two-layer sports fabric of palm leaf and lavender essence with a ratio of 100:100 and applying it to organic cotton fabric using Nano finish gives it a cooling and anti-odor finish. When wearing sportswear treated with nanotechnology, experience the dual benefits of cooling and anti-odor properties. Stay refreshed during physical activity as the fabric provides both a cooling sensation and a pleasant fragrance, combating sweat and discomfort. The extract is applied to the organic cotton knitted fabric with a cooling and anti-odor finish, providing refreshment to the body and enhancing comfort. Mint leaf and lavender flower extract have the potential to be useful in the areas of food, cosmetics, antimicrobial, and pharmaceutical industries.

Keywords: Cooling finish, Fragrance finish, Scanning Electron Microscope, Colour fastness, Soxhlet method, Rubbing Fastness, Air permeability, Water drop test.

I INTRODUCTION :

In today's world, technology is used in many ways. The active wear industry is always changing to meet the needs of athletes and fitness enthusiasts. As more people exercise, they want clothes that are both comfortable and practical. Athletes care a lot about staying warm and managing odour. When you sweat during exercise, it can make you feel too hot and uncomfortable, which can make it hard to perform well and stay motivated. Plus, sweat can lead to bad smells if bacteria start to grow, which can make you feel less clean and confident. Our innovation helps solve these problems with sportswear. Sweating can cause rashes and bad smells, but our clothes have special finishes made from mint and lavender flower extract. These finishes cool you down and stop bad odours, making you feel refreshed and more comfortable.

To develop the cooling and anti-odour finish sportswear application using mint leaf and lavender essence represents a significant in protective sportstech technology. The main purpose of the sportswear is to stay refreshed during physical activity, and to increase the pleasant fragrance, combating sweat and discomfort. The mint leaf and lavender flower contain cooling properties and a pleasant fragrance, which help reduce bad smells from our body and prevent them from being noticeable to others.

The main purpose of the t-shirt is to keep the player comfort cooling and improve anti-odour growth. The mint leaf and lavender essence contains phytochemical compounds such as flavonoids, phenolic acids, volatile oils, linalyl acetate, coumarin, caffeic acid, and camphor that will help in the inhibition growth of antimicrobial activity. In this paper, the antimicrobial cooling finish and anti-odour is applied on the double cotton knitted fabric used to develop sportswear application.

The combination of mint leaf and lavender flower not only offers practical benefits but also aligns with the growing trend of eco- friendly. As safety and comfort are paramount in the realm of sportswear application, the develop make a significant impact. The extraction is applied to the fabric for imparting Nano-particle activity.

II MATERIALS :

The mint leaf and lavender flower was brought at local markets in Sathyamangalam, Erode. The enzymes used for the extraction process are pectinases, cellulases. Methanol can be used for the extraction process. All chemicals were used in this process for laboratory grade and were purchased from National Scientific Chemicals Private. Limited, Erode.

III METHODS OF MINT LEAF AND LAVENDER FLOWER :

In this process the leaf was detached from mint stem and the leaf is grinded separately
in the powder forms and dry the powder at room temperature as show in figure 1(a). The lavender flower was extract by cutting to just above the bottom two sets of leaves on each green stem, and store it in a glass plate for subsequent process as shown in Figure 1(b). The flow process for the extraction of mint leaf powder and lavender essence is shown in Figure 2.

Mint Leaf (a) Lavender flower (b)

Figure 1 Mint Leaf and Lavender flower.

quarters

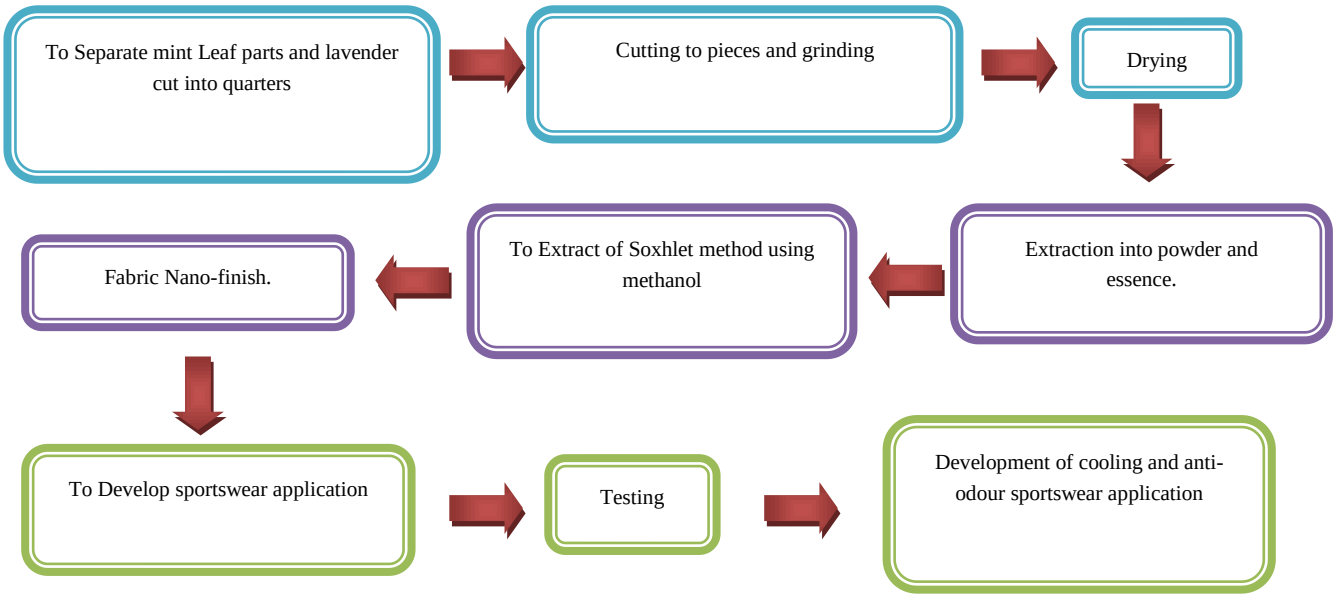

Figure 2 Flow chart of mint leaf and lavender flower.

3.2 SOXHLET METHOD :

The Soxhlet extraction method, performed with 10 cycles, involves the continuous process of isolating organic compounds from solid samples using a solvent in each cycle; a thimble is used to hold a solid sample, positioned above a boiling flask filled with the extraction solvent. As the solvent in the boiling flask is heated and vaporized, it rises through a condenser, condenses, and drips back into the thimble, extracting the target compounds. After a certain solvent level is reached in the boiling flask, a siphoning action begins, pulling the solvent back into the flask while leaving behind the extracted compounds in the thimble. This process repeats for a predetermined number of cycle upto 10 times allowing for the accumulation and concentration of the extracted compounds in the thimble. Finally, the concentrated extract can be recovered by evaporating the solvent, yielding the desired organic compounds.

Figure 3 Extraction using Soxhlet Method

3.3 QUALITATIVE ANALYSIS OF BIOACTIVE COMPOUNDS.

- When a small sample of mint and extracts is subjected to the addition of a few drops of concentrated HCl, followed by the addition of magnesium powder. The appearance of a pink, violet, and red color specifies the existence of flavonoids.
- The mint leaf and extract trace was observed on a filter paper, and a droplet of the phosphomolybdic acid reagent was applied onto the position. After exposure to ammonia fumes, the appearance of a blue color confirmed the presence of phenols. In addition, when a few droplets of a 1% (FeCl3) ferric chloride, A remedy was added to a small portion of the sample, the observation of a bluish-green and violet color showed phenolic compounds existence.
- To extract volatile water from lavender, start by taking 200 grams of dried lavender leaf powder sifted through a fine filter. Place it in a round-bottomed flask and add 600 millilitres of distilled water. Use a volatile oil extractor following XD extraction standards. Collect the resulting distillate and extract it using diethyl ether. Afterward, dry the extracted liquid with anhydrous sodium sulphate. The resulting volatile oil will be an oily liquid with a faint yellow color and a rich fragrance. The water content extracted from the lavender is 3.25%.
- After adding 25 ml of chloroform to the crude lavender extract, the combined solution was dried over anhydrous Na2SO4 and then evaporated under reduced pressure to yield a crude product. This crude product was subsequently purified using column chromatography on silica gel as the adsorbent. Elution of the column with a solvent mixture consisting of petroleum ether (boiling point range 60–80°C) and diethyl ether (in a ratio of 9:2) resulted in the separation of a mixture containing compounds 3 and 4.
- After immersing 1 gram of powdered lavender material in 500 millilitres of aqueous ethanol (80%) and shaking it for 1 hour at room temperature, the resulting solution was filtered. The liquid phase was then evaporated under vacuum at a low temperature (30°C). Following this, the residue was dissolved in acetate buffer (pH 5) and hydrolyzed for 4 hours with 0.3% emulsion at 37°C. Subsequently, the solution was acidified to pH 2.0 using HCl.

3.4 ANTIMICROBIAL PROPERTY OF MINT LEAF POWDER AND LAVENDER FLOWER

The MICs and MBCs values were controlled using the agar dilution technique. One hundred micro-liters of inoculums contains approximately 5×105 CFU/mL of test bacteria were added to both well against the two pathogenic organisms for testing (Staphylococcus aureus and Escherichia coli), 48 hours were spent processing micro-plates at 45°C. The lowest concentration was identified as the minimal inhibitory concentration (MIC). The excerpt that exhibited inhibition of visible bacterial growth. For determination of MBC, 30 µL of the suspension of Well before MIC of the extract were cultured on agar using the agar dilution technique. By counting the number of bacterial colonies after 24 hours of growth at 45°C, the MBC were assessed.

Mint leaf powder and Lavender essence are prized for their potent antimicrobial properties due to the presence of bioactive compounds like phenols, flavonoids, volatile oil, linalyl acetate, and coumarin. These compounds display strong antibacterial, antifungal, and antiviral effects, making them valuable for medicinal and cosmetic uses. phenols, flavonoids in Mint leaf powder contributing to its potent medicinal properties. These compounds are known for their antioxidant and anti-inflammatory effects, enhancing the therapeutic benefits of mint in traditional herbal remedies and modern pharmacology. The scent of lavender comes from its volatile oils, which are important parts of the plant. These oils give lavender its special smell and also have healing properties. linalyl acetate contributes to its characteristic scent, enhancing its floral and sweet notes. Additionally, linalyl acetate is believed to have calming and relaxing properties, coumarin may be used as a supporting note in fragrance compositions to add depth and richness to the overall scent profile. The combination of these bioactive compounds in Mint leaf powder and Lavender essence not only provides robust protection against microbial 11 infections but also supports wound healing, skincare, and overall health. Their antimicrobial strength, along with other therapeutic benefits, underscores their importance in both traditional and modern medicine.

3.5 SCOURING

Scouring, the initial step in fiber and textile preparation provides several key benefits. Firstly, it eliminates impurities like oils, dirt, and lingering chemicals, creating a cleaner surface for subsequent treatments. Secondly, it improves dye absorption, ensuring textiles display vivid and even colors. Thirdly, it enhances the penetration of chemicals in subsequent processes, elevating overall textile quality. Lastly, scouring prevents defects and inconsistencies in the final products, promoting the textile production standard.

In the scouring method for double cotton knitted fabric, is treated with pectinases, and emulsifier are used for the fabric scouring. The quantity of the enzyme is calculated as per the weight of the fabric. The process occurs at a 60°C temperature for 30 minutes. The Sequestering agent and wetting agent ranges from 1g/L. This process removes natural impurities, present in the fabric such fabric is used for subsequent processing.

Figure 4 Scoured fabric

3.6 BLEACHING

Bleaching plays a crucial part in the paper and textile industries, providing notable benefits. Firstly, it efficiently eliminates stains, colorants, and contaminants from fibers and materials, resulting in a brighter and uniform look. Secondly, it enhances the whiteness of textiles and paper, enhancing their visual appeal. Moreover, it can boost absorbency and printability, expanding their usefulness. Lastly, bleaching prolongs the lifespan of textile and paper goods by curbing discoloration and deterioration over time.

In the bleaching process for double cotton knitted fabric, is treated with cellulases are used for the fabric bleaching. The quantity of the enzyme is calculated as per the weight of the fabric. The process occurs at a 55°C temperature for 55 minutes. The pH value of the bleaching is 4-5.

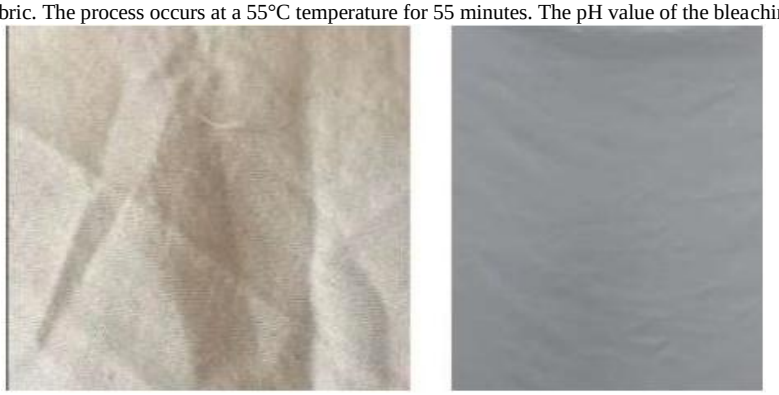

Figure 5 Bleached fabric

3.7 FINISHING

The application of an antimicrobial finish of mint leaf and lavender esence to fabrics can be achieved using the padding mangle process. The essential features of these padding machines involve immersing the fabric initially into the solution contained within the trough and then subjecting it to compression. Applying pressure at the nip aids in the solution permeating the fabric thoroughly, aloevera gel were applied through the padding mangle at the pressure of 3-4 bar, maintained at a constant temperature of 60°C. The finished organic knitted cotton fabric was processed through a curing chamber at the temperature of 110°C-120°C for 2-3 min.

IV RESULTS AND DISCUSSION :

4.1 BIO-ACTIVE COMPONENTS OF MINT LEAF POWDER AND LAVENDER FLOWER

Table 1 shows the bioactive compounds of mint leaf powder and lavender flower. The result shows that the blending of mint leaf powder and lavender

flower has the higher amount of total present of flavonoids, phenolic acids, volatile oils, linalyl acetate, coumarin, and camphor are responsible for the higher amount of antimicrobial activity.

Both mint leaf powder and lavender flower are packed with bio-active components that offer a wide range of health and skincare benefits. Mint leaf powder typically contains antioxidants, vitamins, and dietary fiber, which collectively combat oxidative stress and promote overall well-being while supporting digestive health.

In contrast, Mint leaves offer a strong, refreshing aroma and medicinal benefits, perfect for flavouring foods and aiding in traditional remedies. Lavender flowers, prized for their sweet scent properties, they are commonly used in herbal remedies and antimicrobial attributes make it an effective remedy for minor burns and skin irritations, further enhancing its skincare benefits.

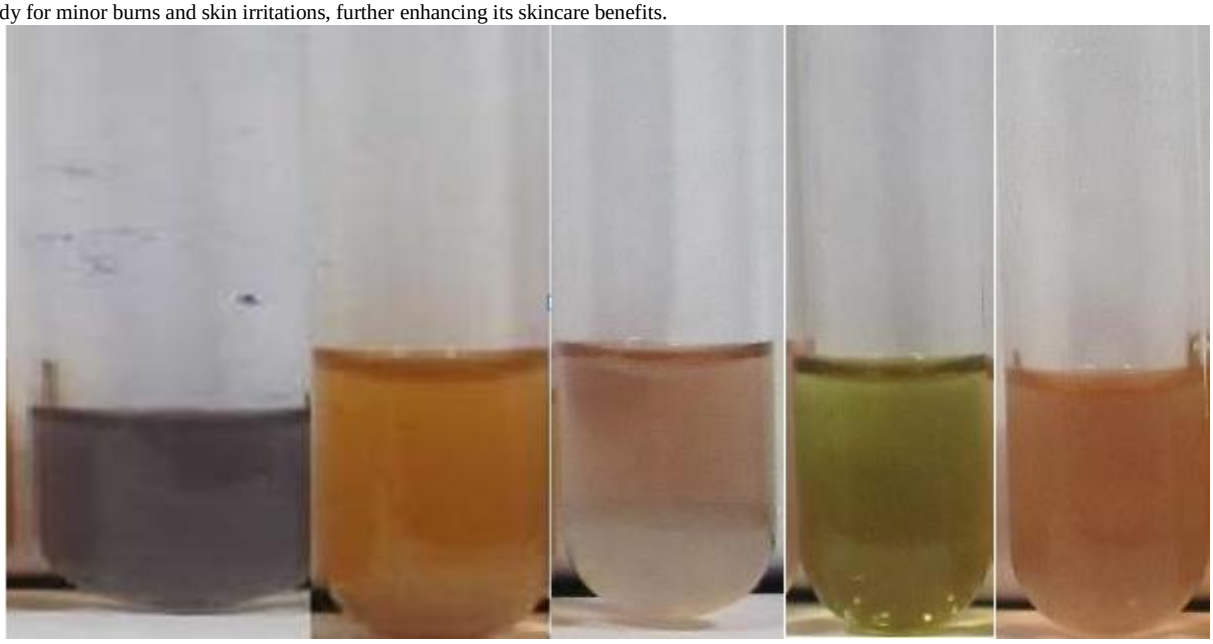

Figure 6 Bioactive compounds of mint leaf powder and lavender flower powder.

Table 1 Bioactive compounds assessment of mint leaf powder and lavender flower powder.

S.No	Bioactive Compoundsof mint leaf and Lavender flower	Inference	Results
1	Flavonoids	Light red colour	present
2	Phenol	Violet	present
3	Volatile oils	Light red	present
4	Linalyl acetate	Light green	present
5	Coumarin	Light brown	present

4.2 ANTI-ODOUR (FRAGRANCE) FINISH

The fragrance retention and durability of double cotton knitted fabrics treated with fragrance finish, specifically focusing on lavender, were assessed after three washing cycles. The results indicated a considerable release of lavender scent, up to 27.8%, without the addition of AgNp.

To enhance the fragrance release rate, the fabric was further treated with silver nanoparticles and β-cyclodextrin (β-CD). The presence of β-CD played a significant role in this improvement, as its cavities can form inclusion complexes with various molecules, including those from lavender. The dimensions of the β-CD cavities allowed for a perfect fit with the lavender molecules, thereby facilitating a more efficient release of the fragrance.

Table 2 Scent intensity rating of finished cotton

Techniques	0 h	2 h	4 h	6 h	12 h	24 h	48 h	72 h
β-CD	4	3	5	4	3	2	2	2

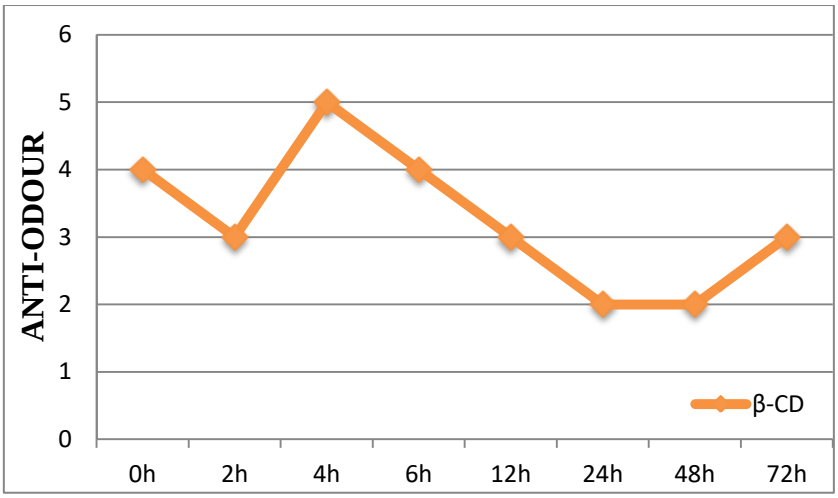

Figure 7 Scent intensity rating

4.2 WASHING FASTNESS

The washing fastness test is employed to ascertain the capacity of an double cotton knitted finished fabric, treated with both mint and lavender extracts, to uphold its color after enduring 20 washes. Any alterations in color can significantly impact both the fabric's functionality and its visual allure. The outcomes of the test, as detailed in Table 5, demonstrate the resilience of the extract absorbed within the intermolecular structure of the cotton fabric. Remarkably, even after 20 washings, the extract proves steadfast, permeating evenly within the fabric's pores.

Table 3 Washing fastness test

S.no	Cycle of washing	Fabric type	Evaluation the colour change grade	Evaluate the staining grade
1	5	100% Double Cotton knitted finished fabric	5	5
2	10		5	5
3	15		4.5	4
4	20		4.5	4

4.3 RUBBING FASTNESS MINT TREATED FABRIC

Rubbing fastness test is used to determine the ability of a double cotton knitted
finished fabric to retain its color after repeated rubbing on both wet and dry samples. The test
outcomes are provided in Table 4.

The test results show that the rubbing fastness properties of dry samples are good compared to wet samples. In wet samples, the finishing of extracts present on the interstices of the fabric are slightly removed after repeated rubbing as per the ASTM (08) standards.

Table 4 Rubbing fastness test

S.no	Fabric type	Finished fabric

		(wet)	(dry)
1	100% double Cotton knitted finished fabric	4	4-5
2		4	4-5
3		4	4-5
4		4	4-5

4.4 WATER DROP TEST

The water drop test was performed on both unfinished and finished double knitted cotton fabrics. The test results indicate that the finished fabric absorbs less water than the unfinished fabric, and it takes around 10-12 seconds to penetrate into the fabric.

The fabric's finishing treatment enhances its water resistance by infiltrating the interstices and reducing pore size. The untreated fabric absorbed water within 2 seconds during the water drop test, while the finished fabric required 4 seconds, indicating a significant improvement in water-repelling capabilities.

Table 5 Water drop test

S.no	Fabric type	Unfinished fabric (sec)	Finished fabric (sec)
1	100% double Cottonknitted finished fabric	2	4
2		1.5	3
3		4	6
4		3.5	5.2

4.5 AIR PERMEABILITY

The concept of air permeability is a fabric to permit the passage of air to pass through

and also indicates breathability of the fabric. Cotton fabric is typically a plain weave structure, which means that air can easily pass through both finished and unfinished fabrics. However, the test results show that the amount of air passed through the finished fabric was slightly affected compared to unfinished fabrics. In the case of unfinished fabric, increase in air permeability is a result of the fabrics pore size and dimensional attributes. In contrast, in the case of finished fabrics, the mint leaf and lavender flower extract covers the pores of the fabric surface, increasing the hydrophobic property of the fabrics and therefore reducing air permeability.

Table 6 Effect of Air Permeability Test

S.NO	Unfinished fabric	Finished fabric
1	3.32	3.79
2	3.48	3.98
3	3.96	4.92
4	3.84	4.08
5	3.65	4.40

CONCLUSION :

The powder was extracted from mint leaf and lavender flower was applied to the cotton fabric used for making sportswear application. The bioactive compound present in the mint leaf and lavender flower was assessed using qualitative analysis. The anti- microbial activity of mint leaf powder, lavender leaf powder and double cotton finished fabric were assessed using agar diffusion technique and parallel streak method. The anti-microbial activity was achieved against S.Aureus (gram negative bacteria) compared with Escherichia coli. The washing fastness of the finished cotton fabric shows better durability upto 20 washing. The finished cotton fabric has slightly decreased in air permeability and water drop test compared with unfinished fabric. The finished cotton fabric can also be usedin the area of food, cosmetic, and pharmaceutical industries.

REFERENCE:

1. Wisam J. Aziza and Haneen A. Jassimb Green chemistry for the preparation of silver nanoparticles using mint leaf leaves extracts and evaluation of their antimicrobial potential 163-170 2018.
2. Gaber El-Saber Batiha, John Oluwafemi Teibo, Lamiaa Wasef, Hazem M. Shaheen,1 Ayomide Peter Akomolafe, Titilade Kehinde Ayandeyi Teibo, Hayder M. Al-kuraishy, Ali I. Al-Garbeeb,5 Athanasios Alexiou, and Marios Papadakis A review of the bioactive components and pharmacological properties of Lavandula species 396(5): 877–900, 2023.
3. Nagender Singha , Manisha Yadavb , Shelly Khannac , Omprakash Sahud, Sustainable fragrance cum antimicrobial finishing on cotton: Indigenous essential oil, 5 22-29 2017
4. James Redfern, Malcolm Kinninmonth, Dariel Burdass, and Joanna Verran, Using Soxhlet Ethanol Extraction to Produce and Test Plant Material (Essential Oils) for Their Antimicrobial Properties, , p. 45-46, , May 2014.
5. AATCC Test method 147. Antibacterial Activity Assessment of Textile Materials: Parallel streak method", American Association of Textile Chemist and Colorist. AATCC technical Manual. 1-3 – PP (2016);
6. AATCC Technical Manual 'Antibacterial finishes on textile materials, Test method 100-2004, June, pp. 149-150 2006.
7. Sandra Truong and Poonam Mudgi The antibacterial effectiveness of lavender essential oil against methicillin-resistant Staphylococcus aureus: a systematic review. Volume 14 – 2023.
8. G. Thilagavathi, R. Rathinamoorthy, Odour in Textiles: Generation and Control, First edition published 2022.
9. M Deepa 1 and C. K. Padmaja 2 preliminary phytochemical analysis and thin layer chromatography of the extracts of excoecaria agallocha l. Vol. 5(10): 4535-4542 2014.
10. Kamrun nahar, department of textile engineering, northern university, Bangladesh, a review on anti odor finishing of textiles, its application method and commercialization, 2020.