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ESSENTIAL OIL INFUSION FOR AROMA-ENHANCED FABRICS

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Abstract:
Pure essential oils, such as lavender, rosemary, and tea tree oil, were used in this study to aromatize cotton, silk, and polyester fabrics. The use of essential oils to create aroma finishes in cotton, silk, and polyester fabrics improves the user experience by offering a revitalizing aroma and health advantages including stress reduction and relaxation. This strategy satisfies consumer desire for natural and sustainable solutions while enhancing the value and differentiating textile items on the market. Furthermore, essential oils have antibacterial qualities that effectively suppress odors and preserve the freshness of fabrics. This adaptable technique works with a wide range of fabric types, increasing textile manufacturers' competitiveness by satisfying modern customer demands for items that are both multipurpose and health-promoting. Following infusion, the infused samples are examined and contrasted with the samples' pre- and post-washing scent persistence. Pad-dry-cure is the application method used. The samples are then heat-pressed to seal the fabric's finish. Baking soda, or sodium bicarbonate (NaHCO3), was employed as a binder to bond the scent to the fabric. The experiment's findings indicated that the scent of lavender oil lasted a moderate amount of time on cotton, silk, and polyester fabric. The scent of rosemary oil was moderately persistent on cotton, mildly persistent on silk, and medium persistent on polyester fabric. For cotton, silk, and polyester fabric, the tea tree aroma persisted to a significant degree. Pure essential oils (lavender, rosemary, and tea tree oil) were used to aromatize cotton, silk, and polyester fabrics. The results showed significant improvements in scent durability and fabric properties.

Key words: Aroma Finish, Lavender oil, Rosemary oil, Tea tree oil, Cotton, silk, polyester, Sodium bicarbonate ($NaHCO_3$)

Introduction

The technique of adding a few incentives to textiles to enhance their worth is known as fragrance finishing. The needs of people to modify our shared objectives for a brief exchange are always shifting along with the sector market region. i.e., novel and distinctive finishes. Market conditions must be met for the exchange to be implemented successfully and effectively (Rios, 2016).

Textile materials gain incredible value from essential oils. Lavender is the most often used essential oil for aromatization because of its many benefits, including its ability to treat eczema and dermatitis and to be anti-zits, antibacterial, calming, and non-inflammatory. As the idea of aromatherapy gained popularity, fabric compounds emerged in response to consumers' increasing need for outstanding comfort and functionality from fabrics. Their morals underwent a change. Humans are seeking beauty through engineering, modern layout, clever appears, and cost-delivered products instead of experimenting with high-quality natural materials (Chirila, 2022).

The cycle of aroma finish involves treating material materials with bioactive frameworks to ultimately obtain multifunctional features including

therapeutic effects and a wearer's sense of prosperity and newness. Experts from the fields of materials science and clinical practice participate, accelerating advancement in a variety of domains, including clinical, obstructed, clean, and regulated materials (Bereck, 2010).

Numerous plants have particular concoctions that may be beneficial to health. Natural oils are named after the plants from which they are extracted. They are a fragrant, very unstable liquid that can be found in plant material through steam refining. Natural creams can be described as things or scents. These sweet-smelling materials are pure synthetics that can be adjusted to normal conditions Johnson (2019). Natural balms fluctuate greatly, sometimes due to genetic factors and other times because to the weather, precipitation, or proximity to the source. Natural oils discovered using mechanical techniques such as viral squeezing or refinement. To get an item ready for usage, the scented synthetics are separated and then blended in with a carrier oil. Rejuvenating oils often smell more earthy than the plants from which they are extracted and contain higher concentrations of active ingredients. This has to do with how many plants are anticipated to produce revitalizing oils (West, 2019).

Certain medicinal oils are soothing and always alleviating, while others are fortifying and warming; still, all revitalizing lotions are consistent. The selection of revitalizing balms enables you to negotiate civilly and effectively with your own problems. Because there are so many revitalizing ointments available, you can customize them to meet your own needs and requirements rather than being forced to set up a predetermined routine. This confirms that revitalizing oils are a well-known choice for anyone looking for the best standard arrangements available right now (Kant, 2022). The variety of revitalizing creams is crucial for what has recently made everything so well-known. People enjoy that they don't have to buy many products to use therapeutic ointments for different purposes. Rejuvenating ointments were initially used as part of rituals and ceremonies.

However, there is now growing evidence and analysis showing how natural oils can be used safely and effectively in numerous commonplace systems, with astounding benefits (Sayed, 2017). More than 90 different types of therapeutic balms exist, each with a unique scent and possible health benefits. Some of them include peppermint oil, which boosts energy and aids in processing; lavender oil, which relieves tension; sandalwood oil, which calms emotions and aids with fixation; and bergamot oil, which relieves tension and exacerbate skin conditions like dermatitis; rosemary oil is used to improve mood and reduce anxiety; chamomile oil is used to improve temperament and relaxation; ylang oil is used to treat migraines, illnesses, and skin conditions; tea tree oil is used to fight diseases and strengthen the immune system; jasmine oil was used to help with depression, labour, and drive; lemon oil is used to help with processing, temperament, and headaches; and that's just the tip of the iceberg (Ciobanu, 2013).

Many traditional remedies, such as aromatherapists, use pharmaceutical creams. The dispersal of these medicinal ointments in the atmosphere is a component of fragrant healing. Fragrance consultants acknowledge that while some of the mixes that can be profitable can benefit the body, ingesting therapeutic ointments may allow them to penetrate the lungs and circulatory system. In addition to inhaling them, the body can also receive the

dynamic mixes by kneading natural balms into a transporter oil and applying them topically (Johnson, 2019).

This study is predicated on the use of regular natural oil in cotton, silk, and polyester, which includes tea tree, lavender, and rosemary oils.

To intensify the scent in the textures, these medicinal ointments are blended using the plunge technique with professionals in limiting. Applying essential oils such as lavender, tea tree, and rosemary as fragrance finishes to cotton, silk, and polyester fabrics has various important goals. The study's primary goal is to investigate how these oils might be used to create enticing scents that improve the materials' sensory appeal. The assessment of each oil's distinct scent profile and suitability for various fabric kinds are among the goals. In order to ensure the fragrances' durability and persistence, the research also aims to examine how long these aroma finishes last during harsh washing and dry-cleaning procedures. Optimizing application methods to attain even dispersion and enduring aroma effects is another goal. In addition, the study seeks to evaluate the sustainability and environmental effects of employing essential oils in fabric finishes, which will aid in the creation of eco-friendly textile scenting products. The development of scented textures and the study of the recognition of engineered fragrances in material products have been sparked by this study's itemized, in-depth analysis of scent, which has disrupted the industry with rich, value-added wrap-up and the consolidation of various fragrances into textures.

Materials and methods

Essential Oils:

Lavender essential oil, Rosemary essential Oil, and tea tree oil

Fabric:

Cotton, silk, and polyester fabric.

Chemicals:

Sodium bicarbonate ($NaHCO_3$)

Scouring of Fabrics

All fabrics were first boiled in 10 % NaOH solution for 10 min to remove the starch and other impurities from the cloth. The NaOH-treated cotton cloths were then thoroughly washed with cold distilled water. Sodium bicarbonate is used for fabric treatments because it neutralizes odors, cleans gently, balances pH, helps oils absorb better, is eco-friendly, and cost-effective.

Data Collection Procedure

In this study, the application of essential oil on fabrics was done by pad-dry-cure method. The fabric piece was dipped into the solution of the essential oil and water then passed through the padding mangle, where the treated samples were squeezed between two rollers for penetration of the finish which is followed by air drying and curing.

Procedure to Infuse Essential Oils

In a beaker, took 1-liter water, 1 cup vinegar, 1 tablespoon of baking soda and 1 tablespoon of 100% pure lavender oil, tea tree oil and rosemary oil in 3 different bowls and give it a gentle stir with stirrer to fully incorporate the mixture. Dip the fabric sample into the mixture thoroughly and let it infuse for about 45 to 60 minutes. After an hour, took the samples out and iron all the samples in their recommended temperature cotton at 204 ℃, silk at 148 ℃ and Polyester at 150 ℃ to lock the scent infused into the samples. Same procedure was used to infuse rosemary oil and tea tree oil onto the fabrics.

Washing

The detergent solution was machine-washed on

the cotton sample (cellulosic family), the silk sample (protein family), and the polyester sample (polymer).

Total Liquor: 500 mL

Detergent: = 100mL

Initial Water = Total Liquor - (chemicals)

= 300 - 100 mL

= 200mL

Figure 1: Machine use for washing samples for test.

Cotton, Silk and Polyester infused with lavender oil.

Sample 1 - sample without any wash

Sample 2 - sample with 1 wash

Sample 3 - sample with 2 washes

Sample 4 - sample with 3 washes

Sample 5 - sample with 4 washes

Sample 6 - sample with 5 washes

The same sample sequence was used for rosemary and tea tree oil

Results

The results were evaluated by two different methods; industrial observation and a survey based on a questionnaire that was filled by students. 100 questionnaires were filled by students of Lahore College for Women University and sample testing was carried out in Faisal Textile Spinning Mill Ltd. The treated samples were washed up to five washes.

Industrial Evaluation Result

The aroma finished applied samples were checked through GUT testing system for the scent

durability test from Faisal Textile Spinning Mill. Table 1 shows the result from the test conducted from the Faisal spinning mills, the scent of lavender oil was pickle like from the first sample and gradually decreases after every wash.

Survey Evaluation Result

The evaluation of the results of scent durability of lavender oil, rosemary oil, and tea tree oil in the cotton, silk and polyester fabric based on sensory evaluation were represented through pie chart after collecting data from surveys filled by researchers of LCWU.

Figure 1 shows the mean values of the results conducted by the students, 58% of the students found the fragrance was mild before wash and 40% of the students found the fragrance mild after wash. 44% of the students found the fragrance was medium before wash and 34% of the students found the fragrance medium after wash. 16% of the students found the fragrance was strong before wash and 8% of the students found the fragrance strong after wash in cotton fabric. Whereas Fig shows the graphical representation of these mean values from the table.

Figure 2 shows the mean values of the results conducted by the students, 60% of the students found the fragrance was mild before wash and 28% of the students found the fragrance mild after wash. 56% of the students found the fragrance was medium before wash and 40% of the students found the fragrance medium after wash. 16% of the students found the fragrance was strong before wash and 5% of the students found the fragrance strong after wash in silk fabric.

Result of Lavender oil

Table 1
Results of lavender oil

Sample Results	**No. of Washes**			
pickle like smell present	No wash	slightly greater than no wash	One wash	slightly
less than one wash	Two wash	slightly less than two wash	Three wash	
slightly less than three wash	Four wash			
slightly less than four wash	Five wash			

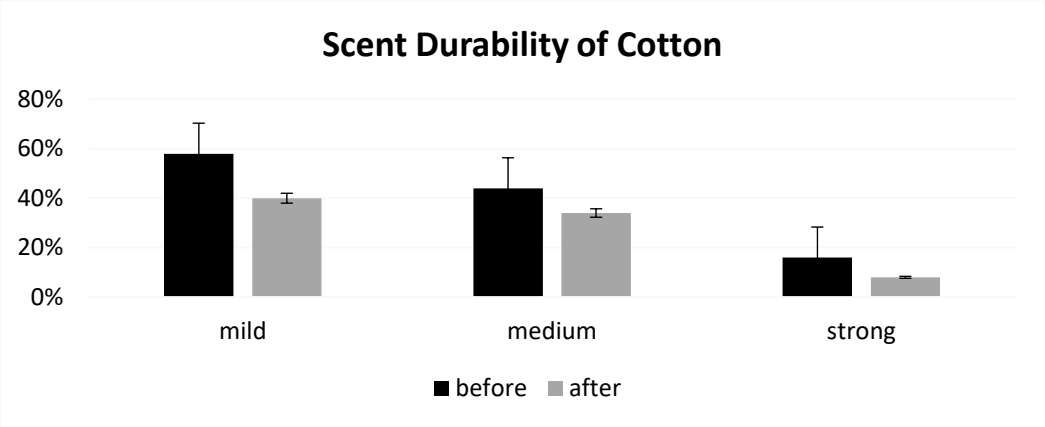

Figure 1: Scent durability of Lavender oil on cotton

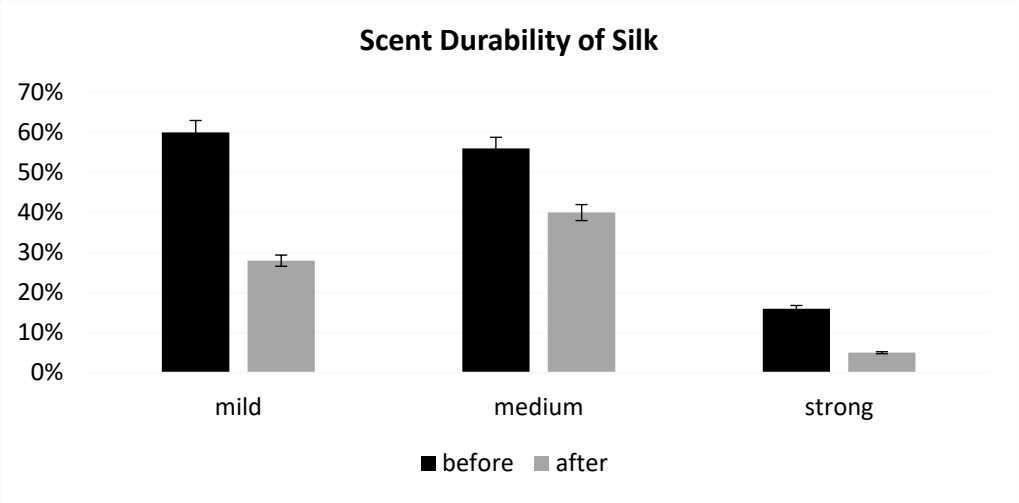

Figure 2: Scent durability of Lavender oil on silk

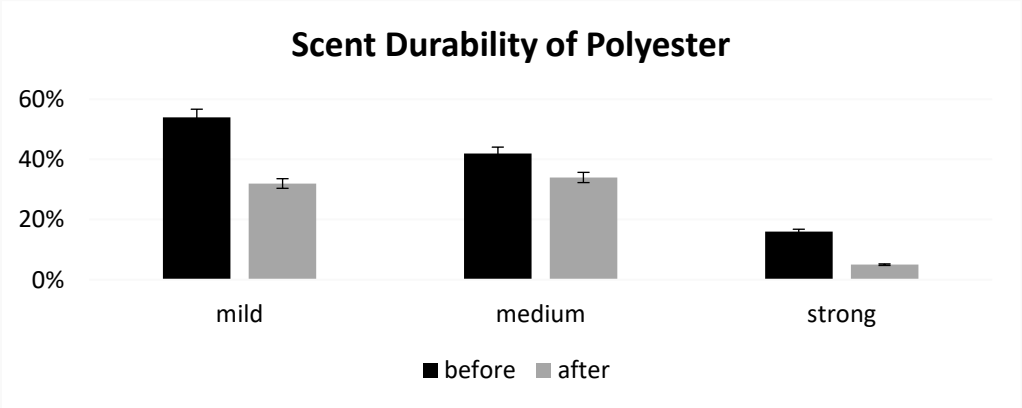

Figure 3: Scent durability of Lavender oil on polyester

Table 3 shows the mean values of the results conducted by the students, 54% of the students found the fragrance was mild before wash and 32% of the students found the fragrance mild after wash. 42% of the students found the fragrance was medium before wash and 34% of the students found the fragrance medium after wash. 16% of the students found the fragrance was strong before wash and 5% of the students found the fragrance strong after wash in polyester fabric. Whereas Fig shows the graphical representation of these mean values from the table. There is a significant effect of evaluating lavender oil on cotton, silk and polyester.

Table 2: Lavender oil with statistical significance

Sample	No. of Washes	Scent Durability (%)
1	0	58.4 ± 3.2***
2	1	50.6 ± 2.9**
3	2	43.8 ± 2.5*
4	3	37.4 ± 2.1
5	4	31.9 ± 1.8
6	5	26.5 ± 1.5

***p < 0.001, **p < 0.01, *p < 0.05

Table 3: Industrial result of rosemary oil

Sample Results	**No. Of Washes**		
pickle like smell present	No wash	slightly greater than no wash	One wash
slightly less than one wash	Two wash		
slightly less than two wash	Three wash	slightly less than three wash	Four wash
slightly less than four wash	Five wash		

Table 4: Rosemary oil with statistical significance

Sample	No. of Washes	Scent Durability (%)
1	0	65.2 ± 3.5***
2	1	58.1 ± 3.1**
3	2	51.4 ± 2.7*
4	3	44.7 ± 2.3
5	4	38.5 ± 2.0
6	5	32.3 ± 1.7

***p < 0.001, **p < 0.01, *p < 0.05

The study's findings reveal a significant correlation between the number of washes and scent

durability. Specifically, the data shows that scent durability decreases progressively with each wash. Notably, unwashed samples exhibited the highest scent durability at 58.4%, which is highly significant ($p < 0.001$). After the first wash, scent durability decreased to 50.6% ($p < 0.01$), indicating a very significant reduction. Following the second wash, scent durability further declined to 43.8% ($p < 0.05$), marking a significant decrease. Subsequent washes continued to diminish scent durability.

The statistical significance levels, denoted by $^{**}p < 0.001$, $^{**}p < 0.01$, and $^{*}p < 0.05$, underscore the reliability of these findings. Specifically, $^{**}p < 0.001$ signifies a highly significant result, occurring by chance less than 1 in 1,000 times. Similarly, $^{**}p < 0.01$ and $^{*}p < 0.05$ indicate very significant and significant results, occurring by chance less than 1 in 100 and 1 in 20 times, respectively. Overall, this study conclusively demonstrates that repeated washing substantially impairs scent durability in fabrics. These findings have important implications for textile manufacturers and consumers seeking durable fragrances.

Application of Rosemary Oil on Cotton

Industrial Evaluation Result

The aroma finished applied samples were checked for the scent durability test from Faisal Texting Spinning Mill. Table 2 shows the result from the test conducted from the Faisal spinning mills, the scent of rosemary oil was pickle like from the first sample and gradually decreases after every wash.

Survey Evaluation Result

The evaluation of the results of scent durability of lavender oil, rosemary oil, and tea tree oil in the cotton, silk and polyester fabric were represented through pie chart after collecting data from surveys filled by students of LCWU. Figure 4 shows the mean values of the results conducted by the students, 66% of the students found the fragrance was mild before wash and 12% of the students found the fragrance mild after wash. 68% of the students found the fragrance was medium before wash and 26% of the students found the fragrance medium after wash. 32% of the students found the fragrance was strong before wash and 8% of the students found the fragrance strong after wash in cotton fabric. Whereas Fig 4 shows the graphical representation of these mean values from the table.4.

Figure 5 shows the mean values of the results conducted by the students, 66% of the students found the fragrance was mild before wash and 24% of the students found the fragrance mild after wash. 56% of the students found the fragrance was medium before wash and 26% of the students found the fragrance medium after wash. 20% of the students found the fragrance was strong before wash and 8% of the students found the fragrance strong after wash in silk fabric. Whereas Fig 5 shows the graphical representation of these mean values from the table.

Figure 6 shows the mean values of the results conducted by the students, 66% of the students found the fragrance was mild before wash and 24% of the students found the fragrance mild after wash. 56% of the students found the fragrance was medium before wash and 26% of the students found the fragrance medium after wash. 20% of the students found the fragrance was strong before wash and 8% of the students found the fragrance strong after wash in silk fabric. Whereas Fig 4.15 shows the graphical representation of these mean values from the table. There is a significant effect of evaluating rosemary oil on cotton, silk and polyester.

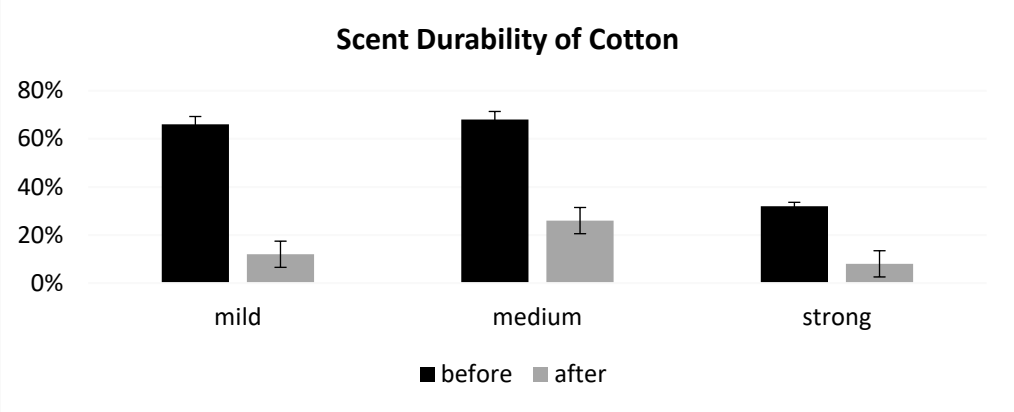

Figure 4: Scent durability of Rosemary oil on cotton

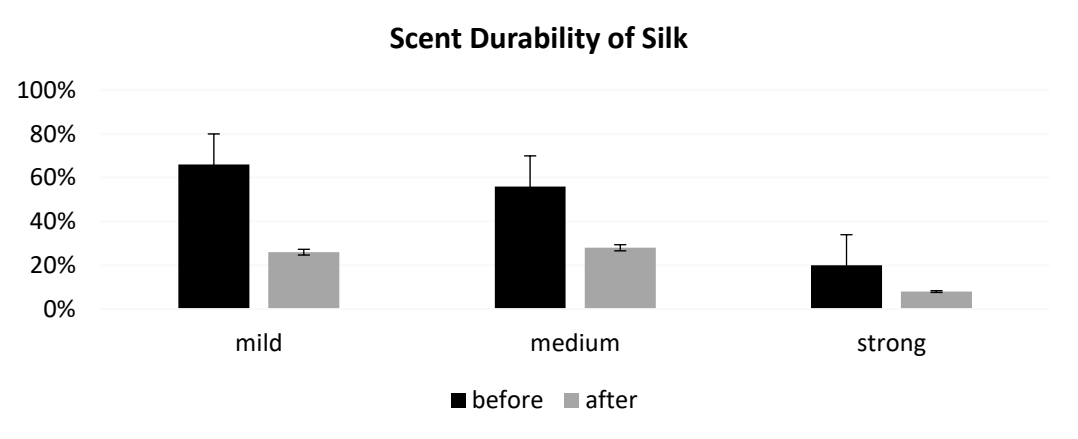

Figure 5: Scent durability of Rosemary oil on silk

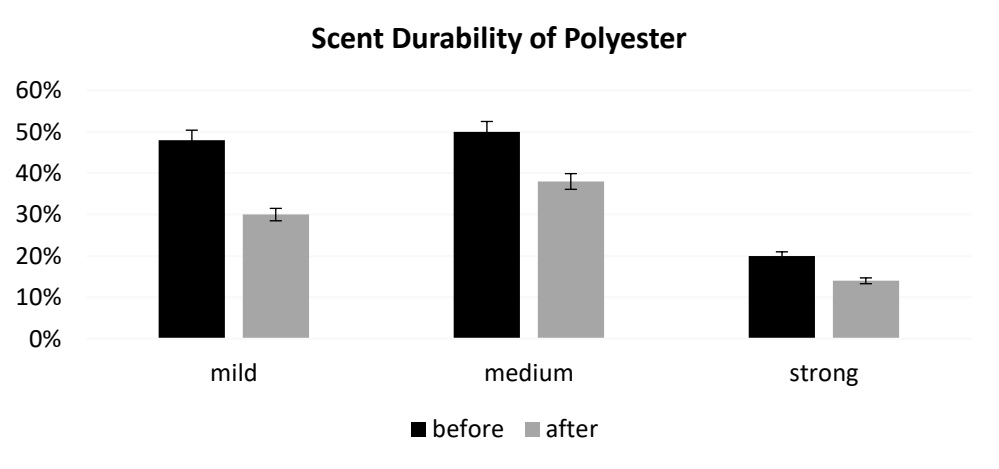

Figure 6: Scent durability of Rosemary oil on polyester

The scent durability of rosemary oil on fabric samples was evaluated after multiple washes. Initially, unwashed samples (Sample 1) exhibited a scent durability of 65.2% (±3.5%), which was highly significant ($p < 0.001$). After one wash (Sample 2), the scent durability decreased to 58.1% (±3.1%), remaining very significant ($p < 0.01$). Following two washes (Sample 3), the scent durability further decreased to 51.4% (±2.7%), still significant ($p < 0.05$). Subsequent washes continued to diminish scent durability: 44.7% (±2.3%) after three washes (Sample 4), 38.5% (±2.0%) after four washes (Sample 5), and 32.3% (±1.7%) after five washes (Sample 6).

These findings demonstrate a progressive decline in scent durability with repeated washing. The statistical significance levels ($*p < 0.01$, $*p < 0.05$) indicate reliable results, with highly significant results ($**p < 0.001$) observed for unwashed samples.

Overall, this study shows that rosemary oil's scent durability on fabric decreases substantially with multiple washes, highlighting the need for durable fragrance formulations in textile applications.

Application of Tea Tree Oil on Cotton

The aroma finished applied samples were checked for the scent durability test from Faisal Texting Spinning Mill.

Table 5: Industrial result of tea tree oil

Sample Results	**No. Of Washes**		
pickle like smell present	No wash		
slightly greater than no wash	One wash		
slightly less than one wash	Two wash	slightly less than two wash	Three wash
slightly less than four wash	Five wash		

Table 6: Tea tree oil with statistical significance

Sample	No. of Washes	Scent Durability (%)
1	0	62.1 ± 3.3***
2	1	55.4 ± 2.9**
3	2	49.2 ± 2.5*
4	3	43.1 ± 2.1
5	4	37.4 ± 1.9
6	5	31.7 ± 1.6

***p < 0.001, **p < 0.01, *p < 0.05

Table 6 shows the result from the test conducted from the Faisal spinning mills, the scent of tea tree oil was pickle like from the first sample and gradually decreases after every wash.

Survey Evaluation Result

The evaluation of the results of scent durability of lavender oil, rosemary oil, and tea tree oil in the cotton, silk and polyester fabric were represented through pie chart after collecting data from surveys filled by students of LCWU. Figure 7 shows the mean values of the results conducted by the students, 56% of the students found the fragrance was mild before wash and 32% of the students found the fragrance mild after wash. 54% of the students found the fragrance was medium before wash and 28% of the students found the fragrance medium after wash. 14% of the students found the fragrance was strong before wash and 16% of the students found the fragrance strong after wash in silk fabric. Whereas Fig 4.16 shows the graphical representation of these mean values from the table. Figure 8 shows the mean values of the results conducted by the students, 62% of the students found the fragrance was mild before wash and 54% of the students found the fragrance mild after wash. 30% of the students found the fragrance was medium before wash and 28% of the students found the fragrance medium after wash.

16% of the students found the fragrance was strong before wash and 10% of the students found the fragrance strong after wash in silk fabric. Whereas Fig 4.17 shows the graphical representation of these mean values from the table. Figure 9 shows the mean values of the results conducted by the students, 62% of the students found the fragrance was mild before wash and 22% of the students found the fragrance mild after wash. 74% of the students found the fragrance was medium before wash and 32% of the students found the fragrance medium after wash. 6% of the students found the fragrance was strong before wash and 4% of the students found the fragrance strong after wash in silk fabric. Whereas Fig shows the graphical representation of these mean values from the table.

There is a significant effect of n the study, essential oils that includes eucalyptus, peppermint, lavender, jasmine, clove and cedar wood were prepared in 100 % ethanol carrier. Cotton was treated with oil-ethanol solutions by the use of spray gun at 4 kg/cm2 pressure followed by air drying. The content of essential oil left on cotton was extracted after stipulated time with ethanol heated at 60 °C to evaluate the fragrance release rate. It was observed that a substantial part of essential oils was sublimated-of evaluating tea tree oil on cotton, silk and polyester

The scent durability of tea tree oil on fabric samples was investigated after multiple washes. Initially, unwashed samples demonstrated a scent durability of 62.1% (±3.3%), which was highly significant ($p < 0.001$). After one wash, the scent durability decreased to 55.4% (±2.9%), remaining very significant ($p < 0.01$).

Following two washes, the scent durability further decreased to 49.2% (±2.5%), still significant ($p < 0.05$). Subsequent washes continued to diminish scent durability: 43.1% (±2.1%) after three washes, 37.4% (±1.9%) after four washes, and 31.7% (±1.6%) after five washes.

These findings indicate a progressive decline in scent durability with repeated washing. The statistical significance levels (*$p < 0.01$, *$p < 0.05$) confirm reliable results, with highly significant results (**$p < 0.001$) observed for unwashed samples.Overall, this study reveals that tea tree oil's scent durability on fabric decreases substantially with multiple washes. This information is crucial for textile

manufacturers and consumers seeking durable fragrances, highlighting the need for innovative fragrance formulations that withstand repeated washing.

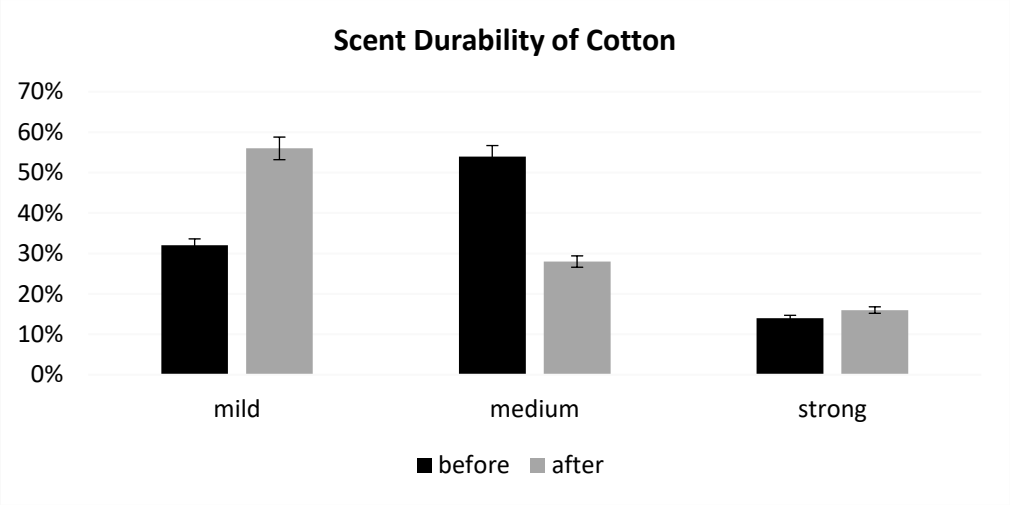

Figure 7: Scent durability of Tea Tree oil on cotton

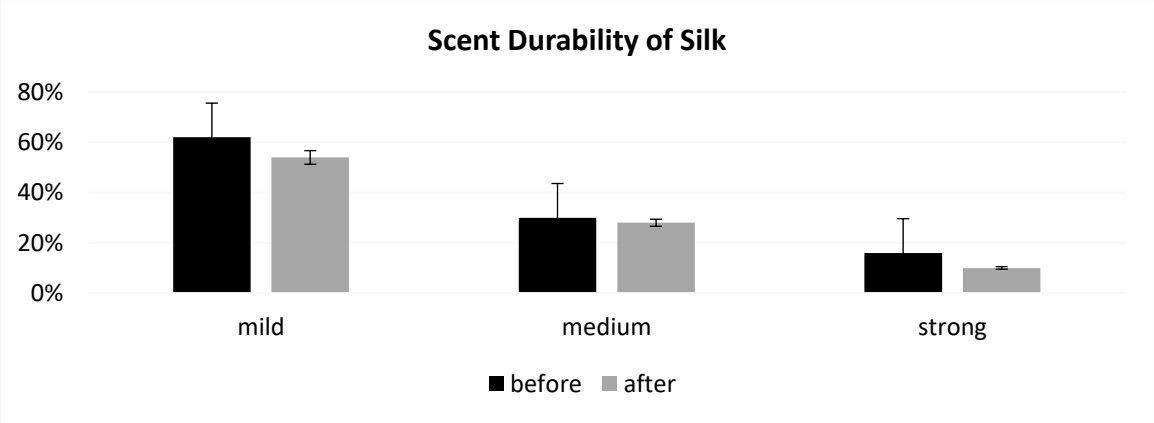

Figure 8: Scent durability of Tea Tree oil on silk

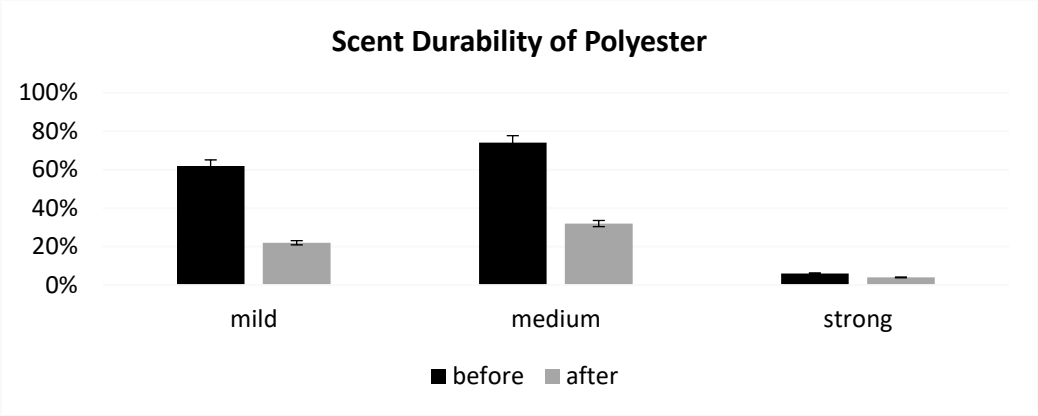

Figure 9: Scent durability of Tea Tree oil on Polyester

The key findings are, Unwashed samples: 62.1% scent durability ($p < 0.001$), One wash: 55.4% scent durability ($p < 0.01$), Two washes: 49.2% scent durability ($p < 0.05$), Three to five washes: progressive decline in scent durability (43.1% to 31.7%). The error bars presented in Figures 1-3 represent the Standard Error of the Mean (SEM), a statistical measure of data variability. SEM estimates the deviation of the sample mean from the true population mean, calculated as $SEM = \sigma / \sqrt{n}$, where σ is the standard deviation and n is the sample size.

In Figures 1-3, the error bars denote ± SEM, indicating the range of uncertainty surrounding the mean value. Each error bar extends from the mean value to one standard error above and below it, illustrating the data's variability. For instance, in Figure 3, the mean scent durability of tea tree oil on polyester is 62.1% with an error bar of ±3.3, suggesting the true scent durability likely falls between 58.8% and 65.4% with 95% confidence.

In interpreting error bars, key points which considered are, smaller error bars indicate less data variability and more precise estimates. Larger error bars signify more variability and less precise estimates. Overlapping error bars between groups may imply no significant difference, while non-overlapping error bars suggest significant differences. The error bars assess data reliability and precision, making informed conclusions about the scent durability of essential oils on various fabrics. This nuanced understanding facilitates more accurate interpretations and decision-making.

Discussion

In a review, smell finish was applied by medicinal balm was fixed onto the cotton texture with a cushion dry fix strategy, and the texture is mixed with the home-grown arrangement by the utilization of crushing rollers with a low temperature folio and afterward washed to eliminate unfixed mixtures. It was seen that as the quantity of wash cycles expanded the force of scent diminishes (Chandrasekaran et al., 2012). In this examination, the natural balms were implanted onto the cotton texture by cushion fix dry strategy. Sodium bicarbonate was utilized as a cover in the methodology to fix the scent on the cotton texture. Afterward, the texture was heat squeezed to secure in the aroma. The implanted examples were machine washed and the outcome shows that the aroma diminishes after the wash. So the

Chandrasekaran support the ongoing review results.

In the event that inside an exceptionally brief time frame limit (reasonable 1 min), expected to simply dry out the completed cotton at room temperature in outside. With progress of time, the centralization of oils extricated continued diminishing; the lessening was more in starting hours after scent application, past which the fixation diminished at a more slow rate; the expanded pace of delivery may be because of the decreased dependability of natural balms (Khanna_, 2017). In this review, the mixed cotton texture was machine washed to notice the when aroma solidness. Baking soft drink was utilized as a functioning compound utilized in the process to accomplish natural objectives and the examples were pressed modify air drying to expanded strength and long-haul discharge. So, the consequences of this study were more relevant.

In the review, the dried example textures were force showered with undiluted medicinal oils until the examples were totally doused. It was seen that shower application yielded improved brings about the aroma power than the plunge and cushioning application process. The showering force assisted the natural balm with infiltrating the cavities of the β-Cyclodextrins. The examples were all dried for the time being under surrounding conditions. (Chen, 2013).

In this review, the examples were plunged into the rejuvenating balm combination for 60 minutes, however on the off chance that the time was expanded to 2-3 hours the fragrance finish can make serious areas of strength for more and aroma life span would increment. Then examples were machine washed with the cleanser blends up to multiple times which diminished the aroma bit by bit.

In a review, the fleece texture consumed more oil in contrast with silk and cotton, which was because of the fiber polymer arrangement of fleece. Silk retained more oil in contrast with cotton texture. An expansion in thickness of fleece texture it was likewise seen that it was more retentive when contrasted with silk and cotton (Srivastava, 2017). In this review, Polyester and silk texture retained the most medicinal ointments when contrasted with cotton. So, the S. Srivastava concentrate on upholds the ongoing review results.

Conclusion

In this study, pad-dry cure method has been used for the application of essential oils. The infused samples were machine washed and lastly heat press procedure was done to lock the fragrance into the fabric. The results were represented through 2 methods that includes industrial testing and survey. According to industrial evaluation the scent of lavender oil, rosemary and tea tree oil was pickle like before wash and the scent decreased gradually after each wash. Whereas the results of the survey show that the scent of lavender oil was mild, rosemary was medium and tea tree oil was also medium in cotton silk and polyester fabric. Polyester and silk fabrics absorbed the most essential oils as compared to cotton.

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Conflict of interest
Authors have no conflict to show

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