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ANTI-DIABETIC AND ANTIMICROBIAL ACTIVITIES OF GRONA TRIFLORA MEDICINAL PLANT

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SUMMARY

This research analyses the bioactive Components of Grona Triflora, a medicinal plant that has potential health benefits, and its application in textile finishing to enhance fabric functionality and property. Grona Triflora was purified, dried, and ground into a powdered material for extraction using methanol, ethanol, and distilled water. The extraction's, anti-diabetic activity of each extract was analyzed using the alpha-amylase and alpha-glycosidase biocatalyst prevention assays to determine effectiveness in modulating polysaccharide metabolism. The Anti-microbial activity was assessed against bacterial strains E. coli and Pseudomonas aeruginosa and fungal strains Staphylococcus aureus and Enterococcus, indicating substantial efficacy. The herbal finishing was then applied to pre-treated thermal knit fabric using a dip and nip padding mangle technique [12]. The FTIR Spectroscopy ratified the existence of functional bioactive groups, the SEM showed texture and structural alternations.

Key words: *grona triflora, herbal extraction, ant-microbial activity, anti-diabetic activity, herbal finishing.*

INTRODUCTION

According to a new study, which was used for various purposes well in the past to harness nature's bright colors are plant-based colorants. As interest in cultural traditions re-emerges as well as awareness about the environmental impact of industrial dyes rises, the colorants offer up sustainable solutions and aesthetically pleasing options to accommodate the increasing demand for eco-friendly products [4]. Plant-based colorants could provide an interesting possibility for creativity and invention [1]. The therapeutic potential of folk medicinal herbs as a route to validate their efficacy and ultimately elucidate the mode of action [2]. They analyzed scientifically the bioactive compounds of the plants and investigated their pharmacotherapeutic potentials, respectively [24]. Traditional uses of these plants have also inspired new applications for modern medicine. It highlighted the importance of biodiversity

and traditional knowledge in sustainable healthcare initiatives [6]. This study encourages further investigations into the medicinal value of herbal drugs and highlights their relevant role, in controlling different health issues [3]. *Green Triflora* is one of the oldest traditional herbal plants that have come under the spotlight of researchers recently. After extensive study, researchers discovered the key bioactive components with *Grona Triflora* and then studied their pharmacological properties [30]. In keeping with its use in conventional medicine [25]. The historical value of *Grona Triflora* makes it a candidate for usage in modern medicinal treatments as well. If its mechanisms of action and clinical uses are researched then there are possibilities for new therapeutic approaches developed from this incredible plant [5]. Alkaloids are pharmacologically active natural products of many medicinal plants and herbs. These bio-active compounds are separated from these sources using numerous methods like Paper chromatography, Steam distillation, and Solvent extraction [10]. These methods aim to first separate the alkaloids from the plant material while preserving their pharmacological activity. Bioactive components can be removed, and more refined to be utilized for drugs, treatments, and Nutrition [8]. They include anti-inflammatory, anti-pain, antibacterial, and in some cases even hallucinogenic effects. Also, the extraction must be adequate [26]. It can efficiently extract a variety of molecules, including both hydrophilic and hydrophobic components; ethanol extraction is widely used [7]. Although methanol extraction is comparable, safety considerations may make it less desirable and perhaps more harmful [27]. Distilled water extraction is frequently used to extract polar substances and is thought to be safer for ingestion, even though it is less effective at removing some chemicals. The specific characteristics of the herb and the desired components will determine which solvent is best for you, as each has advantages and disadvantages [9]. *Grona Triflora* a plant with several therapeutic uses may have anti-diabetic effects. These techniques seek to separate a variety of phytochemicals that could be involved in the plant's ability to prevent diabetes. Alpha-amylase biocatalyst prevention and alpha-glycosidase biocatalyst prevention assays were used to evaluate the extracts' anti-diabetic properties. With the use of these tests, it will be possible to ascertain whether extracts from *Grona Triflora* can alter important biocatalysts involved in the metabolism of carbohydrates, offering important information about their potential as natural diabetic treatments. An important first step in investigating *Grona Triflora* potential as a treatment for diabetes is this study [4].

Common microbes that can significantly affect human vitality comprise Antimicrobial and anti-fungal [28]. *Pseudomonas aeruginosa* is a multipurpose microbe that can infect various regions of the body. It is difficult to treat because of its resistance to various pharmaceuticals [10–11]. Physically people regularly have *Staphylococcus aureus* microbe on their skin and in their airways passages. It can result in a variety of infective conditions, ranging from mild-term viral infective conditions to more important illnesses like bloodstream infections and pneumonia [11]. A type of microbe called *Enterococcus* is detected in the female vaginal system. The majority of strains are benign; some can lead to infections, in those with compromised immune systems [29]. Citric acid is a cross-linker that enhances the stability and effectiveness of extracts by aiding in the connection of active ingredients, to it more effectively due to its natural occurrence in citrus fruits and various applications in herbal treatments. Its cross-linkage attributes contribute to preserving the extract’s integrity and prolonging its shelf life significantly. Using citric acid (CA) to link substances assures the efficiency and bioactive comports establishing them as allies, the comprehensive well-being as well as medical treatments [13-14]. Scanning electron microscopy (SEM) is a tool, for studying the surface morphology and arrangements of fibers, yarn, and textiles. Advanced quality images from SEM allow scientists and manufacturers to scrutinize the composition of the fiber, outer layer texture, and imperfections, like porosity. Knowing this information is crucial to comprehending the functionality, robustness, and general quality of textiles. SEM analysis facilitates the development of novel textile materials with improved qualities, the optimization of manufacturing procedures, and the identification of possible areas for improvement [15]. FTIR spectroscopy is a technique, for analyzing the fabric structure and coatings of assessing the assimilation of light in the specimen to identify various functional groups like amine and carbonyls present, in the material. This information aids in the identification of certain fibers, the detection of harmful compounds or additions, and the evaluation of the efficacy of textile treatments or improvements. The facilitating accuracy study and enhancement of apparel materials and production process. The FTIR analysis is essential to find the chemical compositions, product development, and quality control in the apparel industry [16].

MATERIALS AND METHODS

Selection of Medicinal Herb

Figure 1 shows the therapeutic plant *Grona Trifloral*, used to treat fever, rheumatism, varicose vein problems, and diarrhea. It is commonly found in damp or moist areas and is known as "creeping tick trefoil" (tiny). The plant's growth style, which enables it to spread efficiently across the ground, and the unusual shape of its seeds—which resemble ticks—are reflected in this common term, which adds to the plant's distinguishing character in the botanical community. This charming plant not only enhances the visual appeal of its surroundings but also plays a role in nitrogen fixation, contributing to soil health. To gather any extra water, the tree, a tiny plant known as *Grona Triflora*, is collected (Figure 2) and purified before being spread out on a piece of newspaper or cotton cloth.

Figure 1. Grona Triflora

Figure 2. Pulverized Medicinal Herb

Drying Process

The gathered herbs were dried in a microwave oven set at 50 degrees Celsius (P 100). Hit the start/+3 minute button. Since most herbs retain moisture level of 70 to 90% and drying is essential for preserving it effectively, the collected herbs' a moisture content was lowered to less than 10% with appropriate drying. To avoid contaminating critical molecules, proper dying has to be done. Following drying, the plant's leaves were ground into extremely tiny pieces, varying in size from fine powder to coarse fragments.

Herbs Bioactive Component Extraction

Extraction is the physical or chemical process of obtaining the target material with the aid of a solvent. The distinctive component of the plant was extracted using methanol, ethanol, and distilled water extraction procedures. Using distilled water, methanol, and ethanol extraction techniques, the plant was ground into a powder. After properly mixing one gram of herbal powder with twenty milliliters of the solutions, they were heated in a water bath at 80 degrees Celsius for 10 minutes [17–18].

Fabric Selection

The fabric's unique construction contributes to its breathability, ensuring that it regulates body temperature during the recreation. The lightweight nature of the thermal knit allows for ease of movement, making it an ideal choice for activewear for outdoor and indoor apparel. Its versatility extends beyond functionality; the elegant texture and appearance make it suitable for casual and fashionable garments as well. The encouraging environmental responsibility, and the use of sustainable cotton fibers guarantee that the fabric will stay soft and pleasant on the skin, improving the wearing experience overall. The fabric has a distinctive combination of moisture management properties, and thermal performance. The GSM of the fabric is 280 and the base yarn of 18.84 it has distinctive comfort

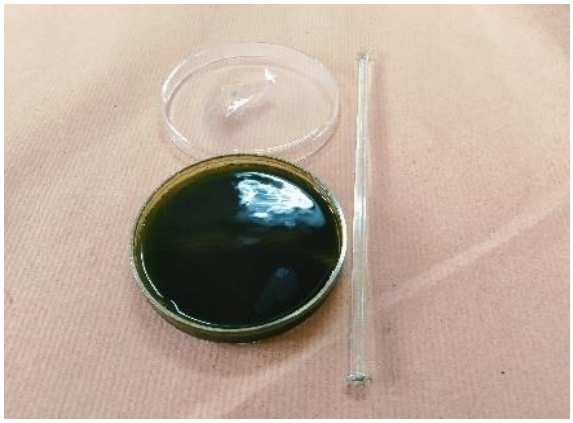
and durability. The wales per inch are 20 and courses per inch are 38. It feels smooth against the skin and has exceptional moisture-wicking properties. The tuck waffle rib gaiting technique is a honeycomb pattern that adds durability and longevity, strengthening the fabric's structural integrity. The fabric will hold its shape and performance characteristics at all times. The thermal knit fabric can be worn for daily wear, outdoor activities, or strenuous sports wear.

Pre-treatment Process

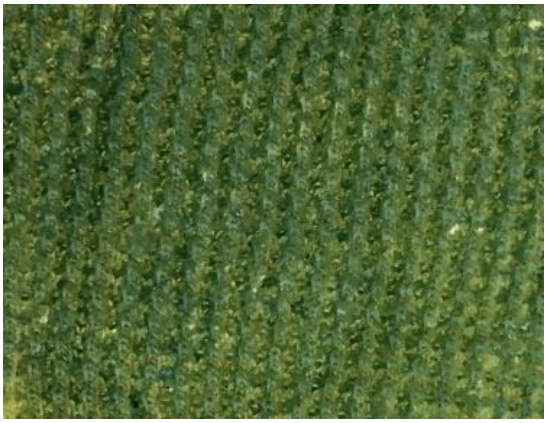
The pre-treatment process was essential for getting rid of impurities, stains, and any left over chemical compounds in the fabrics to guarantee optimal cleaning and enhance its ability to absorb additional treatments. Before scouring, the sample weighed 1 gram (g) after scouring it weighed 910-milligram (mg). The scouring process used glauber salt (1%), soda ash (1%), hydrogen peroxide (1%), and sodium hydroxide (1%). The scouring process is crucial to the fabric's functional qualities in addition to better adhesion appeal. A clean surface allows for better adhesion of finishing, it can bring protective properties. The scouring process must be an industrial requirement for overall performance, and appearance and be suitable for a range of applications, it has enhance the durability [18–19].

Herbal Coating of Selected Fabric

The herbal coating makes it simpler to include therapeutic properties in the fabric. The citric acid is a natural and eco-friendly cross-linking agent. Figure 3a shows the *Grona Triflora* bioactive compound loaded Petri plate, the process ensures that the plant extract is securely bonded to the fabric fibers, creating long-lasting effects. The padded mangle technique's complete impregnation ensures that the extract is distributed uniformly, optimizing its therapeutic properties. The treated fabric should have improved antibacterial and anti-inflammatory qualities after drying (Figure 3b), which qualifies it for usage in textiles with a health-conscious theme. This method exemplifies the potential of integrating botanical extracts into textile treatments, paving the way for the development of functional fabrics that cater to both aesthetic and health-related needs. The results of this experiment could significantly contribute to advancements in sustainable textile technologies and the promotion of wellness in everyday clothing [20-21].



(a) Bioactive compound-loaded Herbal extract



(b) The bioactive compound finished fabric

Figure 3. Finished Thermal Knit Fabric

Different solvents have varying polarities, influencing the types and potency of bioactive compounds they can extract. Ethanol for example is highly effective in extracting a broad spectrum of compounds including flavonoids and alkaloids, which are crucial for antimicrobial and anti-diabetic activities. Methanol being a polar solvent, often yields concentrated bioactive compounds, while water mainly extracts polar compounds like tannins and polysaccharides.

Bioactive Compound Assessment

The alpha-amylase biocatalyst prevention method as well as the Alpha-glycosidase biocatalyst prevention method. Also Analysis of the anti-microbial assessment.

Agar Plate Technique

The well diffusion method was used to evaluate crude herbal extracts' antibacterial and antifungal properties. In triplicate studies, two to twenty microliters of all plant extracts were put into agar plates, and the plates were left to incubate at 38°C for twenty-four hours. Control plates were made. Millimeters were used to measure the prevention zones from the well's edge to the furthest observable zone. To ascertain the degree of prevention, After incubation, the clean zones surrounding the wells were measured for diameter. After being inoculated in nutrient broth media, the stock culture of bacteria was cultivated at 37% for eighteen hours. Once the Petri dishes with agar were solidified, they were inoculated with specific microbial strains to evaluate the antimicrobial efficacy of the plant extract-infused fabric. The sterile plates were swabbed with bacteria and inoculated with 18-hour-old cultures. Fill each of the five wells with 25 µl, 50 µl, 75 µl, and 100 µl of the extract. Every plate was kept at 37°C for a full day, and the prevention zone's diameter was measured in centimeters.

INSTRUMENTAL ANALYSIS

Scanning Electron Microscopy

Under SEM analysis, thermal knit fabric showed its distinctive surface as well asstructure before infusion. After the herbal extract is infused into the fabric it shows not only the physical surface al also herbal or bioactive components. After the bioactive infusion, the fabric may improve its physical and functional characteristics, which enhances the fabric's overall performance. The significant result to understanding the fabric properties produced application in functional or health care textiles [22].

FTIR -Fourier Transform Infrared Spectroscopy

The chemical composition of the herbal-infused fabric was investigated by the FTIR spectra. After the herbal extraction infusion, the result shows distinct changes. The peaks were compared to untreated cloth, the herbal components were indicated in the fabric. It may be enhancing fabric characterisation, from functional or health care textiles [23–24]. The FTIR spectra is used in potassium bromide (KBr) disks to analyze the solid samples. The solid sample is found in an extremely fine powder to ensure a homogenous mixture and maximize the surface area for infrared interaction. The extremely ground sample was mixed with the dry KBr powder. The finished disk is sufficiently transparent to ensure KBr is mixed with less sample (1% to 2% by weight).To ensure that the mixture is properly compressed, this technique produces a dense disk with improved optical clarity and structural integrity that is ready for testing or other uses. Typically, this disk has a diameter of around 1 cm and a thickness of a few millimeters. Because of its great transparency in the mid-infrared (4000–400 cm^{-1}) range, IR Transparency KBr is selected to ensure minimum disruption of the IR absorption bands in the sample. The method allows for reliable and similar infrared spectra by offering a repeatable way to prepare solid samples.

RESULT AND DISCUSSION

The research for effective anti-diabetic agents from eco-friendly sources has gained momentum in modern years. The research investigates the possible anti-diabetic effects of the medicinally valuable herb *Grona Triflora*. The advantages of *Grona Trifloral* are rheumatism, fever, treated wounds, ulcers, skin diseases, stomachaches, and varicose vein problems. Aqueous and solvent-based extraction will be utilized for functional compounds from *Grona Triflora*. Aqueous extraction uses deionized water, while solvent extraction uses methanol and ethanol. The technique demonstrates the separability of several phytochemicals that may be involved in the antidiabetic effects; it will assess two prevention methods. One is alpha-amylase and the other is alpha-glycosidase biocatalyst prevention assays. The *Grona triflora* extract in changing a key biocatalyst used in the determined by carbohydrates, will provide

crucial information on eco-friendly diabetic treatment. The ethanol can separate active phytochemicals, such as antibacterial and antioxidant substances, and it will enhance fabric functionality. SEM data revealed improved surface morphology. FTIR verified a range of bioactive components, and the *Grona triflora* extract provides beneficial properties.

Assessment of the Grona Triflora Herbal Extract's Anti-Diabetic Effects

Assay for the Prevention of Alpha-amylase Biocatalysis

391 ml of 0.03 M phosphate buffer pH 8 (optimistic control) and 10 µL of amylase were added, with the concentrations of the test samples varied.

10 ml of starch was added after 10 minutes of preheating at 36 °C.

0.1 ml of 1% iodine solution and 5 ml of distilled water were added, and the OD was measured at 564 nm after being reheated for an hour at 36 °C.

Table 1. The Alpha-amylase Biocatalyst Prevention Assay

Sl. No	Solution (µl)	Standard	Methanol Compound	Ethanol Compound	Distilled water Compound
1	20 µl	33 %	31.01 %	34.52 %	25.50 %
2	40 µl	49 %	44.09 %	47.35 %	45.20 %
3	60 µl	57 %	52.30 %	60.45 %	61.10 %
4	80 µl	75 %	66.31 %	66.87 %	70.10 %
5	100 µl	89 %	79.60 %	85.23 %	80.10 %

Using acarbose as the reference, the alpha-amylase biocatalyst prevention experiment findings compare extraction techniques such as methanol, ethanol, and distilled water. Ethanol extraction is particularly noteworthy since it shows better biocatalyst prevention than the other solvents. This shows that ethanol may be used to extract bioactive substances with potent alpha-amylase inhibitory effects. These results demonstrate the effectiveness of ethanol and call for more research into possible therapeutic uses for diseases including diabetes and obesity (Table 1).One of the most important tools to test substances for potential therapeutic action against diabetes and obesity is the alpha-amylase biocatalyst prevention assay. By targeting alpha-amylase, which is involved in the carbohydrate metabolism process, these agents may reduce the uptake of glucose by blocking carbohydrate-to-sugar conversion. In the assay, the biocatalyst is incubated with a substrate and the test chemicals, and the concentration of the remaining substrate is then determined. This decrease in the breakdown of the substrate implies a strong prevention of alpha-amylase activity.

Alpha-glycosidase biocatalyst prevention assay

230ml from 82mM Buffer solution with phosphate8.1/Reference control testing sample concentrations was mixed with 76 ml of alpha-glucosidase. Here's an alternative way to phrase that sentence: After preheating the mixture at 36°C for 29 minutes and allowing it to cool, 252 mL of glucose reagent was added. The optical density was measured at 511 nm after 11 minutes at room temperature.

Table 2. The Alpha-glycosidase Biocatalyst Prevention Assay

Sl. No	Solution (µl)	Standard	Methanol Compound	Ethanol Compound	Distilled water Compound
1	20 µl	35 %	31.18 %	39.00 %	28.50 %
2	40 µl	48 %	39.45 %	48.20 %	35.67 %
3	60 µl	60 %	56.46 %	58.30 %	52.38 %
4	80 µl	75 %	69.30 %	76.46 %	66.40 %
5	100 µl	85 %	75.50 %	89.45 %	73.00 %

The Alpha-glycosidase biocatalyst prevention results for methanol, ethanol as well as distilled water extraction procedures. When compared to methanol and distilled water, ethanol extraction is the most efficient and shows a notable inhibition of the biocatalyst. This is a key component of ethanol's capacity

to extract bioactive substances with strong anti-alpha-glycosidase effects (Table 2). An essential screening technique for determining a substance's capacity to manage diabetes and related metabolomics issues are the alpha-glucosidase biocatalyst prevention assay. In an attempt to reduce postprandial glucose levels, these drugs slow down the segmentation of complex carbs into glucose by targeting alpha-glucosidase, abiocatalyst necessary for the digestion of complex carbohydrates. This assay measures the prevention of alpha-glucosidase activity using spectrophotometric or fluorometric methods, providing important insights into how well possible therapies regulate blood glucose levels and improve metabolic regulation. The *Grona Triflora* has antidiabetic properties as a natural medicinal substance. Ethanol extract had better prevention action than other solvents. The *Grona Triflora* has valuable natural medicine.

Antimicrobial Assessment

Well Diffusion Method

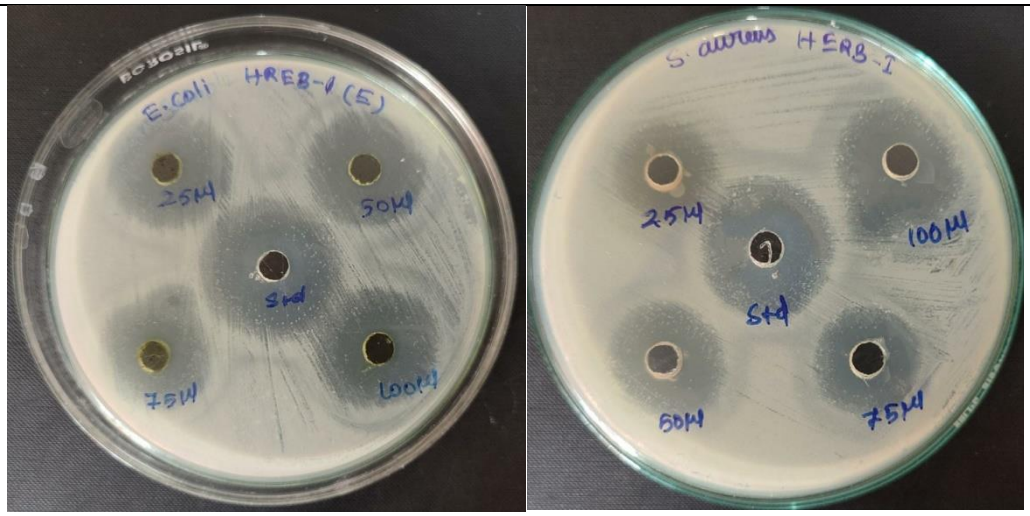
Table 3 shows the agar well diffusion method to assess antibacterial activity and minimum inhibitory concentrations prevention of both gram-positive and gram-negative bacteria. The extracts displayed moderate to strong prevention of growth with the tested microorganisms, thus confirming their antimicrobial potential.

Table 3. The Ethanol Herbal Extract of Grona Triflora Antimicrobial Properties

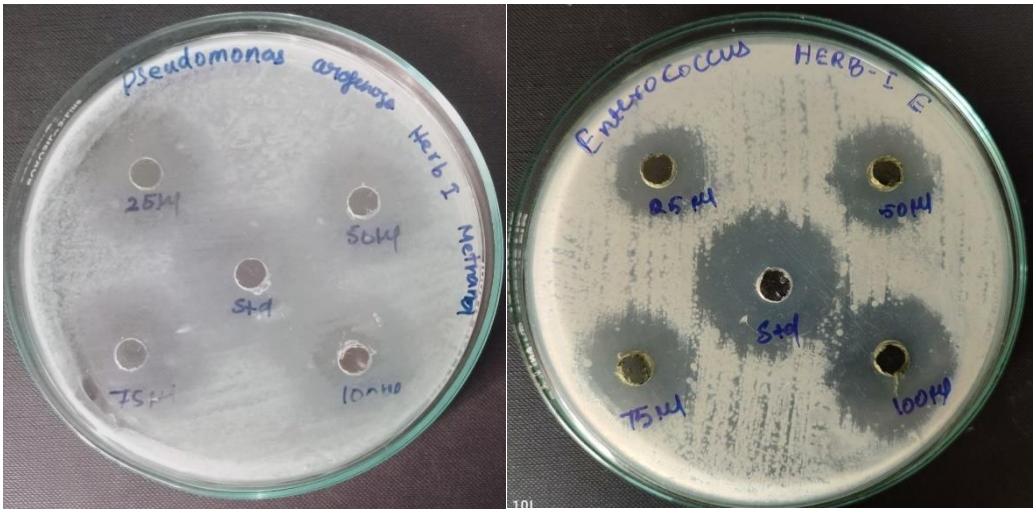
Solution in (µl)	***E.Coli* (cm)**	***Staphylococcus aureus*(cm)**	***Enterococcus* (cm)**	***Pseudomonas aerogenosa* (cm)**
25 µl	.6	.4	.4	.4
50 µl	.7	.5	.5	. 6
75 µl	.9	.6	.8	.8
100 µl	1.0	.8	.9	.9
Standard	1.0	1.0	1.0	1.0

The significant bacterial activity against the selected strains (*Pseudomonas aeruginosa*, *Staphylococcus aureus, Enterococcus*, and *E. coli*), especially at higher concentrations, also supports the studies that reported an antibacterial activity of the substance. The increasing widths of the inhibitory zones of *E. coli*, *Staphylococcus aureus*, and *Enterococcus* in a dose-dependent manner further indicate that the antibacterial potency of the active antimicrobial compounds within the substance correlate with concentration, as higher doses inherently contain more of the substance. Figure 4 shows that *E. Coli* caused increasingly wider inhibitory zones at higher concentrations, the material inhibiting this bacterium. *E. Coli*, and *Staphylococcus aureus* also showed efficacy against rising doses, as seen by bigger prevention zones. Further research is necessary to comprehend the processes underlying this differential reaction, since the comparatively lesser prevention against *Pseudomonas aeruginosa* suggests that this strain may have innate resistance or a decreased susceptibility to the drug. They suggested that the material is used as a substitute antibacterial agent, but for wider-spectrum efficacy, it might need to be enhanced or mixed with other substances.

Grona Triflora exhibits considerable antimicrobial activity, its potential as a natural treatment against multiple microorganisms. Research has exhibited that extracts from this medicinal herb effectively inhibit the growth of both Gram $^{+}$positive and Gram-negative bacteria, including common strains such as *E. coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. The antimicrobial properties of *Grona Triflora* are assigned to its bioactive compounds, which disrupt microbial cell forms and bioenergetics processes.



a) E.coli b) Staphylococcus aureus

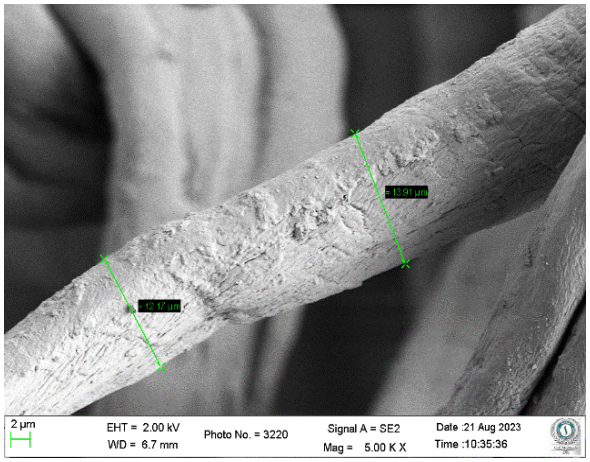


c) Enterococcus d) Pseudomonas aerogenosa

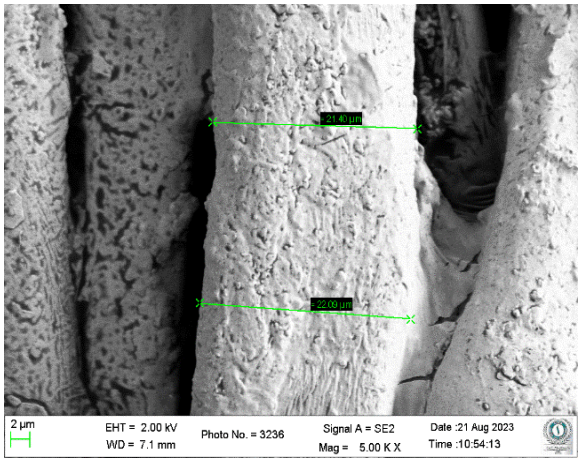
Figure 4. Anti-microbial Activity

Assessing of Scanning Electron Microscopy

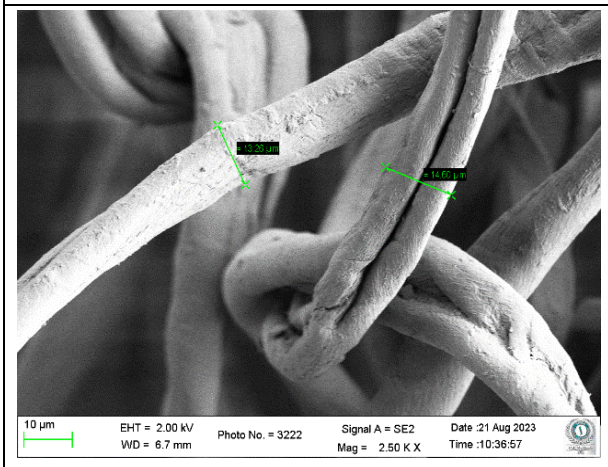
The assessment of scanning electron microscopy highlights significant variation in surface characteristics, with the herbal finished samples exhibiting texture and structural changes compared to the unfinished thermal knit fabric. Particular structural characteristics are displayed in (Figure 4a) by the scouring thermal knit fabric at 2 µm with an accelerating voltage (EHT) of 2.00 kV and a working distance (WD) of 7.1 mm. The distinctive shape of the herbal-infused thermal knit fabric (Figure 4b) is displayed at 2 µm with an EHT of 2.00 kV and a WD of 7.1 mm. Under the same EHT of 2.00 kV, the scouring and herbal-finished thermal knit fabrics exhibit contrasting textures and compositions at (Figure 4c) 10 µm, with WD changing at (Figure 4d) 7.1 mm and 7.1 mm, respectively. This study highlights how herbal finishing modifies the surface characteristics of the fabric, exposing minute features and changes that enhance both practicality and beauty in a range of therapeutic settings and magnifications.



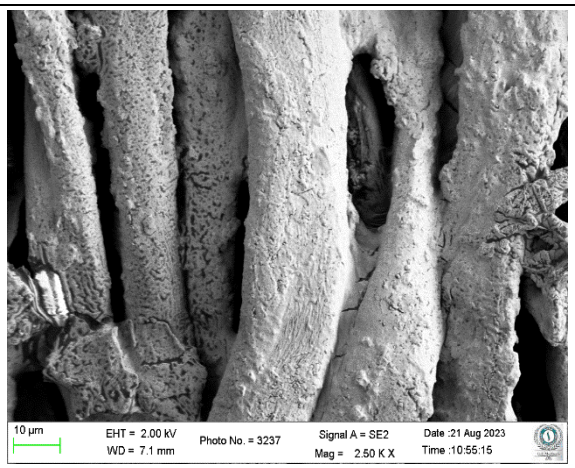
(a) 2 µm Unfinished Fabric



(b) 2 µm Herbal Finished Fabric



(c) 10 µm Unfinished Fabric



(d) 10 µm Finished Fabric

Figure 5. Scanning Electron Microscopy of the Finished Fabric

The SEM analysis provides a comprehensive view of how the herbal finishing process modifies the fabric's structure. The scoured fabric in Figure 5a displayed a smoother surface with fewer irregularities, while Figure 5b illustrated the presence of herbal residues and a more textured surface in the herbal-finished fabric, indicating an effective infusion of the plant extracts. At the higher magnification of 10 µm, Figures 5c and 5d revealed notable differences, with the scoured fabric exhibiting a uniform and less intricate texture compared to the elaborate and enhanced morphology. Potential for herbal finishing to not only improve the aesthetic appeal of thermal knit fabrics but also to enhance their functional properties, moisture management, and antimicrobial activity, paving the way for innovative textile applications.

FTIR Spectroscopy

Fourier Transform Infrared Spectroscopy analysis provides valuable observations into the chemical composition and functional groups present in the herbal finished fabric. Analyzing the FTIR spectra, specific absorption peaks corresponding to various functional groups can be discovered. The successful incorporation of *Grona Triflora* extract onto the fabric surface. Table 3 outlines the details of the herbal-finished fabric samples, while Table 4 presents the relevant spectral data. Figure 6 illustrates the FTIR spectra for the *Grona Triflora* extract-coated fabric, highlighting distinct peaks that correspond to the active compounds in the extract. This information not only confirms the presence of herbal components but also helps in understanding the potential interactions between the fabric and the herbal treatment, which could enhance its functional properties.

Table 4. Specification of the Sample

Sl. No	Types	Data
1	Name of the Sample	Bio Extract Finished Fabric
2	Concentration level	% Transmission
3	Anodization	Hap - Genzel
4	Number of Scanning's	18
5	Determination	18 cm^{-1}

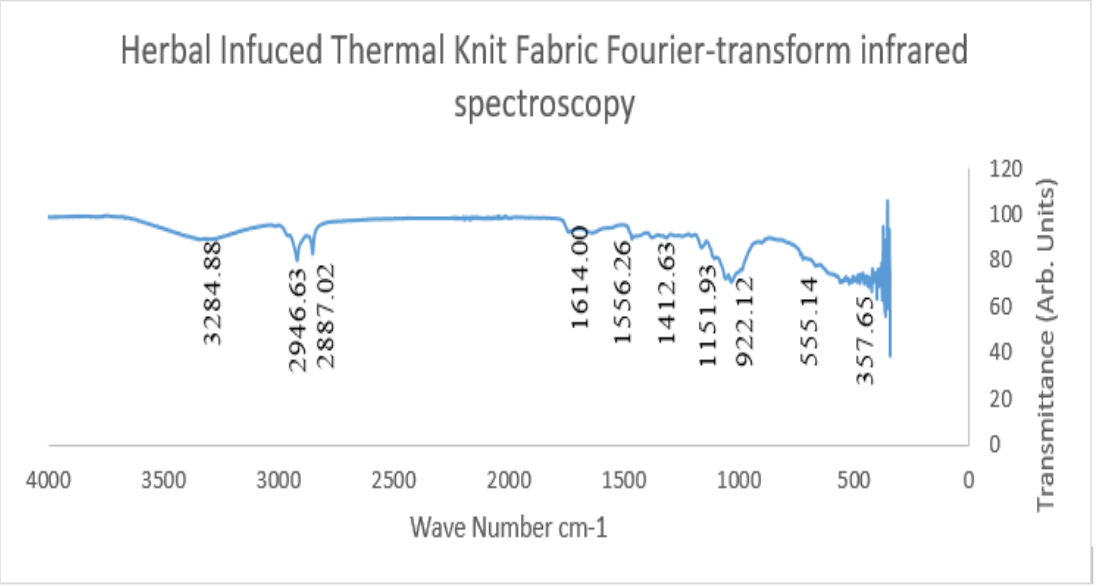


Figure 6. FTIR Dataset

FTIR Spectroscopy Wave Number Evaluation

When Fourier Transform Infrared (FTIR) spectroscopy is used to examine herbal finished textiles (Figure 6), several important functional groups that are suggestive of the chemicals contained are revealed. At 3284.88 cm^{-1}, the hydroxyl groups (-OH) stretching vibration is identified, as the presence of alcohols or phenols, which are frequently present in plant extracts. The C-H bond elongation oscillations, which are typical carbonyl groups (C=O), are depicted by the vibration peaks 2946.63 cm-1 and 2887.02 cm^{-1}. Detection of alkene/olefin Molecular substructures is indicated by molecular substructures1614.00 cm^{-1} as well as 1556.26 cm^{-1}, the existence of unsaturated molecules similar to essential oils. Waves at 1412.63 cm^{-1}, 1151.93 cm^{-1}, and 1030.56 cm^{-1} indicate the existence of compounds containing oxygen, such as carboxylic acids, esters, and ethers. These waves correspond to functional groups that contain C-H, C-O, and O. The waves 922.12 cm^{-1} and 555.14 cm^{-1}, suggest the existence of oxygen-functionalized Molecular substructures, potentially alcohols. The varied molecular makeup of the herbal finished fabric is further defined by the waves 357.65 cm^{-1}, which correlate to C-H deformation vibrations present in alkanes, alkenes, alkynes, and aromatic compounds. The herbal finished fabric's FTIR analysis revealed a diverse molecular composition that was suggestive of the presence of many functional groups in the sample. The existence of alcohols, phenols, hydrocarbons, carbonyl groups, alkene/olefin compounds, and oxygen-containing functional groups such as esters, ethers, and carboxylic acids was shown by significant peaks seen at particular wave numbers. Alkyl chloride-corresponding signals were also found. According to the FTIR spectroscopy analysis, the herbal finished cloth probably contains several bioactive components. Alcohols or phenols, which are commonly found in plant extracts, may have antioxidant properties if they have hydroxyl groups (-OH). Alkene/olefin functional groups imply unsaturated compounds, such as essential oils, which may have antibacterial or anti-inflammatory properties. The existence of functional groups that contain oxygen, such as carboxylic acids, ethers, and esters, suggests the possibility of bioactive substances with a variety of functional effects.

CONCLUSION

This study makes it easier to understand the broad applicability of herbal extracts mostly those made from ethanol in a variety of fields. Engraving herbal extracts into textiles offers an eco-friendly equivalent to conventional antimicrobial treatments, aligning with the growing demand for sustainable and natural solutions in the textile industry. The exhibit is the effective engrafting of *Grona Triflora* extracts into thermal knit fabric using ethanol as an effective solvent for extracting bioactive compounds. Scanning Electron Microscopy (SEM) revealed Substantial morphological changes on the fabric surface, confirming that the herbal infusion altered the fabric's texture, enhancing both its aesthetic and functional Characteristics. Fourier Transform Infrared (FTIR) spectroscopy further Authenticated the presence of diverse functional groups, including hydroxyl, carbonyl, and alkene groups, indicating the rich molecular composition of the herbal finishing. These compounds, which include potential antioxidants and antimicrobials, were shown to improve the fabric's health-related advantages and protective characteristics. This research supports the prospective application of herbal finishes in textiles, particularly for generating functional fabrics that offer health advantages, and underscores ethanol's efficacy as a solvent in capturing the plant's active elements.

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