Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(1), 477-486 | ISSN:2251-6727

Herbal Finish with Antimicrobial and Anticancer Activity on Suitable Fabrics for Cancer Patients

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(Received: 27 October 2023 Revised: 22 November Accepted: 26 December)

KEYWORDS

Medical textiles, Cancer patients clothing, Antibacterial, anti-cancer activity, natural fiber, bamboo, herbal finish.

ABSTRACT:
Cancer patients grapple with a variety of clothing-related difficulties arising from the physical and emotional changes triggered by the disease and its treatments. Patients, especially those dealing with medical conditions, require clothing designed to meet specific needs and contribute to their healing process. Natural fibers are frequently favoured for patient apparel in healthcare settings due to their breathability, comfort, and hypoallergenic qualities. From the family of Zingiberaceae a plant is identified which has culinary, medicinal and ornamental value, extracted with ethanol and finished in the bamboo fabric with the anticancer and antimicrobial activity test. It has demonstrated significant potential in various aspects, positioning it as a valuable option for clothing designed for cancer patients.

1.Introduction:

Fabric plays an essential role in our daily lives, not only in terms of fashion and aesthetics but also in their impact on the health and well-being of our skin. The better choice of fabric can significantly influence the comfort and health of our skin. They can help in preventing skin irritations, allergies and other skin issues. It's important to consider the fabric's breathability, moisture-wicking properties and softness when choosing clothing for our skin. Moreover, eco-friendly and sustainable fabric options like organic cotton and bamboo can also contribute to both individual and the planet wellness. Apparel plays a significant role especially in hygiene and healthcare settings. Patients frequently contend with fluctuating levels of skin sensitivity that can arise and recede during flare-ups [1]. Specific healthcare wearables for patients during their crucial time can help in improving their self-decision management in the cases of chronic illness [2]. One of the top three chronic diseases, Cancer and its treatments takes a painful and agonised process for patients, in which clothing part takes an important role to play a support for the patients in prevention, protection and comfortability.

Cancer patients encounter a multitude of clothing challenges due to the physical and emotional changes brought about by the disease and its treatment [3]. These challenges can have a meaningful impact on their quality of life, self-esteem, and overall comfort. On a physical level, the toll of cancer treatment can manifest in a variety of ways. For instance, the skin's heightened sensitivity caused by chemotherapy or radiation can make fabrics that were once comforting feel abrasive and painful against the body. This can lead to itching, rashes and discomfort turning the simple act of getting dressed into a distressing ordeal. Weight fluctuations is an another common side effect that introduce an additional layer of complexity. Some patients experience dramatic weight loss due to the treatment's effect on their appetite, while others may see weight gain due to medications or hormonal changes. These bodily transformations render their existing clothing ill-fitting and struggle to wear.

2. Selection of fibers and its benefits:

Patients, especially those dealing with medical conditions require clothing that addresses specific needs and contributes to their recovery. Natural fibers are often an excellent choice for patient clothing in healthcare settings due to their breathability, comfort, and hypoallergenic properties [4]. Some of the key

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JCHR (2024) 14(1), 477-486 | ISSN:2251-6727

considerations for the choice of fabrics that consider the following properties:

a) Softness and Comfort: Patients may spend extended periods in bed or seated, so the fabric must be exceptionally soft and comfortable. Fabrics like cotton, bamboo, silk and certain blends that offer a gentle touch are often preferred. These materials minimize irritation and chafing, promoting overall comfort.

b) Breathability: Proper ventilation is essential for patients to prevent overheating and maintain skin health. Breathable fabrics such as cotton and linen allow air to circulate and help wick away moisture. This is especially important for patients prone to sweating or those with sensitive skin.

c) Moisture-Wicking: Patients who may experience excessive sweating, such as those with fever or undergoing treatments that induce perspiration, benefit from moisture-wicking fabrics. These materials draw moisture away from the skin, helping to maintain dryness and reduce the risk of skin irritation.

d) Durability: Clothing for patients should withstand frequent laundering, as hygiene is a top priority in healthcare environments.

e) Antimicrobial Properties: In healthcare settings, where infection control is paramount, fabrics with antimicrobial properties are beneficial. These fabrics can help reduce the risk of cross-contamination and maintain a hygienic environment [5].

f) Temperature Regulation: Patients often experience fluctuations in body temperature. Fabrics that can help regulate temperature is always a better option.

g) Sensitivity to Irritants: Patients may have heightened sensitivity to chemicals and dyes found in clothing. Choosing fabrics that are free from harsh chemicals and dyes will minimize the risk of skin reactions.

h**) Environmental Considerations**: Selection of eco-friendly fabrics like organic cotton, bamboo or tencel that not only benefit the patients but also have a lower environmental impact.

3.Types of finishing for Medical Textiles:

Textile finishing refers to the various processes and treatments applied to textiles after they are woven or knitted to improve their appearance, performance or functionality. Textile finishing for medical textiles involves specialized processes and treatments to ensure that textiles meet the unique requirements of the healthcare industry. Medical textiles are used in various applications within healthcare settings, including patient garments, surgical gowns, drapes, wound dressings, and more. The finishing processes are designed to enhance the performance, safety, and hygiene of these textiles [6]. Some of the finishings that are useful for medical textiles are as follows:

a) Antimicrobial Finishing: This is a necessary finishing technique for medical textiles, as it involves the application of antimicrobial agents to inhibit the growth of microorganisms on the fabric's surface. This helps reduce the risk of infections and maintain a sterile environment.

b) Hypoallergenic Finishing: Medical textiles should be free from common allergens to minimize skin irritations in sensitive patients. Hypoallergenic finishing ensures that the textiles are suitable for a broad range of patients.

c) Biocompatibility Testing: In addition to finishing processes, medical textiles often undergo rigorous testing to ensure they are biocompatible and safe for contact with the skin and body.

d) UV Protection Finishing: Medical textiles may be used outdoors or in situations where UV protection is necessary. Finishing can enhance the textiles' ability to shield the wearer from harmful UV radiation.

e) Easy-Care Finishing: Medical textiles need to withstand frequent laundering and maintain their properties. Easy-care finishing makes textiles more durable and resistant to wear and tear.

h) Barrier Finishing: Barrier fabrics are treated to be impermeable to liquids, such as blood and bodily fluids. These textiles are used in surgical drapes and gowns to protect healthcare professionals from contamination.

g) Moisture Management Finishing: Fabrics are treated to enhance moisture-wicking properties, ensuring that perspiration and moisture are efficiently drawn away from the skin. [6].

h) Herbal Finishing: Herbal finishes for fabrics involve the use of natural substances derived from plants to enhance the properties of textiles. These finishes can provide various benefits such as antimicrobial, insect-repellent, fragrance, or soothing effects and many more. The Finishing processes can be tailored to meet the specific needs of different fabric applications depending on the usage. The specialised application are:

a) Phase Change Materials (PCM) Finish: Helps regulate body temperature by absorbing and releasing

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heat. Found in sportswear, sleepwear and military garments.

b) Microencapsulation: Encapsulates active agents for slow release, often used in wound dressings, skincare textiles, and fragrance applications.

c) Nano Finish:

The uses of nanotechnology is to enhance fabrics' properties, including stain resistance, waterproofing and antimicrobial protection etc., [7].

4. Herbal finishes for the fabrics:

Herbal finishes offers a wide range of benefits from various plants. Aloe vera finishes, for instance, incorporate the hydrating and skin-soothing properties of aloe vera gel, making them ideal for fabrics intended for individuals with sensitive or dry skin. Lavender finishes infuse textiles with the calming and stress-relieving aroma of lavender, often used in sleepwear and linens to promote relaxation. Neem finishes incorporate neem extracts or neem oil, serving as a natural insect repellent and antimicrobial agent offering enhanced protection against microbial growth and pests. Mint finishes provide fabrics with a refreshing and cooling sensation, making them suitable for sportswear and hot weather clothing. Turmeric finishes are imbued with natural antimicrobial and anti-inflammatory properties, ideal for healthcare textiles and garments requiring heightened hygiene. Eucalyptus finishes, incorporating eucalyptus oil or extracts, infuse textiles with a pleasant aroma and potential antimicrobial qualities. Lastly, citrus finishes harness extracts from fruits like oranges or lemons, imparting a fresh and invigorating scent to fabrics, rendering them suitable for linens and sportswear alike. These herbal finishes offer a natural, plant-based approach to improve fabric performance and sensory experiences.

a) Identification of Plant for Herbal finish:

Zingiberaceae" is indeed the family of flowering plants commonly referred to as the ginger family. It is one of the largest families in the order Zingiberales and is known for its diverse and aromatic plant species including ginger, turmeric and cardamom. These plants are primarily found in the moist and tropical regions of the world and they are known for their culinary, medicinal and ornamental value. The family Zingiberaceae includes a wide range of species with various uses and properties, making it of significant botanical and economic importance. Among the broad spectrum of Zingiberaceae family, a species from turmeric is identified for herbal finish for selected fabrics and named as Plant A [8].

Plant A is a less common and distinct variety of turmeric that stands out for its striking properties. Plant A boasts several potential medicinal properties, including anti-inflammatory and antioxidant effects. It has been a part of traditional medicine systems such as Ayurveda, where it is believed to address various health concerns from respiratory issues to skin ailments. Additionally, its antimicrobial properties make it a candidate for skincare and cosmetic applications. Also it has a natural colouring ability which is employed in textiles and foods. Despite its promising attributes, Plant A is relatively less common and cultivated in specific regions, limiting its availability and recognition. As research continues, Plant A unique properties may find broader applications and uses beyond its traditional and cultural significance [9]. Rhizomes of the plant A have been explored for antifungal activity, smooth muscle relaxant, anti-asthmatic activity, antioxidant activity, analgesic activity, locomotor depressant, anticonvulsant anxiolytic and CNS depressant activity, anti-bacterial activity, anti-ulcer activity and many other miscellaneous activities. The plant A ethanal extract was calculated for MIC value. The MIC value or Minimum Inhibitory Concentration value helps determine the potency of the plant extract as an antimicrobial agent and is an important factor in evaluating its potential use for various applications.

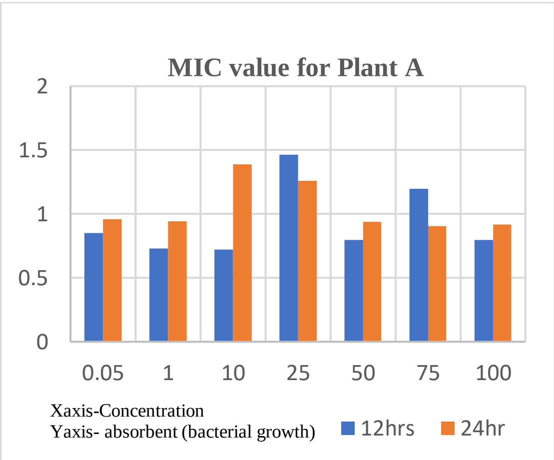

Figure :1

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JCHR (2024) 14(1), 477-486 | ISSN:2251-6727

5. Application of Plant A ethanol extract on Fabric:

Plant A's rhizome is finely ground into a powder and then subjected to ethanol extraction using the Soxhlet method. The resulting solution is prepared with 50 & 100 percent concentration, guided by the MIC (Minimum Inhibitory Concentration) value shown in Fig 1. Natural fixation and cross-linking agents were incorporated into the solution. Subsequently, the solution is measured and applied to the fabric using a padding mangle to meet the specific fabric requirements.

The solution prepared is subjected to tests for both antimicrobial and anti-cancer activities. The prepared extracts, one at a concentration of 50% and the other at 100% were subjected to analysis both with and without the use of a cross-linking agent. This experimental setup allows for a comprehensive evaluation of the effects of the cross-linking agent on the properties and characteristics of the extracts. The analysis would likely involve assessing various parameters such as chemical composition, physical properties and functional attributes, to determine how the presence or absence of the cross-linking agent influences the extracts' behaviour or performance. The 50% concentration solutions were denoted as "Plant A 50" for those without the cross-linker and "Plant A 50C" for those with the cross-linking agent. Similarly, the 100% concentration solutions were labelled as "Plant A 100" for those without the cross-linker and "Plant A 100C" for those with the cross-linking agent.

a) Selection of fabrics:

Bamboo fibers are a valuable choice for medical textiles due to a range of advantageous properties. First and foremost, bamboo exhibits remarkable antimicrobial and antibacterial characteristics, rendering it particularly well-suited for applications in the medical field where hygiene is of utmost importance. These innate properties help create a more sanitary environment for patients and healthcare professionals. In addition to its antimicrobial attributes, bamboo fabrics excel in terms of breathability. This enhanced breathability ensures that patients experience optimal comfort, as it allows air circulation and heat dissipation. The result is a reduction in the risk of moisture build-up, which is vital in preventing skin issues and wellness. Furthermore, bamboo is renowned for being hypoallergenic. Its hypoallergenic nature. This quality is particularly required for individuals with sensitivities, making bamboo an excellent choice for medical textiles that come into direct contact with the skin.

The next option is Cotton which is an exceptional choice for medical textiles for its remarkable qualities. Foremost, cotton is renowned for its softness and comfort when it comes into contact with the skin, a feature that holds significant importance in maintaining patients' safety and overall comfort during medical procedures or while recuperating. Secondly, cotton's remarkable absorbent properties make it a standout material for various medical applications. Its ability to efficiently soak up moisture is particularly valuable for producing items like wound dressings and bed linens, where keeping things dry is difficult and lastly cotton is often considered hypoallergenic. This attribute is of particular importance for individuals with sensitive skin, ensuring that cotton-based medical textiles are gentle and safe for all patients. Making a choice of these two fabrics the above mentioned application were done and further tests were conducted.

b) Anti-cancer activity:

The anti-cancer activity test for Plant A involves evaluating its potential to inhibit or affect the growth and viability of cancer cells.

1. **Cell Lines:**

For the anti-cancer activity test, the A375 cell line was sourced from NCCS, Pune. This choice is underpinned by the fact that A375 is a well-established and extensively characterized cell line known for its reproducible results. The cell line was cultured in MEM medium supplemented with fatal bovine serum. The MTT assay method was employed and reagents included MTT Solution (1mg/ml), DMSO (100%), and PBS (pH 7.2). Incubation was carried out at 37°C in a 5% CO_2 environment for 3-4 hours. Absorbance measurements were taken at 570 nm. Imaging was conducted using an Inverted Phase Contrast Microscope, with the analysis attributed to Analyst ID DS.

2. **Cell Viability**

In the context of anti-cancer activity, the MTT assay was performed to assess the effect of a plant extract at different concentrations (µg) on the viability of cancer cells. The results showed a concentration-dependent response for Plant A 50, at a concentration of 5 µg, the plant extract displayed a relatively high cell viability of 77%, suggesting a lesser impact on the cancer cells. As the concentration increased to 25 µg, cell viability remained relatively high at 58%. However, at 50 µg, the extract exhibited a notable decrease in cell viability to

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JCHR (2024) 14(1), 477-486 | ISSN:2251-6727

47%, indicating a more significant effect on cancer cell survival. Further increases in concentration to 75 µg and 100 µg led to a concentration-dependent reduction in cell viability, with percentages dropping to 32% and 19%, respectively. The specific sample being referred to in Figure 2 is labelled as "Plant A 50" showing the sample of Anticancer Activity with A375 cell line.

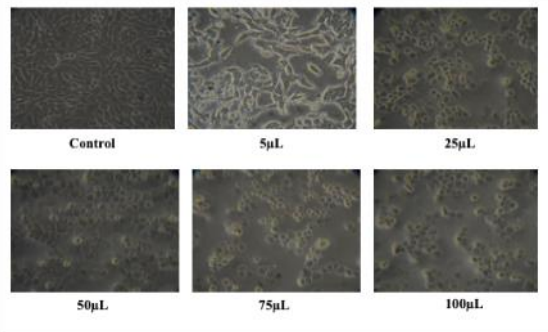

Fig 2 :Plant A 50

Plant A 50C, with varying degrees of cell viability. At lower concentrations, such as 5 µg and 25 µg, the cell viability remained relatively high at 86% and 71%, respectively. As the concentration of the plant extract increased to 50 µg, 75 µg, and 100 µg, the cell viability gradually decreased to 63%, 49%, and 42%, respectively. The details and findings of this particular sample are likely presented in Figure 3, providing insights into its anti-cancer activity and how it affects the A375 cell line.

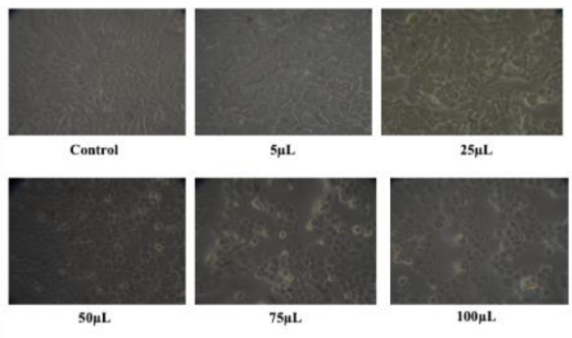

Fig 3 :Plant A 50C

Plant A 100 outcomes of the MTT assay, which assessed the anti-cancer activity of a extract, reveal notable variations in cell viability at different concentrations. At 5 µg concentration, the extract displayed a cell viability of 52%, indicating a reduction in the viability of cancer cells. As the concentration increased to 25 µg, the cell viability remained comparatively low at 46%. The impact of the plant extract became more pronounced at 50 µg, with a cell viability of 27%, suggesting a substantial effect on cancer cell survival. Further increases in concentration to 75 µg and 100 µg continued to show a concentration-dependent reduction in cell viability, with percentages dropping to 23% and 18% respectively. These results strongly imply the potential anti-cancer properties of the plant extract particularly at higher concentrations. The sample labelled as "Plant A 50" are likely presented in Figure 4. This figure is expected to provide a visual representation and insights into the anti-cancer activity of the sample, specifically concerning its impact on the A375 cell line.

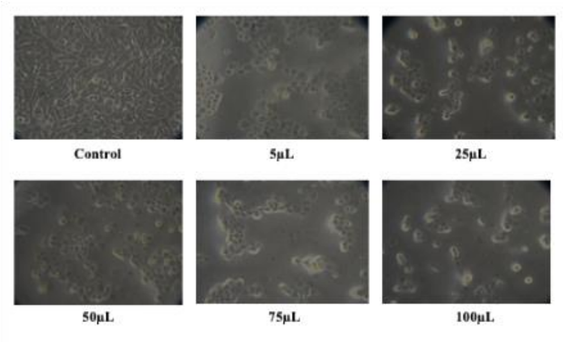

Fig 4 :Plant A 100

The results obtained from the MTT assay, designed to evaluate the anti-cancer activity of a plant extract Plant A 100 C, reveal a concentration-dependent impact on cell viability. At a concentration of 5 µg, the extract demonstrated a cell viability of 73%, indicating a moderate reduction in the viability of cancer cells. As the concentration increased to 25 µg, cell viability remained relatively high at 65%. However, at 50 µg, the plant extract exhibited a notable decrease in cell viability to 56%, suggesting a more substantial impact on the survival of cancer cells. Further increases in concentration to 75 µg and 100 µg continued to show a concentration-dependent reduction in cell viability, with percentages dropping to 43% and 32%, respectively. This figure 5 is expected to offer insights and visual representations of the anti-cancer activity of the sample, particularly in its interaction with the A375 cell line.

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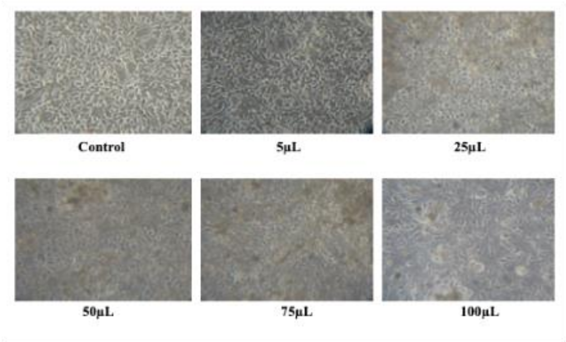

Fig 5 :Plant A 100C

These results strongly support the notion that Plant A's anti-cancer activity is indeed concentration-dependent, with higher concentrations yielding more pronounced impacts on cancer cells. This aligns with the general concept that higher doses of therapeutic agents can lead to more significant effects. It's worth noting that the presence of the cross-linking agent may modify the outcomes, potentially altering the plant extract's anti-cancer performance. To arrive at concrete conclusions and ascertain the clinical relevance of these findings, comprehensive research and detailed investigations are essential. This knowledge holds the potential to be instrumental in the development of effective anti-cancer treatments and the optimized utilization of plant extracts in anti-cancer therapies.

3. **IC50 Value:**

It represents the concentration of a substance such as a drug or compound, needed to inhibit the growth or survival of cancer cells by 50%. In other words, the IC50 value indicates the effectiveness of a substance in inhibiting cancer cell proliferation. It is used to compare and assess the potency of different compounds or treatments for their anti-cancer properties. Lower IC50 values indicate a more potent treatment, as it requires a lower concentration to achieve a 50% inhibition of cancer cell growth [10]. To determine the IC50 for anti-cancer activity, a dose response curve is typically generated by exposing cancer cells to different concentrations of a substance. The IC50 value is then calculated from this curve, providing a quantitative measure of the substance's anti-cancer efficacy.

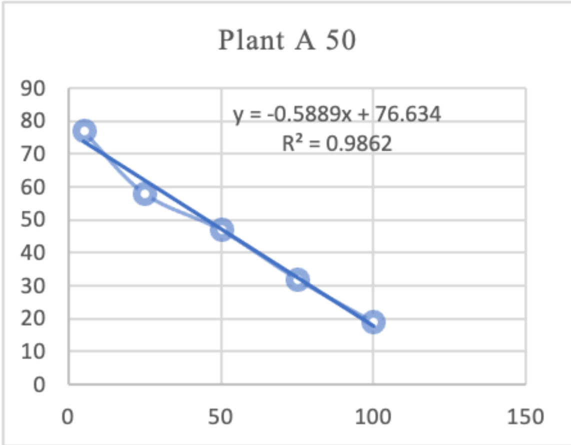

Fig 6: Plant A 50/IC50

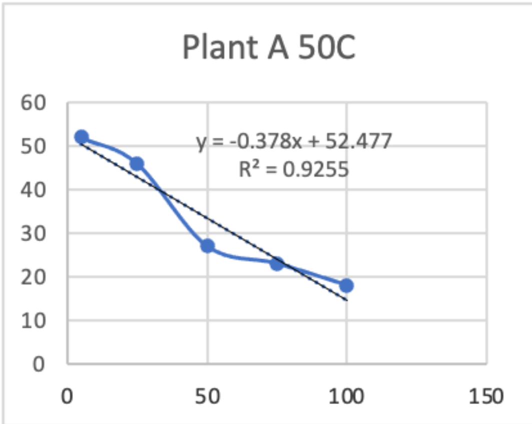

Fig:7 Plant A 50 C

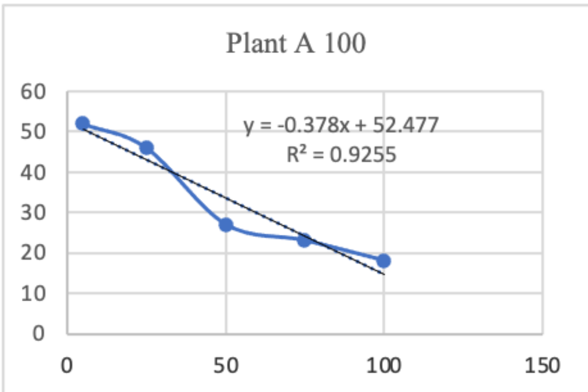

Fig:8 Plant A 100

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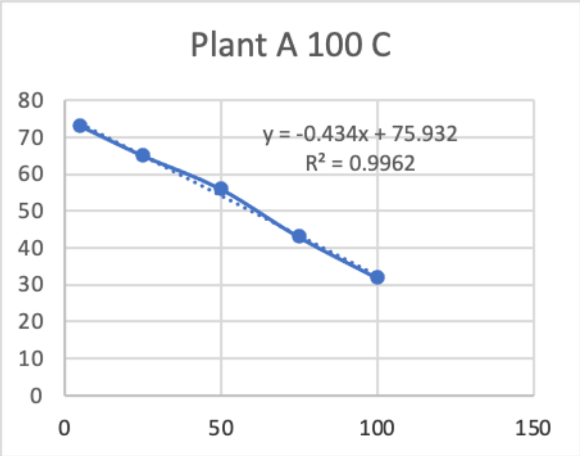

Fig 9: Plant A 100C

The results provided are:

The IC50 value for Plant A 100 is approximately 6.542.
The IC50 value for Plant A 50 is approximately 44.706.
The IC50 value for Plant A 100C is approximately 59.016.
The IC50 value for Plant A 50C is approximately 77.779.

A lower IC50 value means that a lower concentration of the substance (in this case, the plant extract or treatment) is required to inhibit 50% of cancer cell growth. This indicates a more potent anti-cancer effect. The most potent treatment, in this case, is Plant A 100 with the lowest IC50 of approximately 6.542. This suggests that a relatively low concentration of Plant A 100 is required to inhibit 50% of cancer cell growth, indicating its strong anti-cancer potential. Plant A 50 follows with an IC50 of approximately 44.706, also demonstrating notable anti-cancer efficacy. On the other hand, Plant A 100C and Plant A 50C have higher IC50 values, indicating that they require higher concentrations to achieve the same level of inhibition.

c) Anti-microbial activity:

Testing for antimicrobial activity on both the solutions and the fabrics, is a crucial step in ensuring the effectiveness and safety of medical textiles. These tests help evaluate how well the materials can prevent the growth and spread of microorganisms, bacteria and fungi, which is vital in healthcare settings. Conducting this assessments provides valuable insights into the materials overall performance and their suitability for medical use. The results of these tests can inform healthcare professionals and researchers about the fabrics ability to maintain a clean and hygienic environment, reduce the risk of infections, and promote the safety of patients .

1)Preparation of bacterial inoculum

The preparation of the bacterial inoculum involved several steps. Stock cultures were kept at 4°C on nutrient agar and potato dextrose agar slopes. Active cultures were prepared by transferring cells from the stock cultures to 50ml test tubes containing nutrient broth, followed by incubation at 37°C for 24 hours with agitation for bacterial cultures and 3-5 days at 27°C for fungal cultures. The resulting suspensions were streaked onto nutrient agar and potato dextrose agar. Subsequent incubations were carried out at 37°C for bacterial cultures and 27°C for fungal cultures. Single colonies were transferred to nutrient agar and potato dextrose slants and incubated. Stock cultures were stored at 4°C. For experiments, test organisms were transferred into 50ml of nutrient broth and incubated at 37°C for 18-20 hours in the case of bacterial cultures.

The tests were conducted in well diffusion method is a microbiological technique used to assess the antibacterial activity of substances like antibiotics, plant extracts, or synthetic compounds. It involves creating wells in an agar plate inoculated with bacteria and placing the test substance in those wells. After incubation, the inhibition zones around the wells are measured to determine the strength of the antibacterial effect. This method is a preliminary screening tool to assess the potential antibacterial properties of a substance, though further testing is often required for a more detailed evaluation.

a) Antibacterial activity for Plant A extracts

The results of antibacterial testing on treated (Plant A 50, Plant A 50C, Plant A 100, Plant A 100C) treated knitted cotton and bamboo fabrics against Staphylococcus (Staph) and Escherichia coli (E. coli) bacteria shown in Fig 10 & 11 for Staph and for E.coli shown in Fig 12 &13 are as follows:

Plant A prepared solutions for Staph (after 10 tests) the Average values are as follows:

Plant A 50: Average result = 2.5mm
Plant A 50C: Average result = 3mm
Plant A 100: Average result = 3mm
Plant A 100C: Average result = 3.586666667mm

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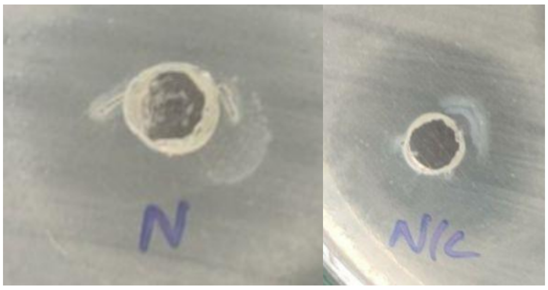

Fig 10. Plant A 50 Staph Activity

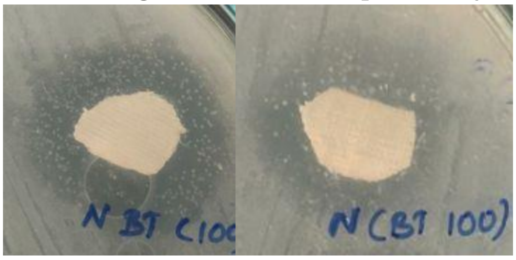

Fig 11. Plant A 100 Staph Activity

For E. coli (after 10 tests):
Plant A 50: Average result = 5.126666667mm
Plant A 50C: Average result = 5.573333333mm
Plant A 100: Average result = 2.52mm
Plant A 100C: Average result = 3.66666667mm

Fig12. Plant A 50 Ecoli Activity

Fig 13. Plant A 100 Ecoli Activity

These results provide an overview of the antibacterial performance of the tested solution against Staph and E. coli bacteria. The values indicate the average effectiveness of each treatment (Plant A 50, Plant A 50C, Plant A 100, Plant A 100C) in inhibiting the growth of these specific bacteria after multiple tests.

b) Antibacterial activity for Fabrics

The antibacterial activity results for different fabrics treated with Plant A at different concentrations (Plant A 50 and Plant A 100) against Staphylococcus (Staph) shown in Fig 14 & 15 and Escherichia coli (E. coli) bacteria shown in Fig 16 &17:

For Staph (after testing):
Plant A 50/Bamboo: 1.773333333mm
Plant A 100/Bamboo: 2.46666667mm
Plant A 50/Cotton: 1.2mm
Plant A 100/Cotton: 1.7mm

Fig 14. Plant A 50 &100 Cotton Staph Activity

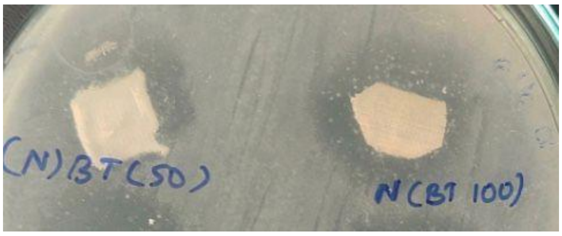

Fig15. Plant A 50 &100 Bamboo Staph Activity

For E. coli (after testing):
Plant A 50/Bamboo: 2.826666667mm
Plant A 100/Bamboo: 5.58666667mm
Plant A 50/Cotton: 3.8mm
Plant A 100/Cotton: 3.5mm

Fig 16. Plant A 50 &100 Cotton Ecoli Activity

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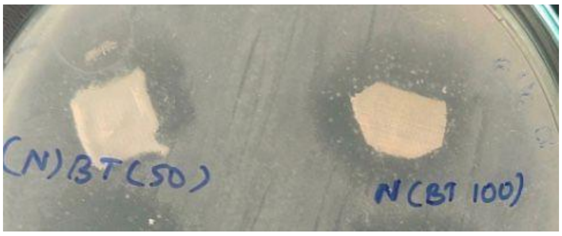

Fig17. Plant A 50 &100 Bamboo Ecoli Activity

These results provide insights into the antibacterial effectiveness of different fabric treatments against Staph and E. coli bacteria. The values represent the average outcomes of the antibacterial tests and demonstrate how the fabrics perform in inhibiting the growth of these specific bacteria.

c)Antifungal activity for Plant Extracts

The results of the antifungal activity for different concentrations of Plant A 50 % and 100 % concentrations shown in Fig 18 & 19 are as follows:

Plant A 50: The antifungal activity measured 1.82mm.

Plant A 50C: The antifungal activity was 2.26mm.

Plant A 100: The antifungal activity exhibited a high value of 4.533333333mm.

Plant A 100C: The antifungal activity was even higher at 5.243333333mm.

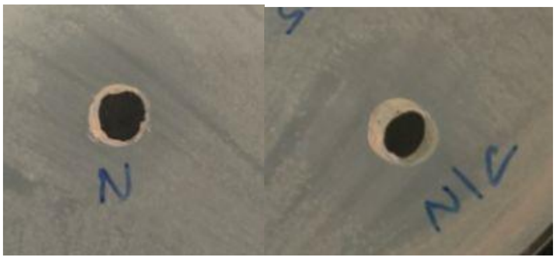

Fig 18. Plant A 50 Antifungal Activity

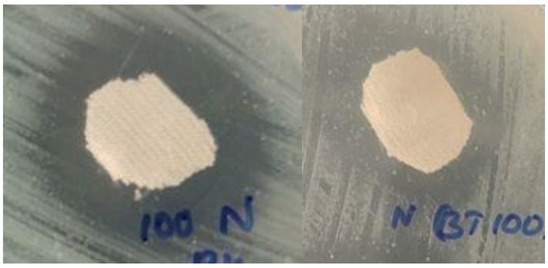

Fig 19. Plant A 100 Antifungal Activity

These results suggest that Plant A, especially at the higher concentration of 100, demonstrates significant antifungal activity. When a cross-linking agent (noted by the "C" designation) is added, it appears to enhance the antifungal effectiveness even further. This data indicates the potential of Plant A, particularly at higher concentrations and with the cross-linking agent, as an effective solution for inhibiting fungal growth. This could be of great significance in a wide range of medical and textile applications

d)Antifungal activity for Fabrics

The results of the antifungal activity for Plant A extract treated at 50% and 100% concentrations on Bamboo and as well as for Cotton Plant A extract treated at 50% and 100% concentrations, are as follows:

Plant A 50/Bamboo: The antifungal activity was measured as 2.9mm.

Plant A 100/Bamboo: The antifungal activity was measured as 3.786666667mm.

Plant A 50/Cotton: The antifungal activity was measured as 1.5mm.

Plant A 100/Cotton: The antifungal activity was measured as 2.2mm.

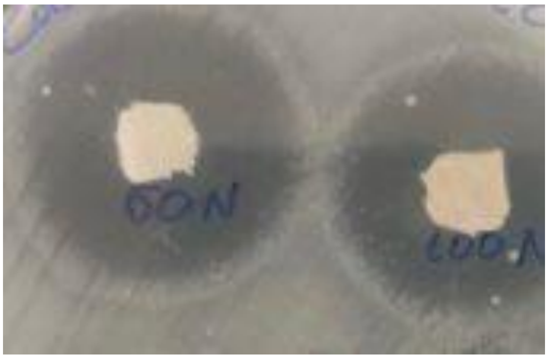

Fig 20. Plant A 50 &100 Cotton Antifungal Activity

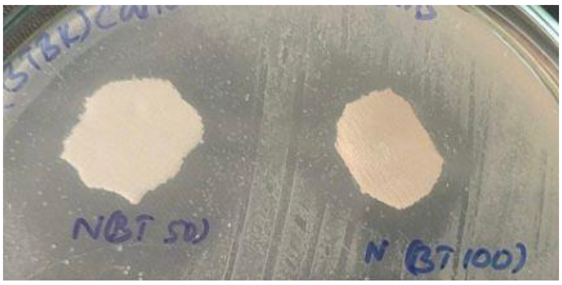

Fig21. Plant A 50 &100 Bamboo Antifungal Activity

These results indicate the effectiveness of the plant extract in inhibiting fungal growth in different fabric compositions. In this context, the combination of Plant A 100 with Bamboo fabric appears to exhibit the highest antifungal activity, with a measurement of 3.786666667mm, while Plant A 100 with Cotton fabric also shows significant antifungal activity with a measurement of 2.2mm.

6. Summary:

Plant A has shown promising potential in multiple aspects, making it a valuable candidate for cancer patient clothing. In terms of anti-cancer activity, it exhibited encouraging results, suggesting its ability to inhibit cancer cell growth. Additionally, Plant A displayed substantial antimicrobial activity, which is important for maintaining a hygienic environment for cancer patients. Moreover, when applied as a finish on both cotton and bamboo fabrics, Plant A demonstrated its capability to enhance the textiles' properties. Cotton, known for its softness and comfort, was improved by the addition of Plant A, making it a comfortable choice for sensitive cancer patients. Bamboo, with its inherent antimicrobial properties and breathability, further benefited from the plant A extract and also enhancing its suitability for cancer patient clothing.

Overall, Plant A's anti-cancer and antimicrobial activities, coupled with its positive impact on cotton and bamboo fabrics positioning it as a promising solution for the development of comfortable, hygienic and potentially therapeutic clothing for cancer patients. However, further research and clinical trials may be necessary to validate its safety and efficacy in real-world medical settings.

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