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Research Article

Antibacterial Efficacy of Glycol-Coated Polyester Fabric: A Potential Solution for Enhanced Wound Care and Infection Control in Medical Textiles

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ABSTRACT
Background: When utilized in hospitals, wound care units, and other hygienic settings, medical textiles may facilitate the spread of bacteria. Although polyester is extensively used due to its availability and durability, it does not natively offer antibacterial protection. Glycol coating polyester fabric may enhance its capacity to restrict bacterial development and lower the risk of infections linked to healthcare.
Objective: To determine whether glycol-coated polyester fabric has antibacterial activity against Staphylococcus aureus ATCC #6538 and to evaluate its possible application in wound care and infection management.
Methodology: This experimental, comparative, in vitro study was conducted at Imran Idrees Teaching Hospital Laboratory, Sialkot from 1st April 2025 to 30th September 2025. Samples of polyester fabric were manufactured as an untreated control, glycol-coated fabric using the dip-coating method, glycol-coated fabric using the spray-coating method, glycol with ceftriaxone-coated fabric, and glycol with meropenem-coated fabric. Using the AATCC 147 agar diffusion method on tryptic soy agar, the antibacterial activity was evaluated against Staphylococcus aureus ATCC #6538. The zone of inhibition surrounding each fabric sample was measured to assess the antibacterial performance following incubation. Washing, abrasion, and environmental stability tests were used to further evaluate durability.
Results: There was very little antibacterial activity in the untreated polyester fabric and all coated samples showed discernible inhibitory zones against Staphylococcus aureus. Whereas the spray-coated glycol fabric displayed a 16 mm inhibition zone, the dip-coated glycol-coated polyester fabric displayed a 15 mm inhibition zone. A 16 mm zone of inhibition was formed by the glycol plus ceftriaxone-coated sample, while a 14 mm zone was produced by the glycol plus meropenem-coated sample. These results suggest that polyester fabric's antibacterial effectiveness was enhanced by glycol coating, with spray coating and ceftriaxone combination exhibiting somewhat higher activity.
Conclusion: Polyester fabric coated with glycol showed encouraging antibacterial activity against Staphylococcus aureus and could be a practical medical textile for hospital textiles, wound care, and infection prevention. Its antimicrobial properties and durability tests using washing, abrasion, and exposure to the environment point to its potential for application in healthcare fabrics that are often used. Prior to normal medical application, additional clinical and broad-spectrum microbiological testing is advised.

Keywords: Glycol-Coated Polyester, Antibacterial Textile, Staphylococcus Aureus, Wound Care, Infection Control.

INTRODUCTION

Technological developments in the textile industry have made it easier to create materials with improved utility, particularly antibacterial ones. A common synthetic fabric, polyester has historically lacked built-in antibacterial properties, which restricts its application in settings where hygienic conditions are critical. Researchers hope to expand the use of polyester in hygienic, athletic, and medicinal contexts by adding antimicrobial coatings, especially using glycol-based chemicals. When applied to textile surfaces, the adaptable organic molecule glycol exhibits promising antibacterial properties that lower the microbial load and lower the risk of infection.[1]

In healthcare settings, where fabric materials are frequently exposed to harmful germs, this strategy is especially pertinent. Hospital bedding, uniforms, and wound dressings are among the surfaces that might act as vectors for the spread of bacteria, and hospital-associated illnesses continue to be a major global concern. Maintaining high hygiene standards in these environments requires improving polyester textiles with a long-lasting, antibacterial coating that keeps its effectiveness even after numerous washings and abrasions. By reducing the possibility of cross-contamination and promoting sterility, the use of glycol-coated polyester in medical textiles may enhance patient outcomes.[2]

The progress made in textile technology has resulted in the creation of materials possessing improved functionality, such as antibacterial qualities. The possibility for polyester, a common synthetic fabric, to be developed with antibacterial properties has drawn a lot of attention. In order to prevent bacterial development and maintain hygiene in a variety of applications, coating polyester fabrics with antimicrobial compounds such as glycol is a potential strategy.[3]

Because they can lessen microbial contamination and related diseases, antibacterial fabrics are becoming more and more essential in everyday clothes, sporting, and healthcare settings. The goal of adding antimicrobial compounds to textiles is to offer a long-lasting and efficient way to keep things clean and stop infectious diseases from spreading.[4]

The possible antibacterial effects of glycol, a versatile chemical molecule, glycol works well as a coating to stop the growth and spread of bacteria on polyester materials. This is especially crucial in settings like hospitals, schools, and sports facilities where there is a significant danger of bacterial contamination.[5]

The effectiveness of polyester fabrics coated with glycol in lowering bacterial load has been found that polyester textiles coated with glycol shown strong antibacterial action against common pathogens such as Escherichia coli and Staphylococcus aureus. Comparably, studies have shown the glycol-coated textiles' capacity to inhibit bacteria over an extended period of time, underscoring its potential for broad use.[6]

Glycol breaks down bacterial cell membranes and interferes with vital biological processes to give polyester fabrics their antibacterial qualities. This mechanism of action guarantees that the bacteria are efficiently neutralized, lowering the danger of contamination and infection.[7]

The antimicrobial coating's longevity is essential to its usefulness and demonstrated that polyester materials coated with glycol maintain their antibacterial effectiveness even after several washing cycles, demonstrating the durability of the coating. Because of its longevity, the fabric may be used for lengthy periods of time without losing its effectiveness, which makes it an affordable option for antimicrobial textiles.[8]

The promising outcomes of testing glycol-coated polyester fabrics for antibacterial activity highlight this technology's potential to improve public health and cleanliness.[9] According to, the introduction of antimicrobial characteristics into common textiles is a major advancement in the fight against bacterial diseases and enhances human well-being.

The creation and examination of polyester fabrics coated with glycol have demonstrated encouraging outcomes concerning their ability to inhibit germs. Using glycol as an antibacterial ingredient provides a long-lasting and efficient way to make sanitary fabrics fit for a range of uses. Subsequent investigations and advancements in this field have the capacity to transform the textile sector and yield noteworthy advantages for public health.[10]

The pathogen load on textiles can be considerably decreased by incorporating polyester materials coated with glycol into medical settings. The reduction of HAIs, enhancement of patient safety, and reduction of healthcare expenses related to infection treatment are all in line with this invention. The complete effectiveness and safety profile of the coating for use in hospitals will be determined by additional clinical testing and validation across different bacterial strains.

MATERIALS AND METHODS

This experimental, comparative, in vitro study was conducted at Imran Idrees Teaching Hospital Laboratory, Sialkot from 1st April 2025 to 30th September 2025. Comparison and control testing are classified in (1) glycol-coated with ceftriaxone for enhanced antibacterial comparison, (2) glycol-coated with meropenem to compare antibiotic effect, (3) uncoated polyester fabric as a negative control, (4) glycol-coating using dip-coating method and (5) Glycol-coating using spray-coating method. The following supplies and tools were set up for coating polyester cloth (i) samples of polyester fabric (ii) ethylene glycol, or glycol (iii) the antibiotic ceftriaxone (iv) the antibiotic meropenem (v) solvent (such as ethanol or water) (vi) spray-coater, or coating apparatus (vii) petri dishes (xiii) tryptic soy agar was taken as 30 g/L (ix) staphylococcus aureus ATCC # 6538 9x) the incubator (xi) sterile forceps and tweezers and (xii) analytical balance.

Preparation of coating solution: Glycol was dissolved in the proper solvent to yield a 10% w/v solution. (1) To the glycol solution, add ceftriaxone and meropenem at the appropriate concentrations for 0.5% w/v each. To guarantee homogeneity, thoroughly stir the mixture, for different tests and (2) prepare the antibiotic solution: Dissolve the antibiotic in a solvent (usually sterile water or ethanol) to the desired concentration. A solution of 10 mg/is used for surface coating.

1. **Coating Process:**

i. Cut sample pieces of polyester fabric into conventional sizes. After giving the fabric samples a thorough rinse with distilled water and a moderate detergent wash, they were cleaned. The samples were air dried. In dip-coating, the fabric samples were immersed in the coating solution for ten minutes, making sure they are completely saturated. The samples were taken out and let the extra solution run off.

ii. When spray coating, the solution to the fabric samples was sprayed in an even layer until they are completely covered. To guarantee even application of the coating, to guarantee correct adherence and drying, the coated cloth was cured by heating it in an oven at 60°C for one hour.

2. **Antibacterial Testing:** Melted agar media was poured onto sterilized Petri dishes and left to harden to create agar plates. Using a sterile swab, the agar plates were inoculated with Staphylococcus aureus (ATCC # 6538) to produce a uniform bacterial lawn. The treated fabric samples were prepared into tiny pieces, about 1 inch. Making sure the fabric pieces make good contact with the agar surface, placed onto the inoculation agar plates. For 24 hours, the plates were incubated at 37°C. To assess the antibacterial efficiency of each cloth sample, the zone of inhibition surrounding it was measured.

Procedure: The antimicrobial testing was performed in accordance with AATCC 147 method.[11] For this method, 9.0±0.1 ml of sterile distilled water was added to 1.0±0.1 ml of a 24-hour culture in tryptic soy broth (TSB). Tryptic soy agar (TSA), was used to create multiple streaks of the diluted inoculum over a typical Petri dish using an inoculating loop, without replenishing the loop. To ensure close contact with the agar surface, the samples were positioned over the streaks. The Petri plates were kept at 37±2°C for duration of 24-48 hours.

Durability Testing

a. Washing Test: The coated fabric samples were put through ten cycles of washing in a regular washer with a light detergent. After every wash cycle, the samples were air dried. To determine whether antibacterial qualities are retained after washing, the antibacterial testing was repeated.

b. Abrasion Test: Abrasion test arranged commercially from Capital Sports, Sialkot. For abrasion testing, Wyzenbeek Abrasion Tester M278 was used. In abrasion test, the fabric samples were rubbed with an abrasion tester for a predetermined number of cycles of 100 cycles. The cloth was examined under a microscope to determine the mechanical stability of the coating. To determine how abrasion affects antibacterial efficacy, the antibacterial testing was repeated.

c. Environmental Stability Test: The coated fabric samples were placed in a UV exposure chamber and exposed to UV radiation for a predetermined amount of time of 24 hours using a UV weathering Test Chamber - 855. Varying the exposure temperature of the samples between 10°C and 40°C was done. After exposure, the alterations in coating integrity and antibacterial activity were analyzed.

RESULTS

The glycol-coated polyester fabric demonstrated significant antibacterial activity against S. aureus. The zones of inhibition observed in the agar diffusion method indicate the release of antibacterial agents from the coating (Figs. 1-4). The untreated polyester fabric showed negligible antibacterial activity, confirming that the observed efficacy was due to the coatings (Fig. 5).

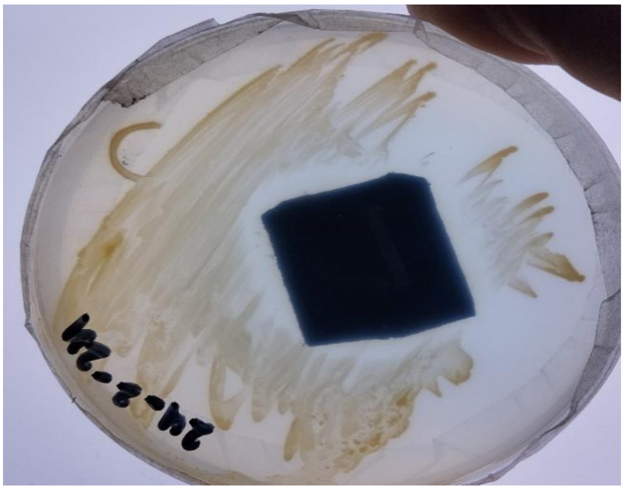

Fig 1: Polyester Fabric Coated with Glycerol Stock Using, Dicoating Method, Showing Antimicrobial Activity Against Staphylococcus Aureus Tryptic Soy Agar Making An Inhibition Zone of 15 Mm

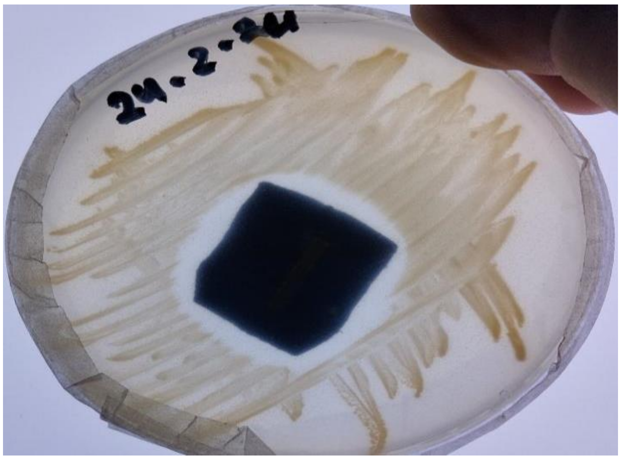

Fig 2: Polyester Fabric Coated using with Glycerol Stock, Using Spray Method, Showing Antimicrobial Activity against Staphylococcus Aureus on Tryptic Soy Agar Making an Inhibition Zone of 16 Mm

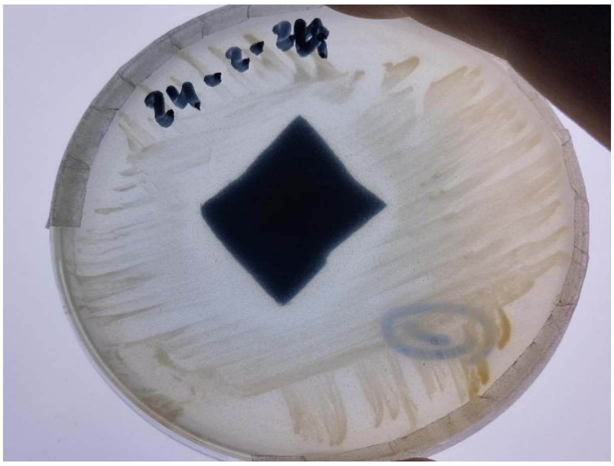

Fig 3: Polyester Fabric Coated Using a Combination of Glycerol Stock and Cefriaxone at a Concentration of 0.5% W/V, Using Dip Method, Showing Antimicrobial Activity against Staphylococcus Aureus on Tryptic Soy Agar Making An Inhibition Zone of 16 Mm

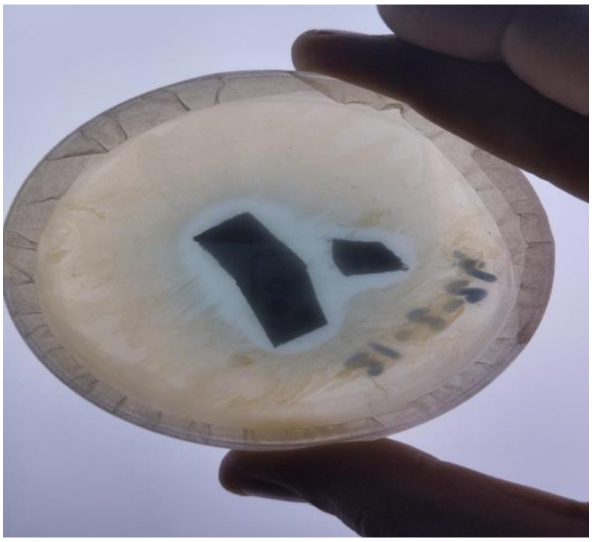

Fig 4: Polyester Fabric Coated using a Combination of Glycerol Stock and Meropenem at a Concentration of 0.5% w/v, Dip Method Showing Antimicrobial Activity against Staphylococcus Aureus on Tryptic Soy Agar Making an Inhibition Zone of 14 Mm

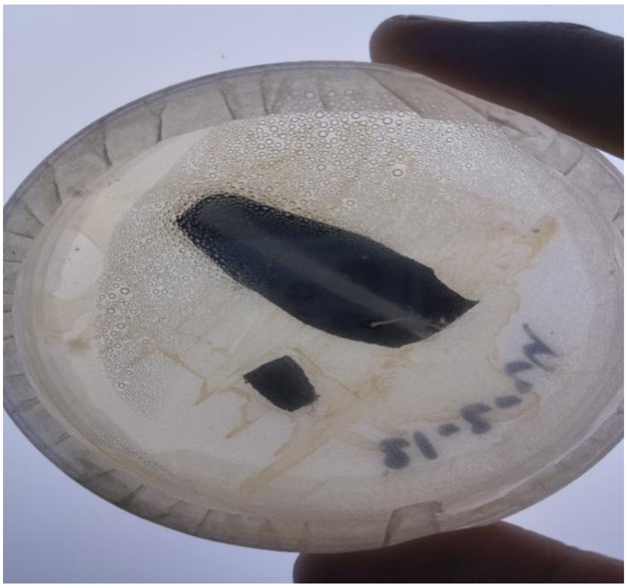

Fig 5: Polyester Fabric as Negative Control, not Coated with Any Compound

DISCUSSION

The results demonstrate that polyester fabrics coated with glycol have strong antibacterial properties, especially against Staphylococcus aureus. Bacterial colonies on fabric surfaces are significantly reduced as a result of glycol's ability to damage bacterial cell membranes and interfere with vital cellular operations. In medical applications, where textiles act as both protective barriers and possible disease reservoirs, this mechanism is essential.[12,13] The glycol coating's longevity across several washing and abrasion cycles, as observed in the study, highlights its applicability in medical settings where frequent laundering and fabric resilience are crucial.

The ramifications for wound care are noteworthy; polyester coated with glycol might be used to make bandages and dressings, actively lowering bacterial colonization on the fabric and preventing infection in open wounds.[14] Because it lowers the risk of local infections and lessens the requirement for systemic antibiotic interventions - a critical function given the rise in antibiotic resistance, this antimicrobial characteristic is essential for wound care. The environmental durability, the fabric may be utilized in a variety of clinical settings, such as UV radiation exposure and high-temperature sterilization, without losing its antibacterial qualities.[15]

It is recommended that to assess the long-term effects of such materials on patient health and infection management in clinical settings, as well as investigate the efficacy of glycol-coated textiles against a wider range of pathogens. The development of antimicrobial textiles, such as glycol-coated polyester, is a significant step forward in the quest for safer, more sanitary healthcare fabrics, as the healthcare sector continues to place a high priority on infection control.

CONCLUSION

The polyester fabric coated with glycol has a lot of potential for use in medical environments, especially those that place a high value on sanitation, including hospitals and wound care centers. Glycol-coated polyester may help lower healthcare-associated illnesses and enhance patient outcomes by efficiently lowering the bacterial load and preserving its antimicrobial qualities during repeated wear and wash cycles.

REFERENCES

1. Gulati R, Sharma S, Sharma RK. Antimicrobial textile: recent developments and functional perspective. Polymer Bulletin. Springer Science and Business Media Deutschland GmbH; 2022; 70; 5747-71.
2. Zhao X, Noro J, Fu J, Wang H, Silva C, Cavaco-Paulo A. “In-situ” lipase-catalyzed cotton coating with polyesters from ethylene glycol and glycerol. Process Biochem 2018;66:82-8.
3. Ploymalee S, Charuchinda S, Srikulkit K. Hydrophilic property of polyester fabric coated with polyethylene glycolated bisphenol A. J Appl Polym Sci 2010;116(1):473-8.
4. Pinho AC, Piedade AP. Polymeric coatings with antimicrobial activity: A short review. Polymers. MDPI AG; 2020; 12: 1-15.
5. Nalawade TM, Bhat K, Sogi SH. Bactericidal activity of propylene glycol, glycerine, polyethylene glycol 400, and polyethylene glycol 1000 against selected microorganisms. J Int Soc Prev Community Dent 2015;5(2):114-9.
6. Khoddami A, Avinc O, Ghahremanzadeh F. Improvement in poly (lactic acid) fabric performance via hydrophilic coating. Prog Org Coatings 2011;72(3):299-304.
7. Olmos D, González-benito J. Polymeric materials with antibacterial activity: a review. Polymers. MDPI AG; 2021l; 13: 1-30.
8. Muzaffar S, Abbas M, Siddiqua UH, Arshad M, Tufail A, Ahsan M, et al. Enhanced mechanical, UV protection and antimicrobial properties of cotton fabric employing nanochitosan and polyurethane based finishing. J Mater Res Technol 2021; 11:946-56.
9. Olewnik-Kruszkowska E, Gierszewska M, Richert A, Grabska-Zielińska S, Rudawska A, Bouaziz M. Antibacterial films based on polylactide with the addition of quercetin and poly (ethylene glycol). Materials (Basel) 2021;14(7).
10. xu H, Shi X, lv Y, Mao Z. The preparation and antibacterial activity of polyester fabric loaded with silver nanoparticles. Text Res J 2013;83(3):321-6.
11. Pinho E, Soares G, Henriques M. Textiles Standards & Parameters Antibacterial Activity of Textiles for Wound Treatment. 2016; 0-6.
12. Orasugh JT, Temane LT, Kesavan Pillai S, Ray SS. Advancements in Antimicrobial Textiles: Fabrication, Mechanisms of Action, and Applications. ACS Omega 2025;10(13):12772-816.
13. Bibi A, Afza G, Afzal Z, Farid M, Sumrra SH, Hanif MA, Kolita Kama Jinadasa BK, Zubair M. Synthetic vs. natural antimicrobial agents for safer textiles: a comparative review. RSC Adv 2024;14(42):30688-706.
14. Shingel KI, Di Stabile L, Marty JP, Faure MP. Inflammatory inert poly(ethylene glycol)--protein wound dressing improves healing responses in partial- and full-thickness wounds. Int Wound J 2006;3(4):332-42.
15. Alkarri S, Bin Saad H, Soliman M. On antimicrobial polymers: development, mechanism of action, international testing procedures, and applications. Polymers (Basel) 2024;16(6):771.