

# Development of Odour-Resistant Socks Infused with Citrus Peel Extracts

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## **Abstract**

Foot odour, commonly caused by bacterial activity due to sweat build-up in socks, is a persistent issue. This study aims to develop odour-resistant socks using citrus peel extracts, known for their natural antibacterial and deodorizing properties. Rich in compounds like flavonoids and limonene, citrus peels were used to treat cotton socks via microencapsulation and infusion methods. Tests evaluated antimicrobial efficacy, durability, and user comfort. Results suggest that citrus-infused socks offer a sustainable, eco-friendly solution for managing foot odour.

**Keywords:** Odour-resistant, natural extracts, citrus peels, antibacterial properties

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## **Introduction**

India's textile legacy, particularly with cotton, plays a vital role in traditional and industrial applications. Technical textiles, especially ClothTech, include functional garments made from innovative fibers. Cotton's softness and breathability make it ideal for socks. Bacterial breakdown of sweat in fabrics often causes odour, prompting the need for antimicrobial solutions. The "dip and dry" method offers a simple way to treat fabrics evenly with such agents.

## **Objectives**

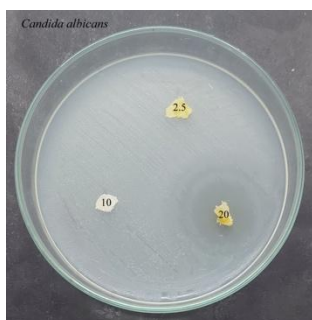
- Study the properties of citrus peels
- Use cotton as the base fabric
- Determine optimal extract concentration
- Apply dip and dry method for treatment

- Develop functional, odour-resistant socks

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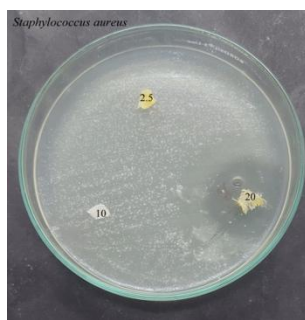
## **Methodology**

- Material: Cotton grey fabric was selected for comfort and absorbency.
- Extraction: Citrus peels were sun- and shade-dried, with bioactive compounds extracted via Ultrasound-Assisted Extraction (UAE).
- Solvents: Both water and ethanol were used to obtain extracts.
- Application: The dip and dry technique was used to infuse the fabric with citrus extract.
- Antimicrobial: Tested with 2.5%, 10%, and 20% extract concentrations against *Candida albicans* and *Staphylococcus aureus*. Only 20% showed clear inhibition (26mm and 27mm zones).
- Fragrance: Participants responded positively, citing the citrus scent as pleasant and effective.



**PLATE 1 : Effect of sample against bacteria**

*Candida albicans*



**PLATE 2:Effect of sample**

*staphylococcus aureus*

## **Results & Discussion**

Treated socks were worn by athletes and wedding couples. Feedback was collected using a five-point scale:

- Fragrance: Most users rated it “Excellent” or “Very Good,” with the citrus scent effectively masking odour.
- Comfort: Participants reported high comfort even during prolonged wear.

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## **Summary & Conclusion**

Citrus peel extracts were successfully applied to cotton socks using the dip and dry method. The resulting socks offered effective antimicrobial and odour-control benefits. Cotton’s breathable nature complemented the treatment. These socks

represent a sustainable, natural alternative to synthetic finishes. Further improvements can focus on durability and extended wear performance.

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### **Bibliography**

#### **Books:**

- Sekhri, S. (2022). Textbook of Fabric Science. PHI Learning.
- Mahadevan, M. G. (2005). Textile Spinning, Weaving & Designing. Abhishek Publications.
- Schindler, W. D., & Hauser, P. J. (2004). Chemical Finishing of Textiles. Elsevier.

#### **Journals & Articles:**

- Shen, L. et al. (2022). Cotton Fabrics with Antibacterial and Antiviral Properties, Applied Surface Science, 600, 154152.
- Hegazy, A. E., & Ibrahim, M. I. (2012). Antioxidant Activities of Orange Peel Extracts, World Applied Sciences Journal, 18(5), 684–688.