



Development Of A Plasma Activated Multifunctional Polyester Fabric Using Zinc Oxide Nanoparticles And Citronella Oil Microcapsules

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Outline of the Presentation



Introduction



Materials
used



Methodology



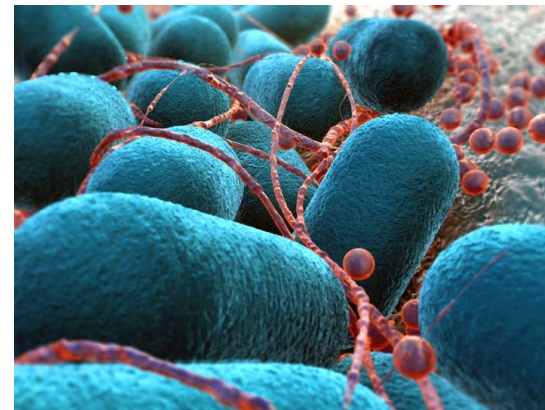
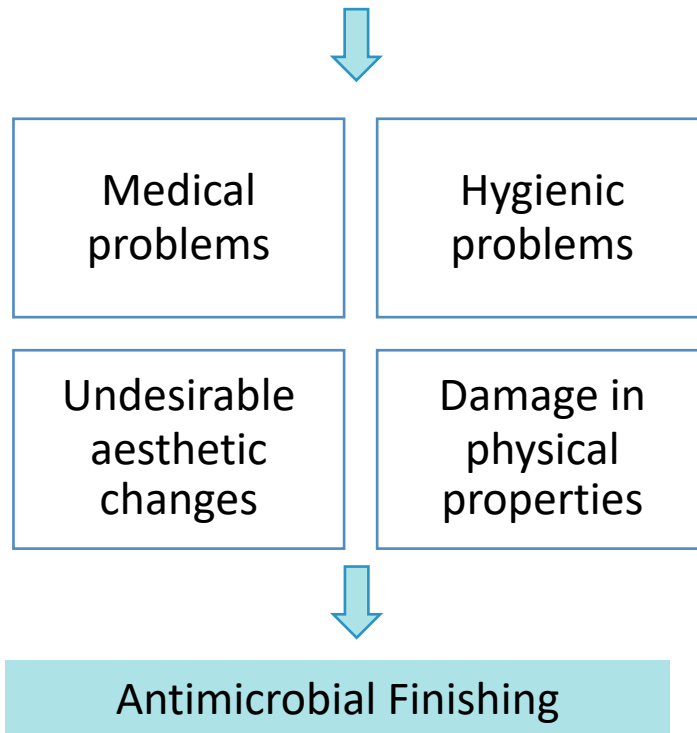
Results



Conclusions

Introduction

Textiles are subject to a range of microbial challenges



Ecotextile.com visited on 01.05.2022

Introduction

Benefits of Antimicrobial Textiles

- ✓ Prevent the Absorption of Odors
- ✓ Require Fewer Washes
- ✓ Prevent the Dissemination of Pathogens
- ✓ Prevent Skin Allergies
- ✓ Generate Longer Product Life

Introduction

Nanotechnology in Textiles

Optical displays



Water repellence



Anti-static properties



Wrinkle resistance



Strength enhancement



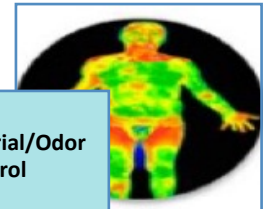
UV blocking



Computing



Antibacterial/Odor control



Sensors



Introduction

Metal Nanoparticles

Unique Chemical and Physical Properties

Selenium

Anti-cancer and antimicrobial

Platinum

Anti-cancer

Gold

DNA labelling, biosensor, drug delivery, cancer therapy and antimicrobial

Palladium

Biocatalysis

Iron

Anti-cancer and molecular imaging

Zinc oxide

Antimicrobial, and therapeutics, Delivery Carrier, coating

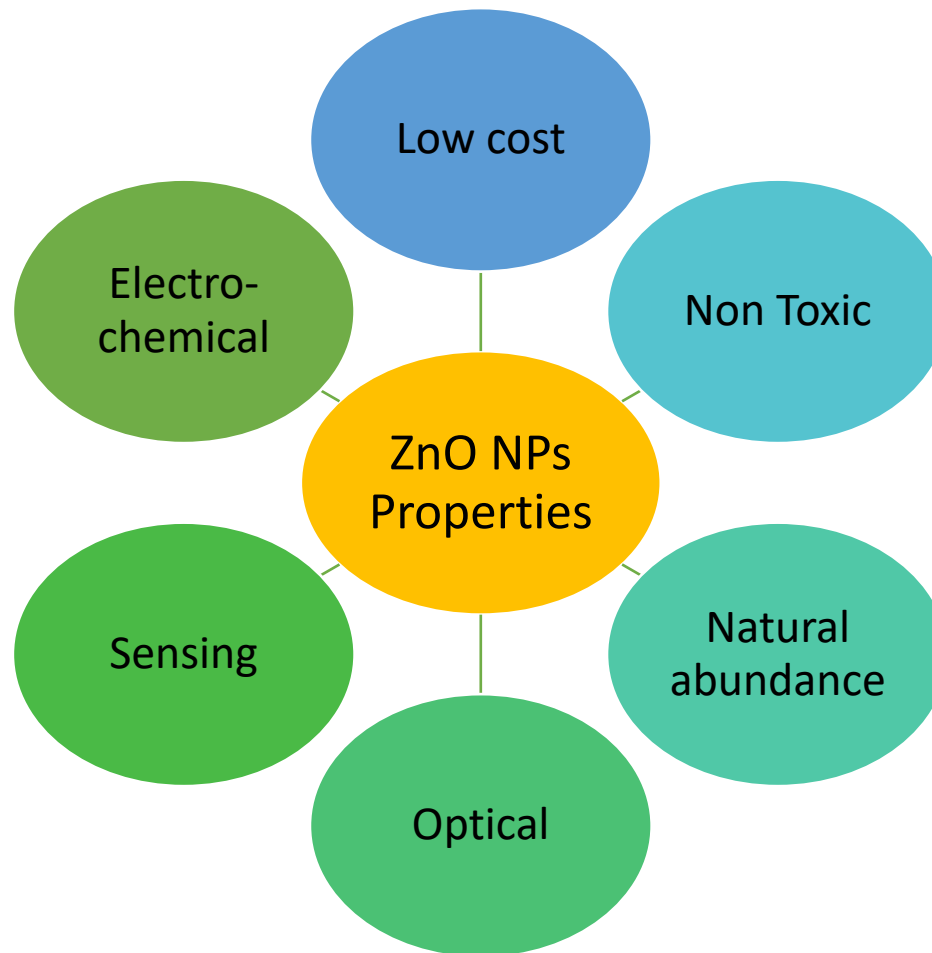
Silver

Anti-cancer and antimicrobial

Copper

Antimicrobial

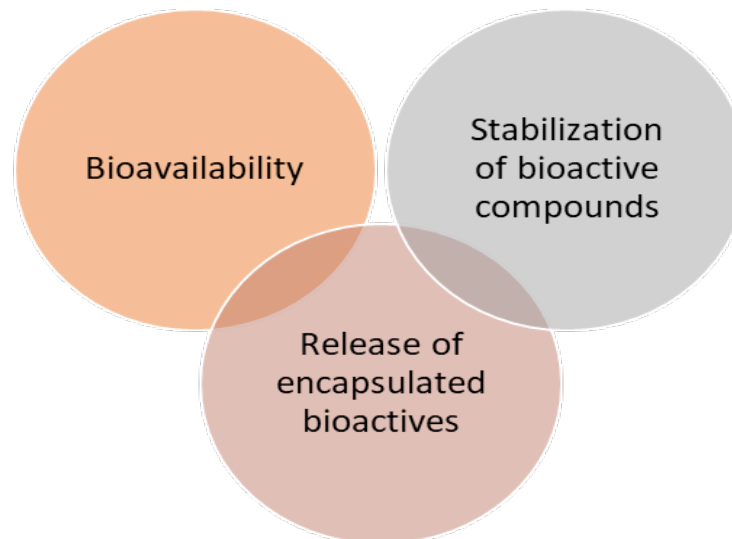
Introduction



Introduction

Microencapsulation is the protective technology of encapsulating solid, liquid or gas materials into micro particles with a diameter of 1–1000 μm , and has been widely used in fields of medicine, cosmetics, food, textile and advanced materials

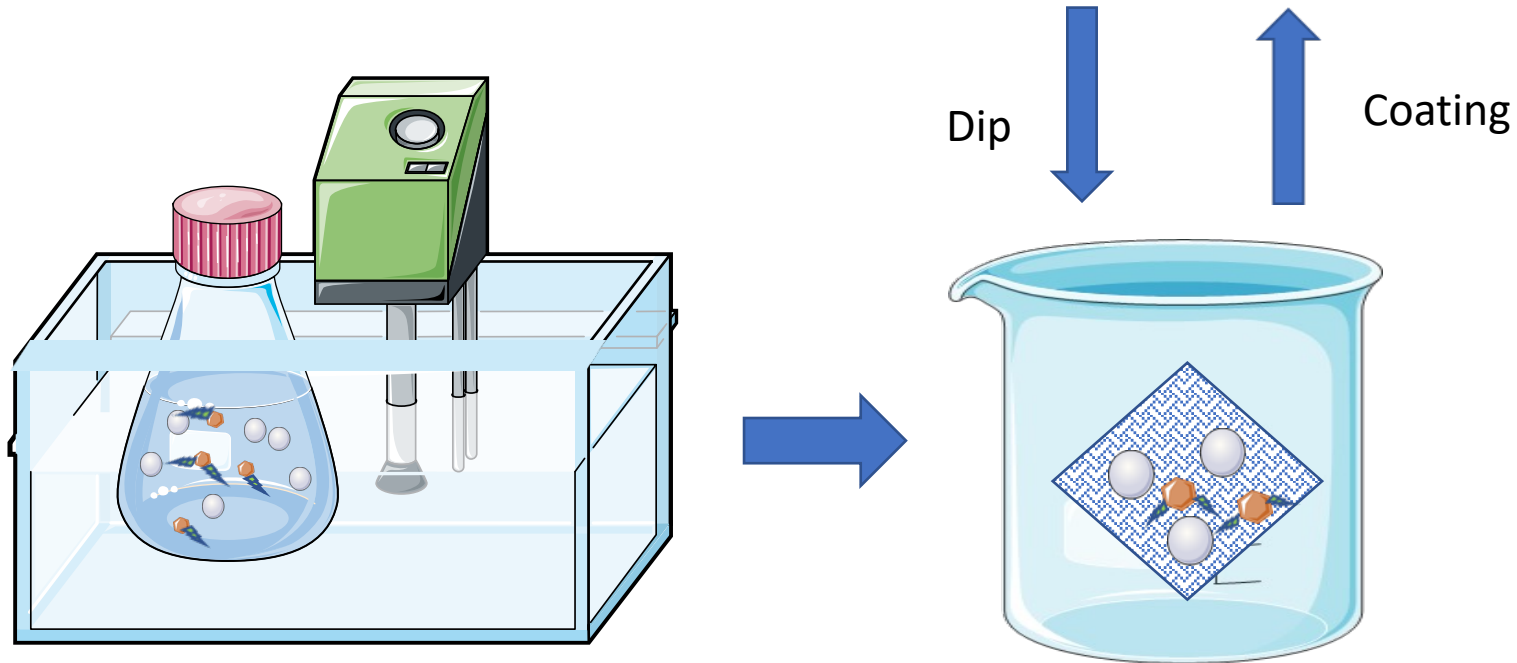
Advantages of Microencapsulation



Materials

- Plain weave commercial PES fabric
- Polyethyleneimine
- ZnO NPs (<50 nm) from Merck
- PMMA microcapsules (MCs) with encapsulated Citronella oil

Objectives



Ultrasonic Bath



PMMA



ZnO NPs



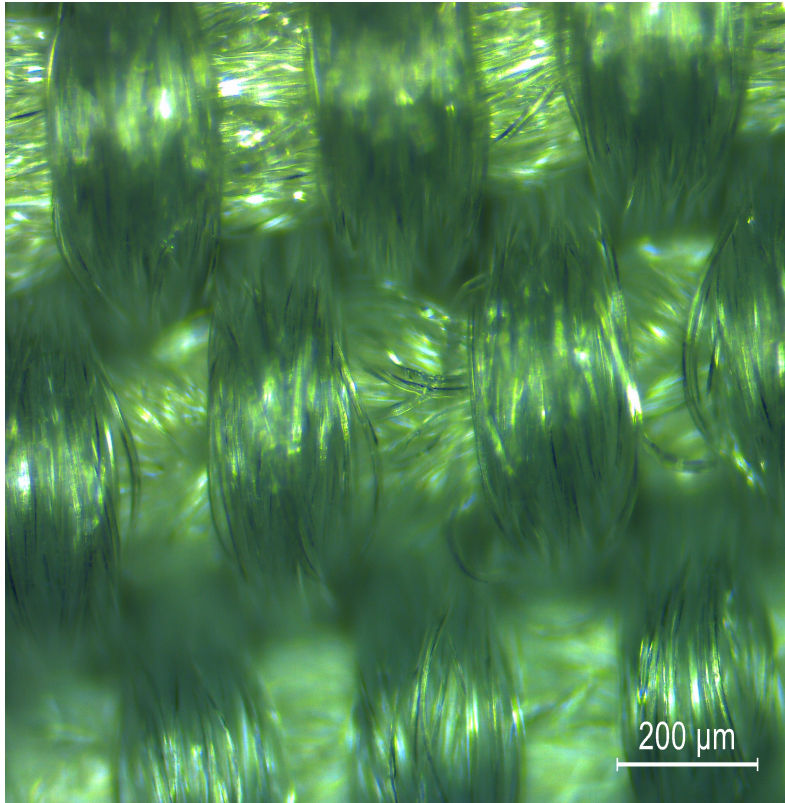
PEI

The main objective of this project is to investigate the effect of plasma treatment and encapsulation of ZnO NPs on the UV and antibacterial properties of PES fabric.

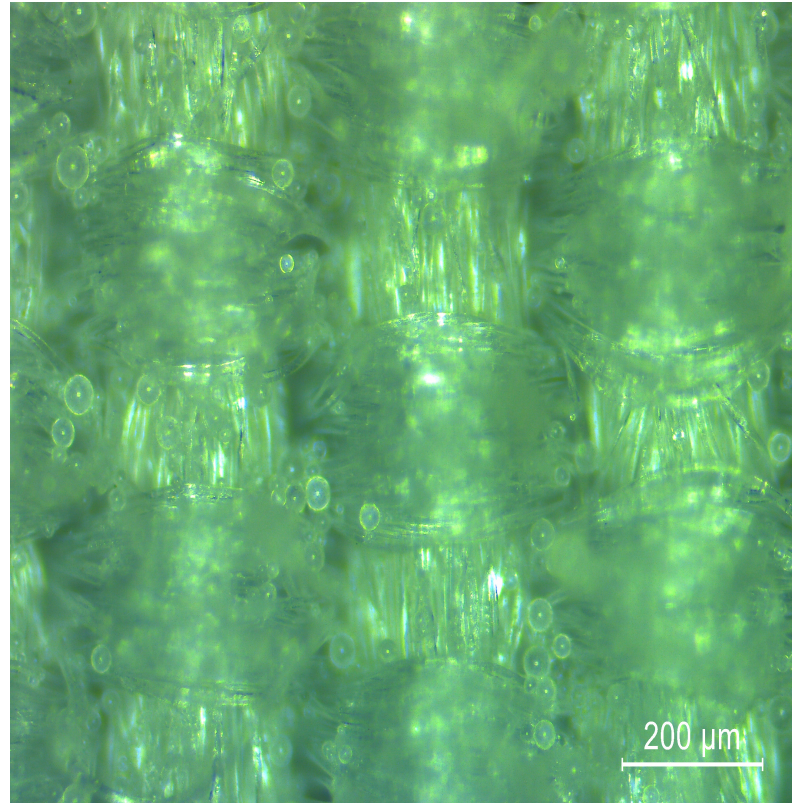
Characterization Techniques

- Bright-field Microscopy (a Leica DM750 microscope and a Leica MC170 HD camera).
- UPF (EN 13758-d)
- Antibacterial (AATCC) 100 TM 100
 - *S. aureus* (ATCC) 6538
 - *E. coli* (ATCC) 25922

Bright-field Microscopy

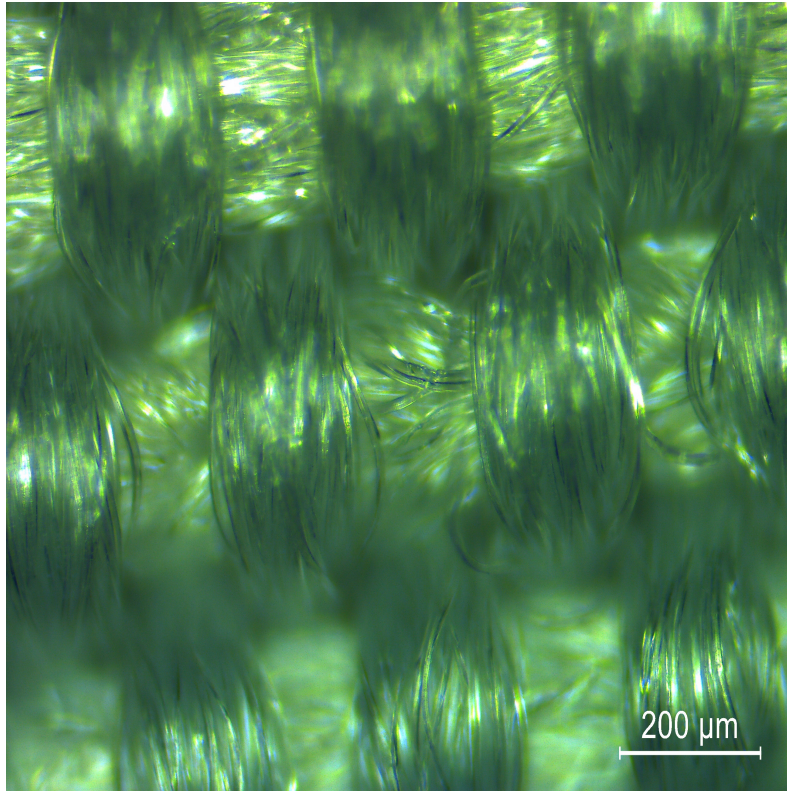


PES

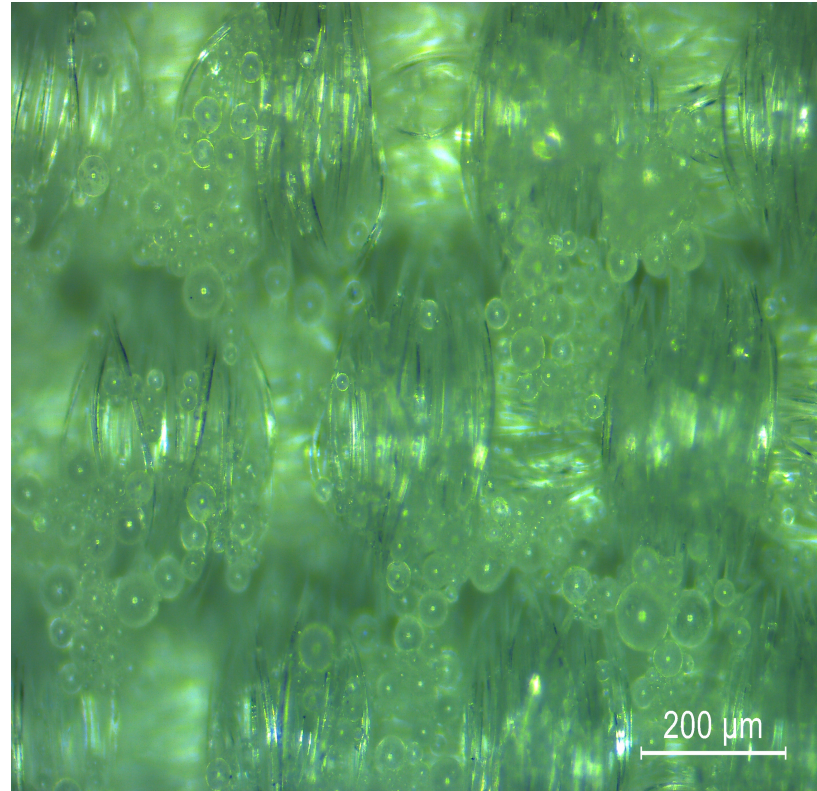


PES+ZnO+MCs

Bright-field Microscopy



PES

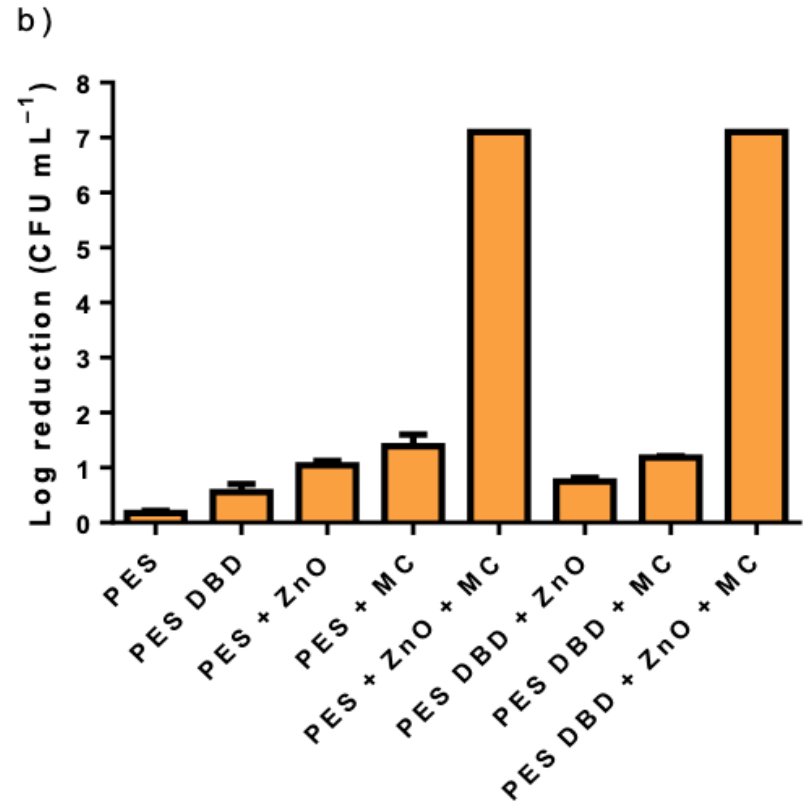
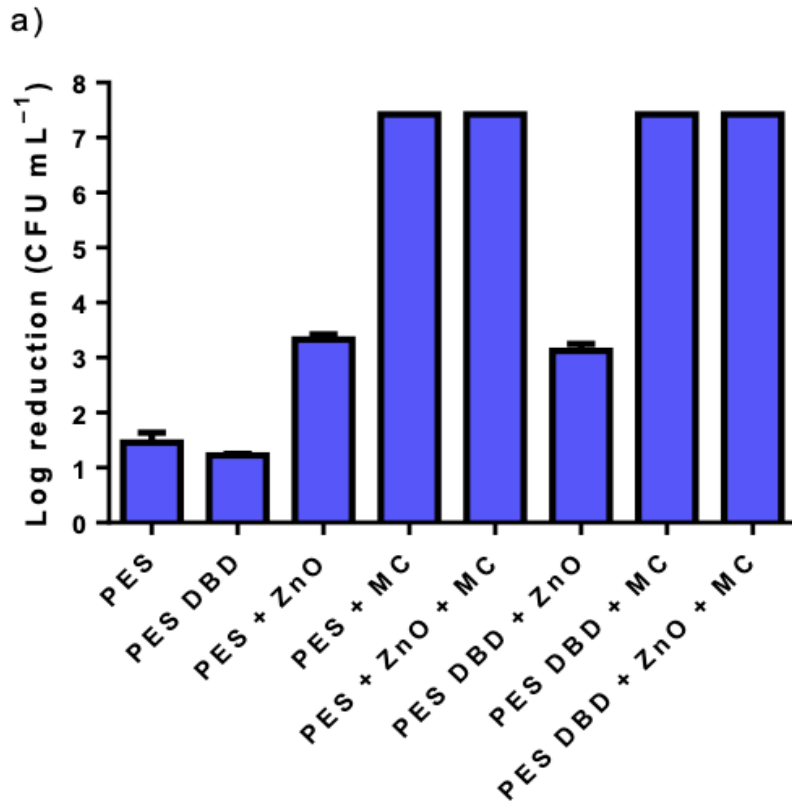


PES DBD+ZnO+MCs

Ultimate Protection Factor (UV Resistance)

SAMPLES	UV-A	UV-B	UPF
PES	12.2	0.6	57
PES DBD	12.2	0.6	57
PES + ZnO	11.6	0.6	60
PES DBD + ZnO	11.7	0.6	56
PES + MCs	10.3	0.4	71
PES DBD + MCs	10.1	0.5	71
PES+ZnO + MCs	13.5	0.6	52
PES DBD+ZnO+MCs	10.8	0.5	63

Antibacterial Activity



Antibacterial activity evaluation against: a) *S. aureus* and b) *E. coli*.

Conclusions and Future Work

- ZnO NPs with encapsulation has shown the positive influence on the UPF and antibacterial properties besides citronella helping in replant properties.
- Against *S.aureus* microencapsulation has shown significant contribution where as against *E.coli* ZnO NPs have shown significant contribution.
- This kind of functionalized fabric can potentially find their applications in outdoor, protective and health care textiles.

Acknowledgment

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