Assessment of Antimicrobial Activity for Some Natural Products in Functional Textile Using Inclusion Complex Technique

Thesis
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By

Maha Salah Mohamed
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Supervisors

Dr. Mohamed Abd-Elmonatser Abouzeid
Professor of Microbiology
Microbiology Department,
Faculty of Science,
Ain Shams University

Dr. Khaled Ebrahim El-Nagar
Professor of Chemistry
Head of Textile Metrology Lab,
Chemical Metrology Division
National Institute for Standards

Dr. Khaled Zakeria El-Baghdady
Lecturer of Microbiology
Microbiology Department,
Faculty of Science,
Ain Shams University

Microbiology Department,
Faculty of Science,
Ain Shams University.
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ABBREVIATIONS

AATCC	American Association of Textile Chemists and Colorists
API	Analytical Profile Index
ASTM	American Standard Testing Method
ATR	Attenuation Total Reflection
CF	cystic fibrosis
CFU	colony forming units
Ch	chitosan
cm	centimeter
CRA	Crease recovery angle
DD	degree of deacetylation
DNA	Deoxyribonucleic acid
DP	Durable press
FTIR	Fourier Transform Infra Red Spectroscopy
IC	inclusion complex
LPS	lipopolysaccharide
LTA	lipoteichoic acids
MDR	Multidrug-resistant
MO	microorganism
mRNA	Messenger ribonucleic acid
MRSA	methicillin-resistant *Staphylococcus aureus*
OM	outer membranes
OSHA	Occupational Safety and Health Administrative
PG	peptidoglycan
RNA	ribonucleic acid
SEM	Scanning electron microscope

SI	International System of Units
TA	teichoic acid
UPF	Ultraviolet protection factor
USA	United States of America
UV	Ultraviolet radiation
β-CD	β-cyclodextrin
µg	microgram
µl	microliter

Aim of the work

This work aims to produce a functional textile for medical purpose that has the ability to inhibit pathogenic bacteria including Gram-positive and Gram-negative bacteria. This new fabric regulates the release of the antimicrobial agent, thus prevents contamination which in turn accelerates the healing and avoids complications.

Abstract

Medical textiles are of much interest nowadays and many efforts have been done to improve them. In this research, we developed medical textile fabric by applying inclusion complex of chitosan in cyclodextrin as two natural polymers onto fabric after irradiation by UV/ozone. Treatment conditions were optimized with respect to mechanical testing including tensile strength and elongation percentage. The treated fabric was tested against some pathogenic bacteria. It was found that the developed fabric was able to inhibit the bacterial growth as (*Staphylococcus aureus, Pseudomonas aeruginosa, Acinetobacter baumannii* and *Proteus mirabilis* **)** after 24 h of direct contact. Marked improvements of mechanical properties of the treated textile were obtained. Scanning electron microscope showed clear bacterial cell deformation when growing on treated textile.

Introduction

Microorganisms create and aggravate problems in hospitals and other environments by transmitting diseases and infections through clothing, bedding etc. Cotton is subjected to growth of pathogenic microorganisms which deteriorate cellulosic fibre and reduce the wear life of the materials (**Vigo, 1997**).

It is known that bacteria are usually active at pH 7.0-8.0 and fungi at pH 4.0-6.5, thus microorganisms exist in abundant quantities on textile materials for example Gram positive and Gram negative bacteria e.g. *Micrococcus luteus*, *Staphylococcus aureus*, *Escherichia coli* and fungi as *Candida albicans* , *Candida krusei* **(Seventekin and Ucarci, 1993).**

Burn patients and people who do not have functioning immune systems also need to wear germ-free or germicidal textiles to avoid infections (**Lewin and Sello, 1983 and Prabaharan and Mano, 2006).** These fabrics use chemical compounds that either destroy or inhibit the growth of microorganisms. Medical textiles as a functional textile are used in a range of applications from wound-care products, surgical drapes and gowns to tissue-engineering scaffolding. They are also a growing sector within the technical textiles industry **(Rigby**, **1997).**