J. Basic. Appl. Sci. Res., 5(12)65-70, 2015
© 2015, TextRoad Publication

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Antimicrobial Effect of Fibers Grafted With Bio- Nanosilver Particles Produced by Fungal Process on Cotton Fabrics

Ahmed Ali Salman[1], Foaad, M.A[2], Ola Mohammed Mohsen[3], and Hanaa Abu Zaid Khalil[4]

[1]Professor of Textile Department Faculty of Applied Arts -Helwan University- Cairo Egypt
[2]Professor of Microbiology, Faculty of Education- Ain Shams University-Cairo Egypt
[3]Assistant Professor, of Textile Department Faculty of Applied Arts- Helwan University- Cairo Egypt
[4]Engineer Textile / Hanaa Abu Zaid Khalil of Industrial Development Authority- Cairo Egypt

Received: August 19, 2015
Accepted: November 6, 2015

ABSTRACT

Governments bear a lot of costs treat burns huge amounts of money, where it is possible for some people to cause permanent disabilities. Research problem is producing an organic, economical, and simple product to treat this deform in the skin. The microbial synthesis of nanoparticles is a green chemistry approach that combines nanotechnology and microbial biotechnology. The aim of this study was to obtain bio fibers grafted silver nanoparticles. Then incorporated it with cotton fabrics. Using from the filamentous fungus *Fusarium oxysporum* as an alternative to chemical procedures and to evaluate its antifungal activity. Filaments were produced containing silver nano-particles in a manner dependent F. oxysporum previously grown on MYG medium at 28ºC was inoculated in Liquid medium containing malt extract and yeast extract and incubated at 28ºC for 7 days. Then a silver nitrate (AgNO3) solution was added to produce of silver ions. Featuring cotton fabrics antimicrobial effect when incorporated with fibers grafted silver nanoparticles product by F. oxysporum and its in against S. aureus. Furthermore, these cotton fabrics can improve wound healing and may be exploitedto dressings for wounds and burns. By examining produced fibers with Scanning electron microscope (SEM),fibers have grafted with bio-nanosilver particles.
KEYWORDS: Nanoparticles, Silver, Antimicrobial, Medical textiles, biosynthesis of bionanosilver.

INTRODUCTION

Biotextiles are structures composed of textile fibers designed for use in specific biological environments where their performance depends on biocompatibility and biostability with cells and biological fluids. The bio-fibers and bio-nanosilver particles have antimicrobial properties. Biotextiles are textiles used against bacterial growth on skin, and also fall under medical textiles [1].

"Medical textiles" are a broader term which also includes bandages, wound dressings, face masks, hospital linens, and protective clothing worn in the operating rooms. Antimicrobial medical textiles are textiles that fight cutaneous bacterial proliferatio[2]. Zeolite and Triclosan are the most commonly used antimicrobial agents at the present time. However, the use of silver nanoparticles and other chemical compounds that can disrupt the normal function of bacteria, viruses, and fungi are becoming increasingly popular in various niche markets. This antimicrobial behavior also allows such medical textiles to inhibit the development of odors and limit the extent of bacterial proliferation in diabetic foot ulcers [3].

Recently, the development of resistant or even multiresistant pathogens has become a major problem. In this concern, *Staphylococcus aureus* and *Candida albicans* have resistant properties against Methicillin and fluconazole respectively .[4]. On the other hand, the introduction of newly devised wound dressing has been a major breakthrough in the management of wounds or infections. In order to prevent or reduce infection, a new generation of dressing incorporating antimicrobial agents like silver was developed[5] . Many authors have tried to developa new and more effective antimicrobial agents. These antimicrobial should be free of resistance and low cost. In this regard, it is well known that silver ions and silver based compounds are highly toxic to micro-organisms[3] . Bionanosilver showed strong biocidal effects on as many as 12 species of bacteria including *E. coli.* Likewise, silver has been used to control bacterial growth in a variety of application including burn and wounds[6]. Moreover, the use of these elements on nanoscale not only improves their properties, but also affords it new advanced characteristics beyond bulk materials. In this respect, Nanofibers are promising for diverse applications, such as, drug delivery, tissue engineering and wound healing due to a very large surface area to volume ratio, flexibility in surface functionalities, and superior mechanical performance[7]

The aim of the present work is a trial to biosynthesis of cotton fabrics incorporated with fibers grafted silver nanoparticles for antimicrobial activity against microbial burns And ulcers.

*** Corresponding author:** Hanaa Abu Zaid Khalil, Engineer Textile / Hanaa Abu Zaid Khalil of Industrial Development Authority- Cairo Egypt. *Email: hanaamoa@yahoo.com*

MATERIALS AND METHODS

Microorganism

Fusarium oxysporum strain EMCC no 137 was obtained from Microbiological Resources Centre (Cairo Mircen), Ain shams University.

Bio fibers grafted silver nanoparticles Preparation

F. oxysporum was grown on the basal medium medium (MYG) with some modification, 3 g/L Malt extract, 3g/L yeast extract , 10g/L glucose , 5g/L Peptone in one liter Erlenmeyer flasks, then Sterilized and incubated at T28ºC for 7 days . After the end of incubation periods,0,5g/L $AgNO_3$ was added and the system was kept for several hours at 28 ºC . Then, the components of the fungal biomass were obtained by filtration through a 0.45 µm pore size nylon membrane filter. The fungal biomass contains fibers grafted with bio-nanosilver particles was examined using SEM. then the biomass was taken in Petri dishes, was dried And crushed Even become a powder .

Powder contains Silver Nanoparticles Loading on Cotton Fabrics

Cotton fabrics were washed, sterilized and dried before use. Experiments were performed on samples with maximum dimensions of 5 cm × 5 cm. solution treatment was prepared in flask contains, 2,5 g/L powder and 8g/L Citric acid. then Cotton fabrics was Immersion in an Erlenmeyer (50 ml) and shaking at 600rpm for 24 h and dried at 70 C. The percentage of silver nanoparticles incorporated in the cotton fabrics was measured by (EDX and SEM , 5000 , 1500 and 20000) .

Antimicrobial activity test

The agar plate method was used to evaluate the antimicrobial activities of untreated and treated textile samples. This disc diffusion test was done according to Collins and Lyne (1985). The antimicrobial activities of the textile specimens were tested against two bacterial test microorganisms (Staphylococcus aureus, G+ve bacteria and Pseudomonas aeruginosa, G-ve bacteria) and yeast test microbe (Candida albicans) as well as fungal test strain Aspergillusniger. The bacterial and yeast test microbes were grown on nutrient agar (DSMZ1) medium (g/L): beef extract (3), peptone (10), and agar (20), whereas the fungal test strain was grown on Szapek-Dox (DSMZ130) medium (g/l): sucrose (30), $NaNO_3$ (3), $MgSO_4 .7H_2 O$ (0.5), KCl (0.5), $Fe_2SO_3 .7H_2O$ (0.001), $K_2 HPO_4$ (1) and agar (20).. The culture of each microorganism was diluted with sterile distilled water to 107–108 CFU/mL. Sample discs (10-mm diameter) were located on the surface of the agar plates (10-cm diameter containing 25 mL of solidified media). The discs were placed on inoculated agar plates and incubated for 24 h at 37°C and for 48h and at 30oC for fungal test microbe. A corresponding plate without any discs was used as a negative control. An antimicrobial test on untreated textile was considered as a positive control. Sample antimicrobial activities were evaluated by the diameter of the clear zones that appeared around the discs.

RESULTS AND DISCUSSION

Preparation and Characterization

The fungal fibers had white and purple color before the addition of Ag^+ions which changed to a brownish color on completion of the reaction with Ag^+ ions for 28 h. The appearance of a brownish color in solution containing the biomass is a clear indication of the formation of silver nanoparticles in the reaction mixture. Results **(Fig. 1)** shows LM fibers grafted with bio-nanosilver particles. On the other hand,(**Fig. 2**) shows SEM micrographs of the fibers grafted with bio-nanosilver particles.

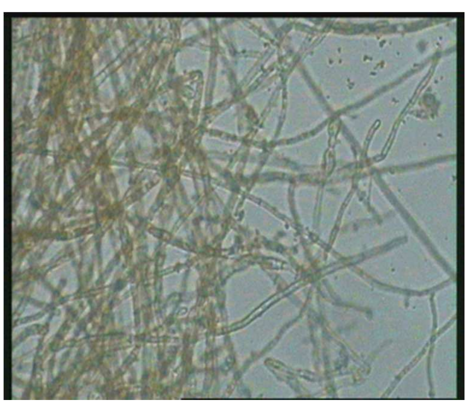


Fig. 1.LM the fibers grafted with bio-nanosilver particles

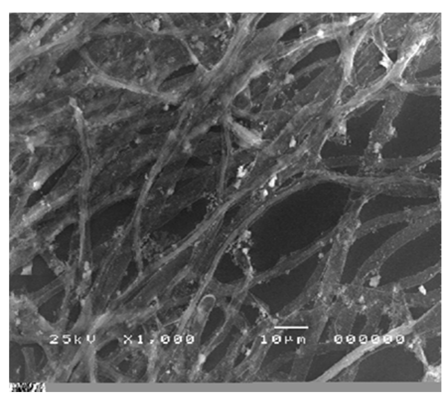


Fig. 2. SEM micrographs of the fibers grafted with bio-nanosilver particles

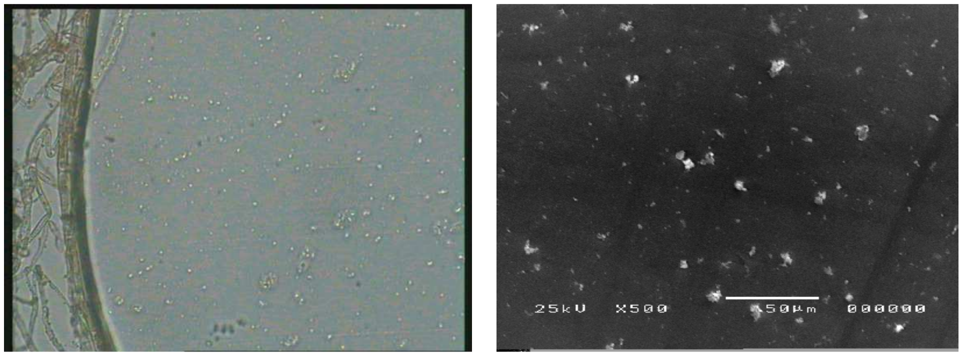


Fig. 3.bright field image of the silver nanoparticles

The **(Fig.3)** shows the bright field image of the silver nanoparticles. The **(Fig.4)** shows fibers with diameters from different micrometers And non-uniformity capillaries of thickness.

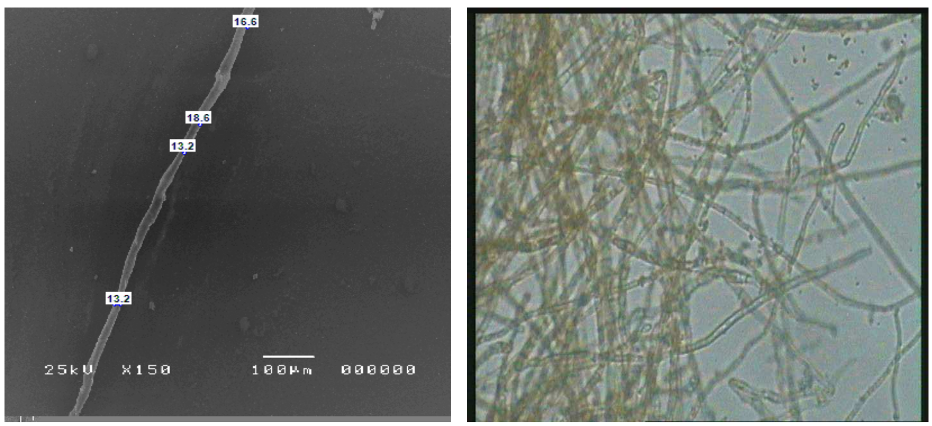


Fig. 4.fibers with diameters from different micrometers And non-uniformity capillaries of thickness.

Nanoparticles Incorporation in Cotton Fabrics and Their antimicrobial Effects

The cotton fabrics incorporated with silver nanoparticles were characterized by EDX. It was obtained 2.5% of incorporation. The bacterial and yeast activity of the silver-impregnated fabrics against (S. aureus, E. coli, Candida albicans and Aspergillusnige) the antimicrobial activity of cotton fabrics with and without silver nanoparticles was evaluated and the fabrics was analyzed by SEM-EDX and antimicrobial activity test. the fabrics without silver nanoparticles (control) a significant bacterial growth as shown in Figures 5(A) and (B) were observed However , the cotton fabrics with silver nanoparticles presented antibacterial activity showing no bacterial growth in this oneFig.5(C). shown in Figures.(6) antimicrobial activity test .Fig.6 (A) the fabrics without silver nanoparticles (control)and Fig.6(B),(C), (D) and (E)the cotton fabrics with silver nanoparticles. This result demonstrated that silver nanoparticles can be used to turn sterile fabrics The incorporation of silver nanoparticles in the cotton fabrics also was verified by SEM-EDX (Fig.7).In this figure of the cotton fibers containing silver nanoparticles was observed the presence of the silver peak and the absence of the contamination with bacteria.

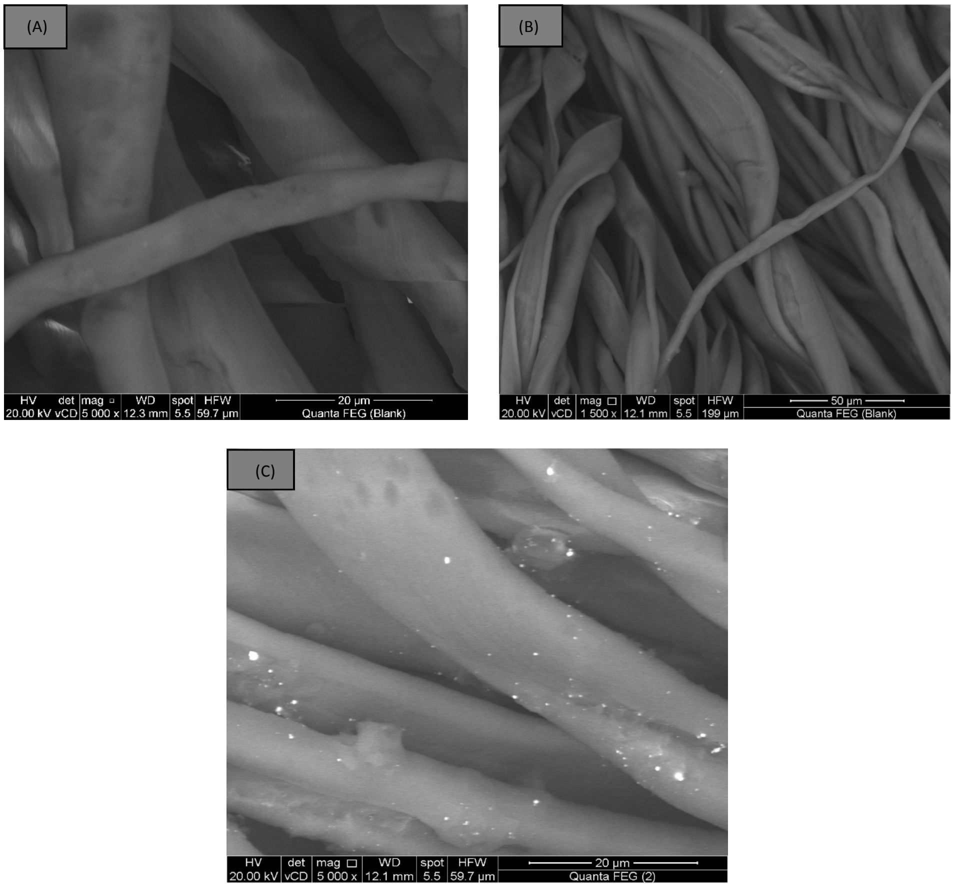
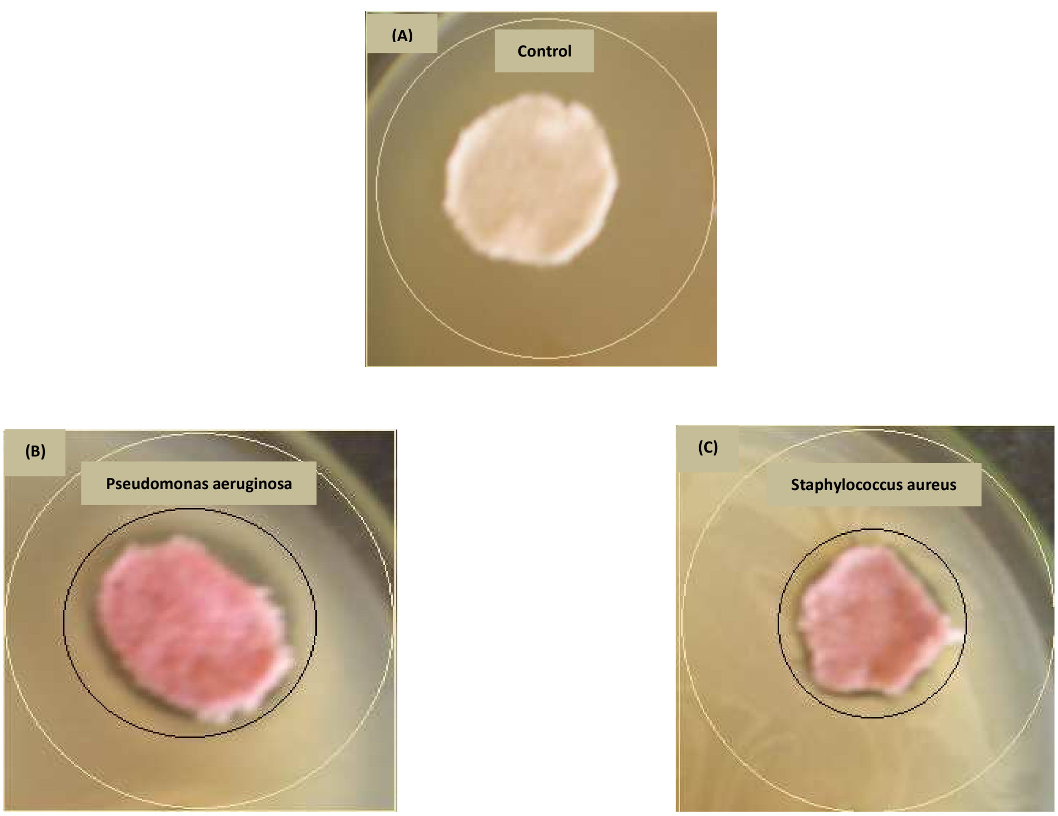


Fig. 5. SEM micrographs of the cotton fiber (A) without silver nanoparticles (control) X 1500, (B) without silver nanoparticles (control) X 5000, (C) containing silver nanoparticles X 5000.



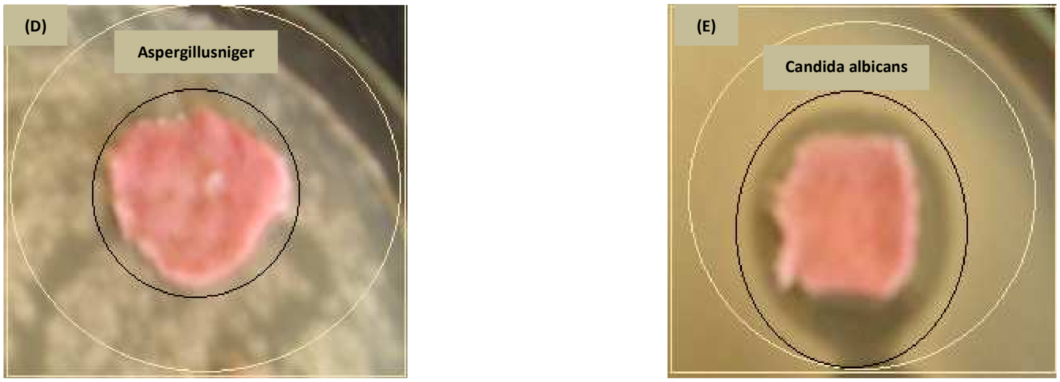


Fig. 6. Antimicrobial activity test

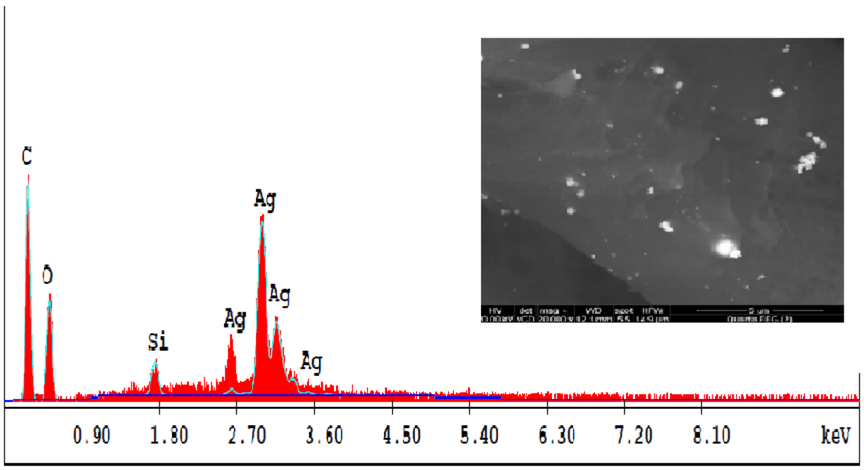


Fig. 7. EDX for the cotton fabrics containing silver nanoparticles the inset shows the SEM micrograph of the cotton fibers × 20000.

Element	Wt %	At %	K-Ratio	Z	A	F
C K	31.61	55.33	0.0908	1.0908	0.4816	**1.0002**
O K	26.79	35.20	0.0470	1.0723	0.1636	**1.0001**
Si K	2.46	1.84	0.0181	1.7127	0.7127	**1.0076**
AgL	39.14	7.63	0.3484	0.8244	1.0798	**1.000**
Total	100.00	100.00				

Table. I. Elements percentage by the EDx analysis

CONCLUSION

This study demonstrated the possibility of use biological synthesized silver nanoparticles and their incorporation in bio fibers and incorporated it in the cotton fabrics. With these silver nanoparticles As the Synthesis of bio nanosilver using fungi are good tools used in controlling many of the drug resistant bacteria this cotton fabrics can be helps In the treatment of Some diseases such as burns and diabetic foot ulcers.

REFERENCES

[1] M. Schaller , J. Laude, H. Bode waldt, G. Hamm, and H. C. K orting , *Toxicity and antimicrobial* activity of a hydrocolloid dressing containing silver particlesin an ex vivo model of cutaneous infection. Skin Pharmacol. Physiol. 17, 31 (2004).

[2]S C. ANAND*, Techtextil North America,* Atlanta*,* USA, Conference Proceedings, 24 March, 2000, p. 3.

[3]H.Q. Y in, R. Langford, and R. E. Burrell, Comparative evaluation of the antimicrobial activity ofACTICOAT *antimicrobial barrier dressing*. J. Burn. Care Rehabil. 20, 195 (1999).

[4] MJ.Richards, JR .Edwards, Culver DH, Gaynes RP. Nosocomial infectionsin medical intensive care *units in the United States. CriCare*Med. 1999;27:887–92

[5] D.Fortin and T.J.Beveridge, Mechanistic routes towards biomineral surface development, Biomineralisation: From *biology to biotechnologyand medical application*, edited by *E.Baeuerlein, Wiley-VCH Verlag, Germany* (2000), p.294

[6]I.Sondi and B. Salopek-Sondi, Silver nanoparticles as antimicrobial agent: a case study on *E. coli* as a model for Gram-negative bacteria *J. Colloid Interf. Sci*. 275, 177 (2004).

[7] Elsayed E. Hafez, M. R. El-Aassar, Khalil Abdelrazek Khalil, Salem S. Al-Deyab and Tarek H. Taha, Poly (acrylonitrile-co-methyl methacrylate) nanofibers grafted with bio-nanosilver particles as ntimicrobial against multidrug resistant bacteria,*African Journal of Biotechnology Vol*. 10(84), pp. 19658-19669, 26 December, 2011 .