

A study on the coating of silver nanoparticles on fabric surfaces with 3-Mercaptopropyltrimethoxysilane(MPTMS)

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Abstract

A solution containing 3-Mercaptopropyltrimethoxysilane(MPTMS) was employed to modify surface of cotton fabrics with a silver colloid. Silver nanoparticles were applied on cotton fabrics via treatment with 3-MPTMS. The rate of silver nanoparticles on the fabric surface were measured with Energy Dispersive Spectroscopy(EDS). EDS results confirm the silver atom on the cotton surface.

1. Introduction

Humans are prone to bacterial infection. In addition, fibers could be proper mediums for bacteria which could cause diseases. Silver has been known as a disinfectant for many years and being used in many forms in the treatment of infectious disease; however, the applications other than spinning process, of silver nanoparticles on fibers and polymers have some difficulties. In this research, fabric treatments with silver nanoparticles will be investigated to develop antimicrobial fibers.

2. Experimental

2.1. Materials

A cotton fabric (KS K 0905) and silver colloid (Nano SF-silver(1.0±0.5nm, 0.5%), Miji Nanotech) were used. Isopropanol(Duksan

pure Chemicals, 95%) and 3-Mercaptopropyltrimethoxysilane(MPTMS) (SIGMA-ALDRICH, 95%) were applied without further purification.

2.2. Experimental

2.2.1. 3-MPTMS effect

The silver colloidal solutions were prepared with 10 mL isopropanol and different amounts of silver colloid (2, 6, 10 mL) with/without 3-MPTMS solution. The cotton samples were immersed into the solutions at 43 °C for 90 min (Table 1).

Table 1. 3-MPTMS effect

	Experimental 1	Experimental 2
Silver colloid	2mL, 6mL, 10mL	2mL, 6mL, 10mL
Temperature	43 °C	43 °C
Time	90 min	90 min
3-MPTMS solution	3-MPTMS: 0.1mL Isopropanol: 10mL	-

2.2.2. Temperature effect

The silver colloidal solution was prepared with isopropanol (10mL), silver colloid (10mL), and 3-MPTMS (1mL). The cotton samples were immersed into the solutions at different temperatures (18 °C and 43 °C) for 90 min (Table 2).

Table 2. Temperature effect

	Experimental 1	Experimental 2
Silver colloid	10mL	10mL
Temperature	18 °C	43 °C
Time	90 min	90 min
3-MPTMS solution	3-MPTMS: 0.1mL Isopropanol: 10mL	3-MPTMS: 0.1mL Isopropanol: 10mL

3. Result and Discussion

3.1. 3-MPTMS effect

Contents of silver nanoparticles on cotton fibers with 3-MPTMS (A) and without 3-MPTMS (B) were shown in Table 3.

Table 3. Contents of silver nanoparticles on cotton fibers with 3-MPTMS (A) and without 3-MPTMS (B)

A		
Silver colloid	Weight%	Atomic%
2mL	0.89	0.11
6mL	1.52	0.20
10mL	3.84	0.30
B		
Silver colloid	Weight %	Atomic %
2mL	0	0
6mL	0	0
10mL	0	0

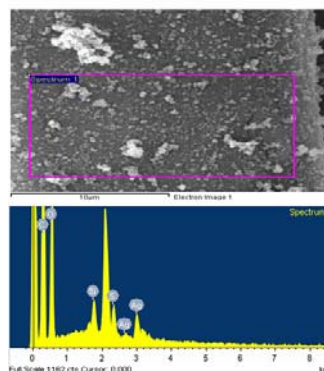
3.2. Temperature effect

Contents of silver nanoparticles on cotton fibers treated with the 3-MPTMS solution at different temperatures (18 °C and 43 °C) were shown in Table 4.

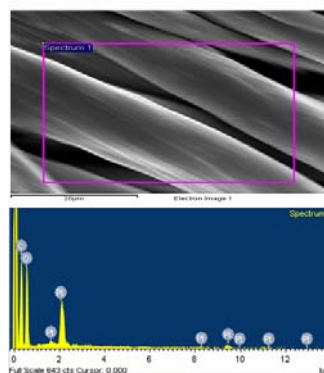
Table 4. Contents of silver nanoparticles on cotton fibers treated with the 3-MPTMS solution at different temperatures (18 °C and 43 °C)

Temperature	Weight %	Atomic %
18 °C	0	0
43 °C	3.84	0.30

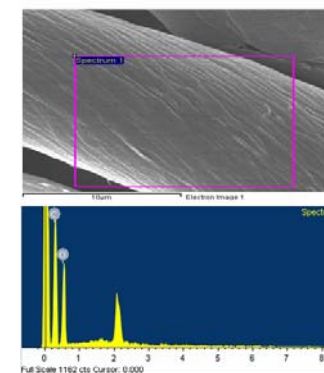
3.3. Scanning electron microscopy (SEM)-EDS analysis



(A) Surface of cotton with 3-MPTMS solutions (43 °C, 90 min)



(B) Surface of cotton without 3-MPTMS solutions (43 °C, 90 min)



(C) Surface of cotton with 3-MPTMS solutions (18 °C, 90 min)

4. Reference

[1] Chang-kyu kang., Uniform control of the density control of the functionalized a modified silicon surface, Master thesis, Auburn University, U. S. A. (2007)