

## Supplementary material

### DESIGN, STRUCTURAL CHARACTERISTIC AND ANTIBACTERIAL PERFORMANCE OF SILVER-CONTAINING COTTON FIBER NANOCOMPOSITE

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#### **1. Preparation of silver-containing cotton fiber nanocomposite (cotton-OH-Ag, cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag)**

Samples (cotton-OH or cotton-(PO(OH)<sub>2</sub>)(Cl) (0.1 g) were placed in a flask containing 50 ml of NaBH<sub>4</sub> solution (2.0 mM). This was immersed in an ice-bath and under intensive stirring 16.6 ml of AgNO<sub>3</sub> solution (1.0 mM) was added drop by drop. When the entire amount of the silver salt was added to the solution, it acquired a characteristic bright yellow color. The obtained cotton-OH-Ag and cotton-

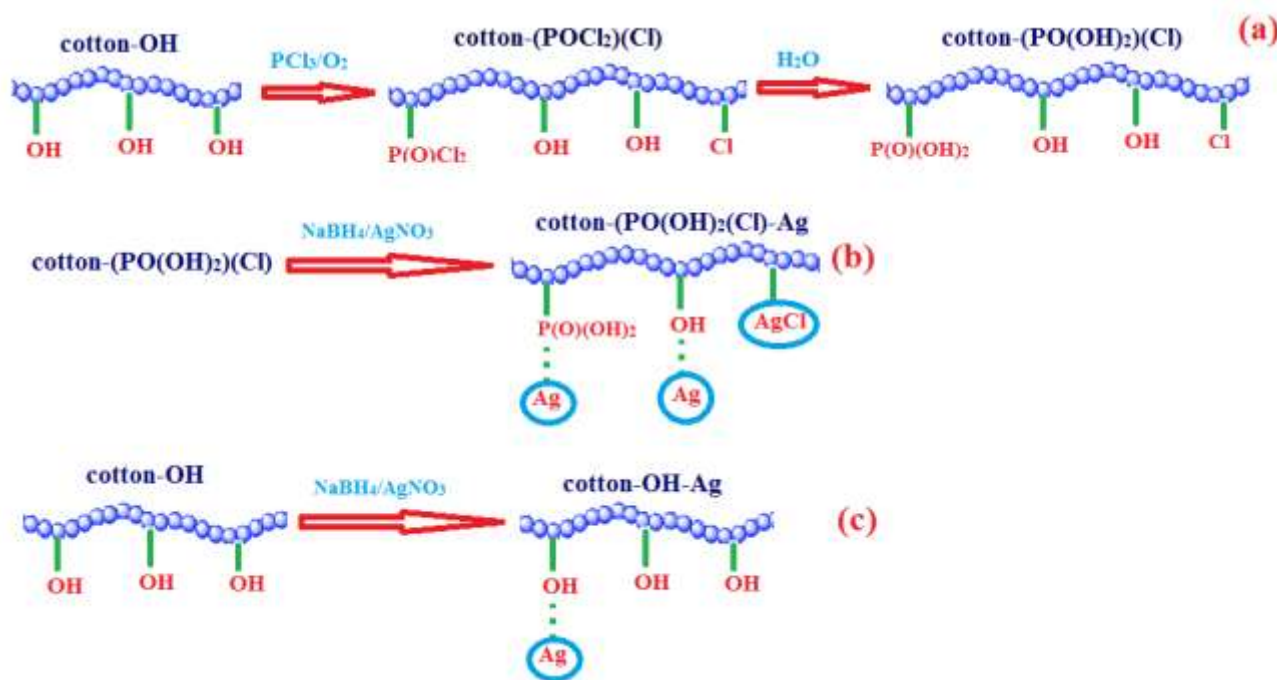
(PO(OH)<sub>2</sub>)(Cl)-Ag were thoroughly rinsed with deionized water, then dried in the air, and kept in a desiccator for further characterization.

## 2. Antibacterial test

We used strains of gram-negative bacteria, *E. coli* ATCC®25922; gram-positive bacteria, *S. aureus* ATCC®25923; and fungus *C. albicans* ATCC®90028; and culture media from «Liofilchem®» (Italy) agar Mueller Hinton, Saburo, Endo, B.Parker, MacConkey.

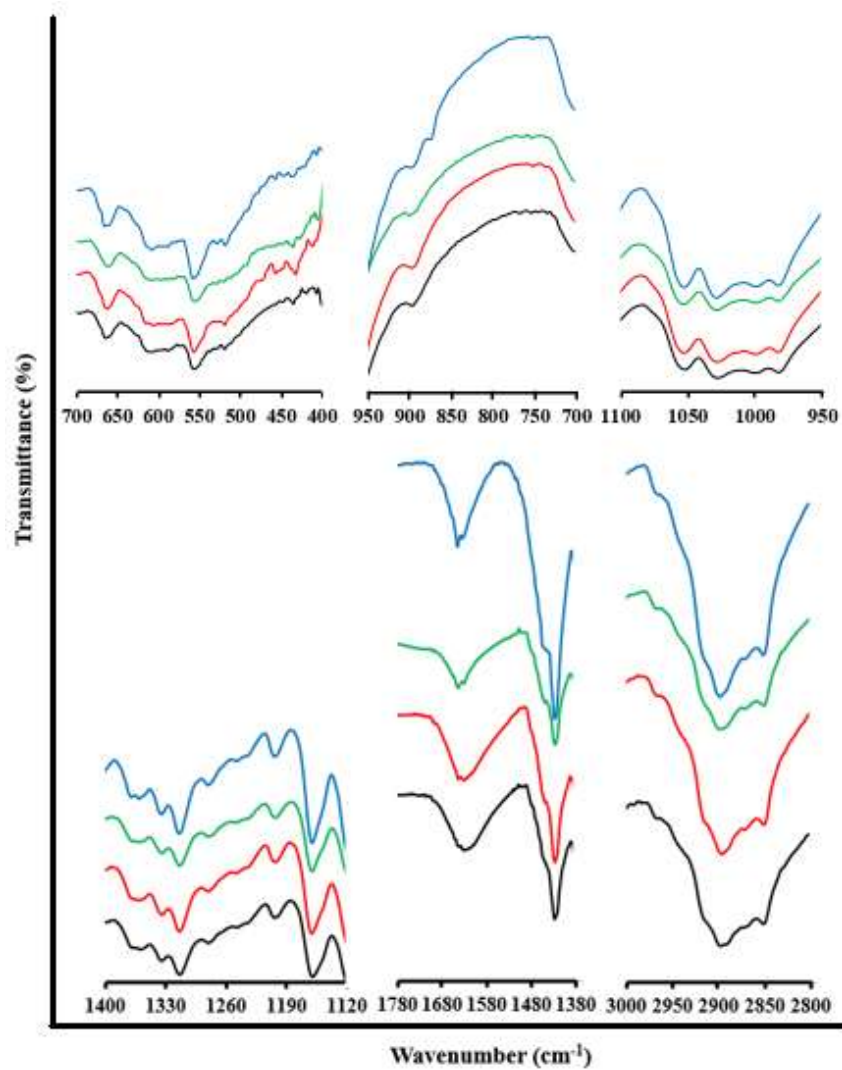
The bacteria were cultured in Liofilchem® trypto-soy broth under aerobic conditions at 37°C for 24 hours. Equal volumes of bacterial suspension (1 ml each) were layered on Petri dishes with selective medium for each pathogen using a standard inoculum corresponding to 0.5 density by McFarland standard and containing approximately 1.5×10<sup>8</sup> colony forming units (CFU)/ml. The partially closed dishes were placed into a drying box at room temperature for 15 minutes, after which the test samples were put into them. The samples were rolled into balls, each ~ 5 mm in diameter and ~ 0.01 g in weight. The dishes were incubated at 37°C for 24 hours. The degree of sensitivity of microorganisms was determined by measuring the diameter zone of inhibition (in mm).

## 3. Scheme of the modification of cotton-OH and preparation of composites



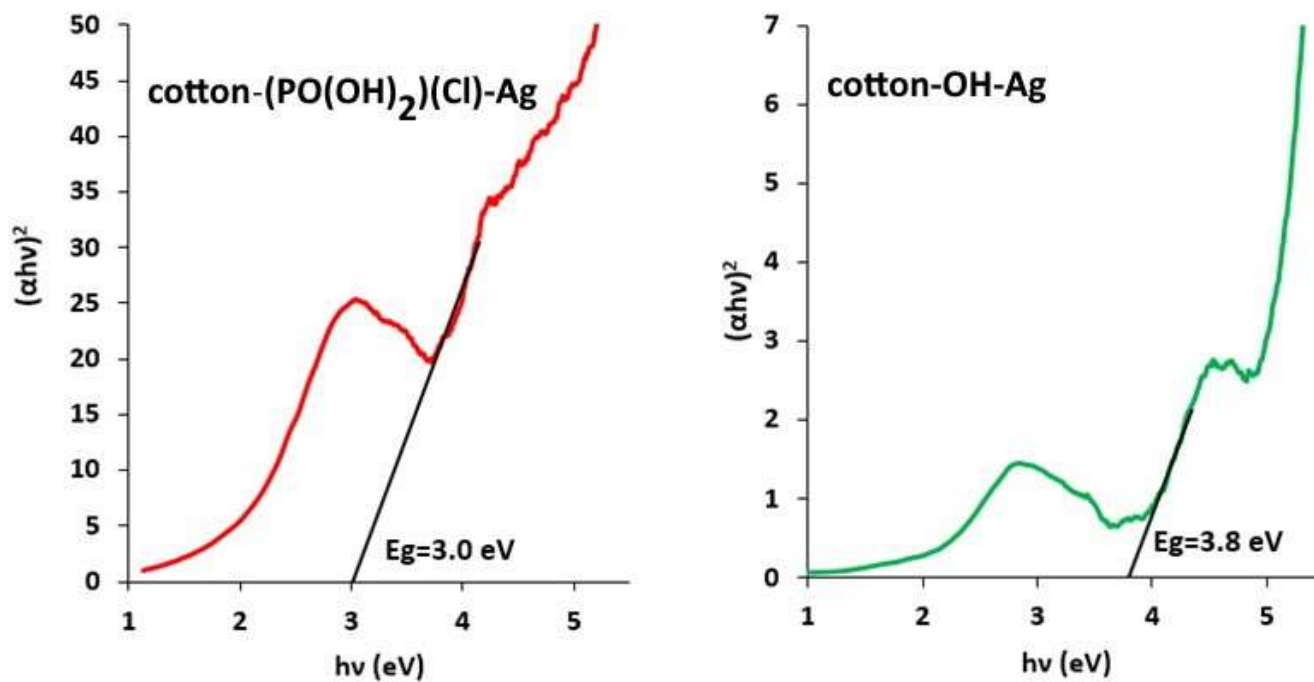
**Scheme S1.** Modification of cotton-OH (a) and preparation of composites: cotton-OH-Ag (b), cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag (c)

## 4. FTIR spectra of the samples in the different range



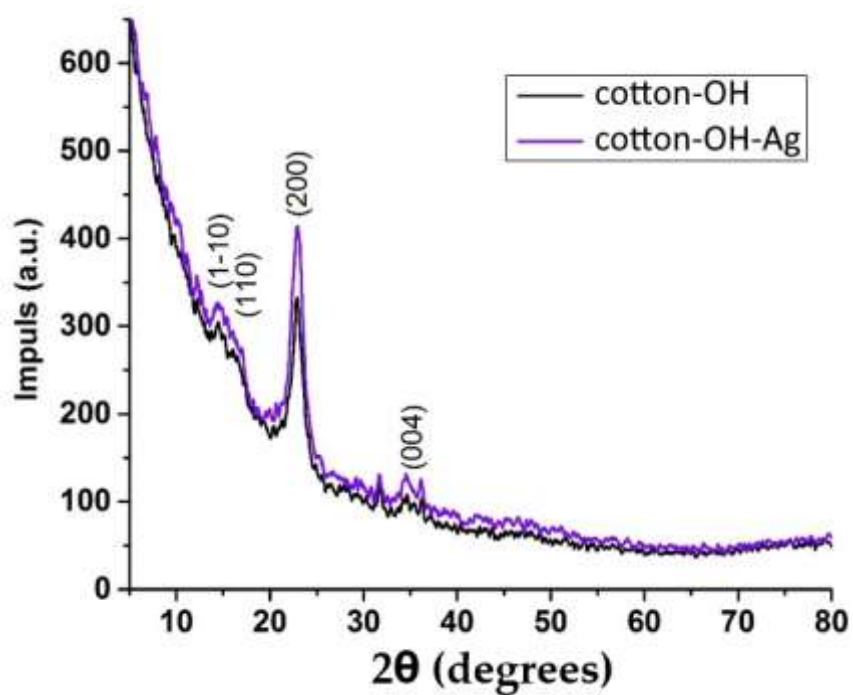
**Figure S1.** FTIR spectra of cotton-OH (black), cotton-OH-Ag (red), cotton-(PO(OH)<sub>2</sub>)(Cl) (green) and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag (blue) in the different range

##### 5. The optical bandgap for cotton-OH-Ag and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag



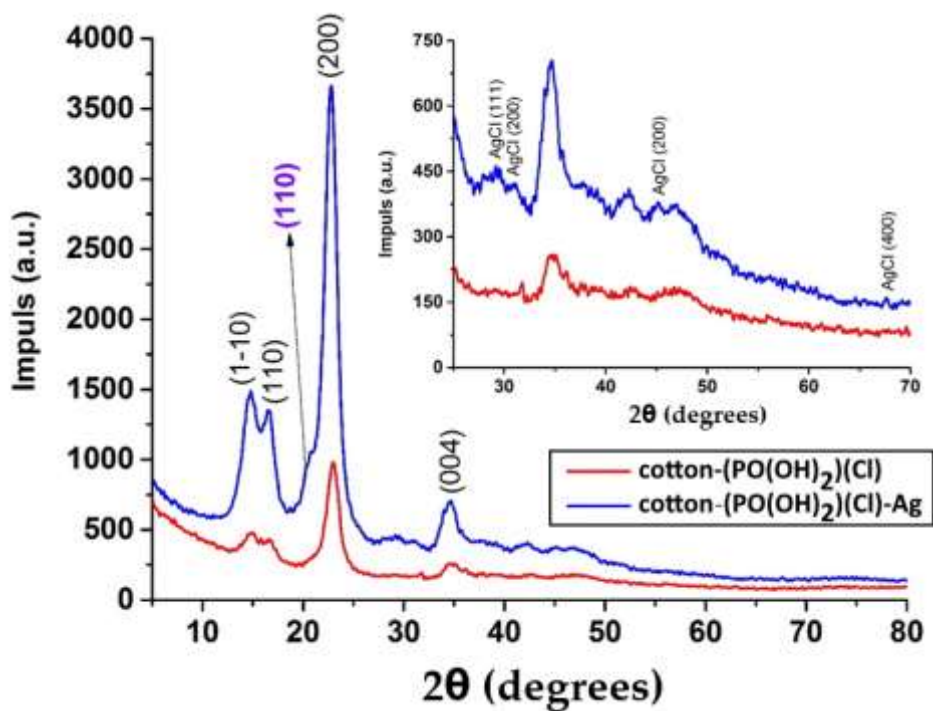
**Figure S2.** The optical bandgap for cotton-OH-Ag and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag

## 6. XRD spectra of cotton-OH and cotton-OH-Ag



**Figure S3.** XRD spectra of cotton-OH and cotton-OH-Ag

## 7. XRD spectra of cotton-(PO(OH)<sub>2</sub>)(Cl) and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag.



**Figure S4.** XRD spectra of cotton-(PO(OH)<sub>2</sub>)(Cl) and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag

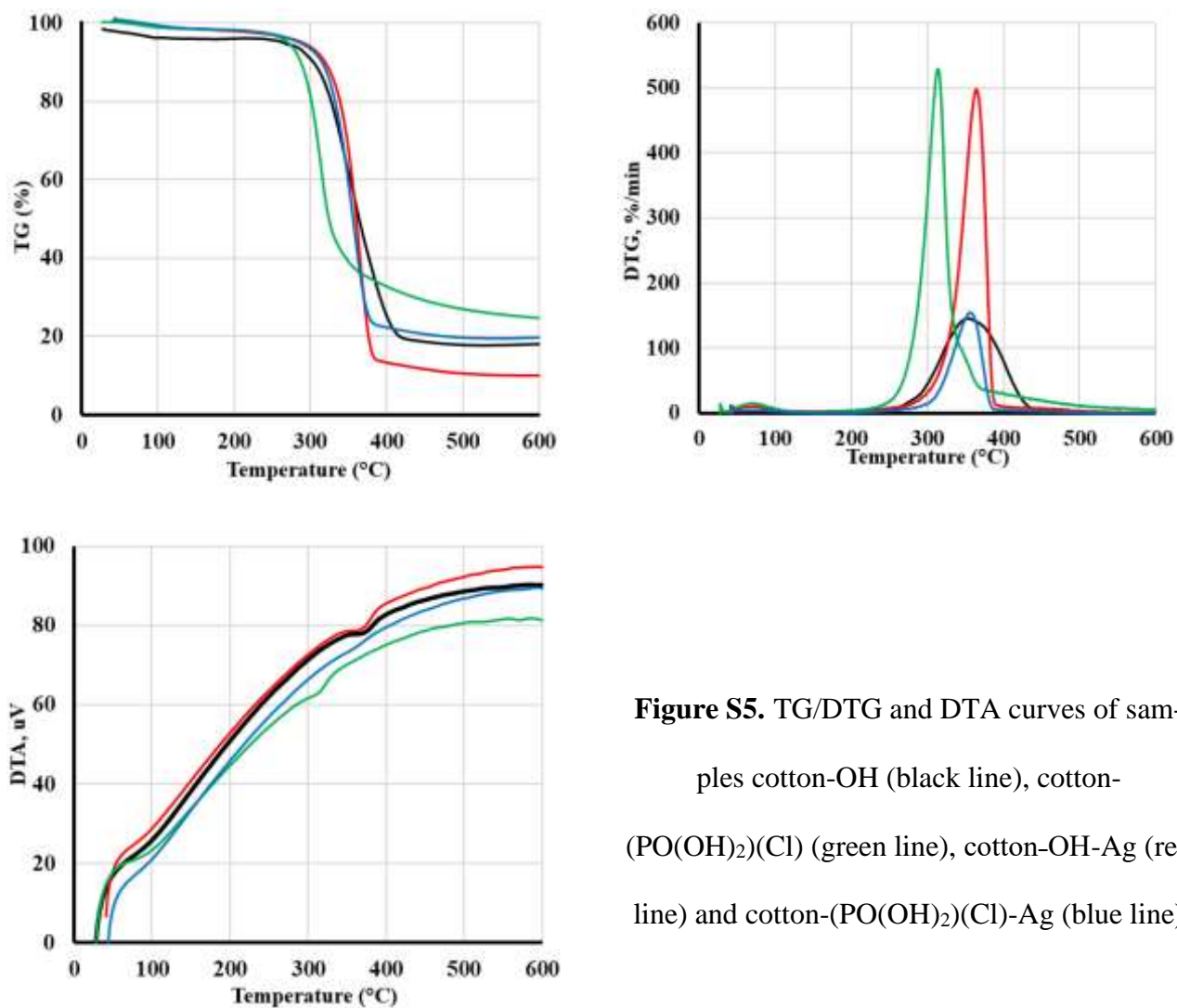
## 8. Crystalline size and Segal CI of the samples

**Table S1.** Crystalline size and Segal CI of cotton-OH, cotton-OH-Ag, cotton-(PO(OH)<sub>2</sub>)(Cl) and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag.

Sample	2θ	Intensity	I <sub>t</sub>	FWHM	I <sub>am</sub>	D (nm)	Segal CI (%)
cotton-OH	14.57	301.70	31.60	0.72	196.10	7.12	41.05
	16.64	260.60	23.33	0.46			
	22.89	332.64	176.43	1.19			
cotton-OH-Ag	14.65	323.56	49.44	0.82	207.13	6.09	49.86
	16.96	273.05	40.76	0.68			
	23.00	413.14	247.59	1.39			
cotton-(PO(OH) <sub>2</sub> )(Cl)	14.96	480.94	156.33	1.42	257.10	6.18	73.76
	16.70	426.11	128.75	1.34			
	23.03	979.90	751.39	1.37			

cotton-	14.78	1476.82	915.74	2.13	642.90	5.76	82.45
(PO(OH) <sub>2</sub> )(Cl)-	16.57	1354.52	813.50	1.48			
Ag	22.76	3663.80	3192.40	1.47			

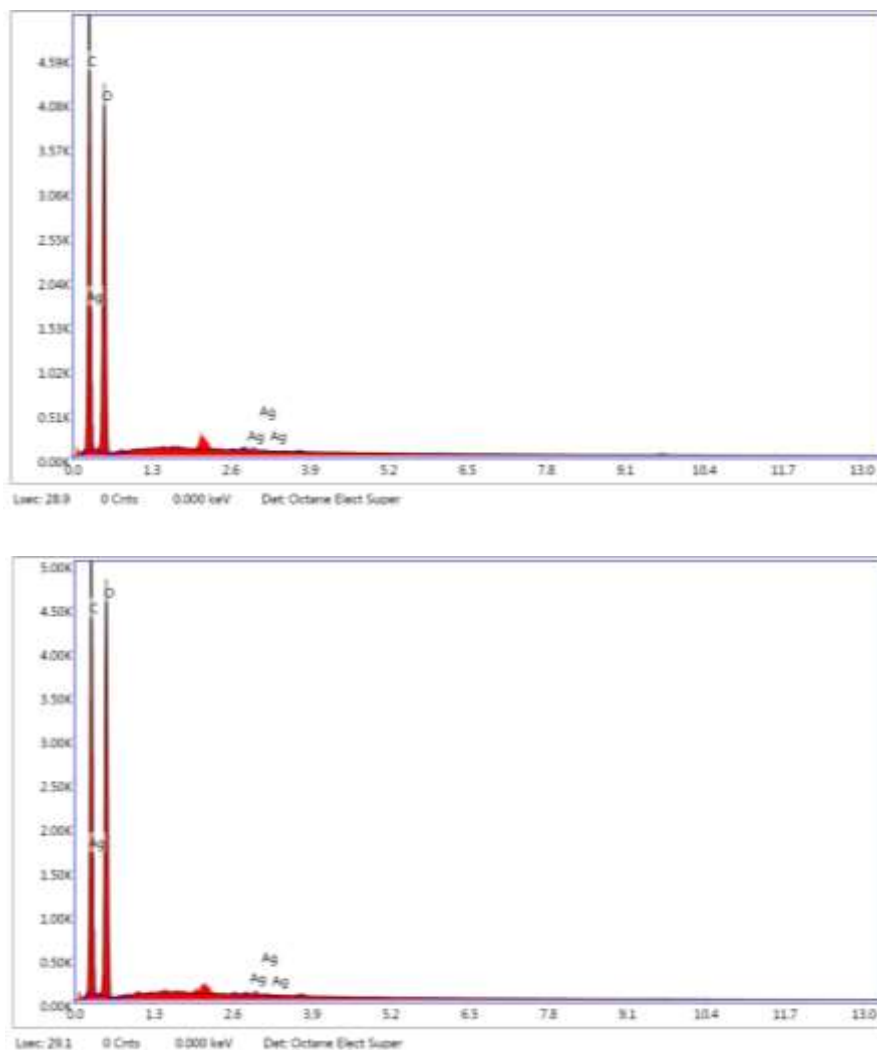
## 9. TG/DTG and DTA curves of samples



**Figure S5.** TG/DTG and DTA curves of samples cotton-OH (black line), cotton-(PO(OH)<sub>2</sub>)(Cl) (green line), cotton-OH-Ag (red line) and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag (blue line)

## 10. SEM images of the samples

## 11. EDX image for samples coated by Ag-containing nanocomposites



**Figure S6.** EDX image for samples coated by Ag-containing nanoparticle:  
cotton-OH-Ag (a) and cotton-(PO(OH)<sub>2</sub>)(Cl)-Ag (b).

## 12. The quantitative content of elements

**Table S2.** EDX Data of Different Cotton Fibers

Samples	C, %	O, %	Ag, %
cotton-OH	50.89	49.11	-
cotton-OH-Ag	47.32	52.31	0.38
cotton-(PO(OH) <sub>2</sub> )(Cl)	49.04	50.96	-
cotton-(PO(OH) <sub>2</sub> )(Cl)-Ag	46.28	53.30	0.42