

Copper-coated textiles with potent antimicrobial activity against methicillin-resistant *Staphylococcus aureus*



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Introduction

Copper has been shown to have broad spectrum antimicrobial properties. We evaluated the effects of four different copper-coated textiles on the survival of contemporary methicillin-resistant *Staphylococcus aureus*, which is known to have the inherent capability to survive on dry surfaces over time and is currently endemic in hospitals in many parts of the world.

Material and Methods

- **Strains:** Five blood isolates of methicillin-resistant *S. aureus*
- **Samples:**
 - Four different copper-coated textiles
 - Para-aramide (A, C)
 - Polyester (B, D)
 - Two coating methods
 - Samples A and B: coating method I (a well-known and proved copper coating method for both Para-aramide and Polyester)
 - Samples C and D: coating method II (a new method for both textiles - is to be published soon)
 - Plain-uncoated textile samples of Polyester (E) and Para-aramide (F) were used as controls.
- **Procedure:**
 - Samples (1x1cm) were sterilized, inoculated with 10 µl of bacterial suspension (10⁸cfu/ml) and incubated at room temperature for 0, 15min, 1h, 3h, 5h and 24h.
 - Then they were individually placed in sterile phosphate buffer saline and vortexed.
 - The saline was serially diluted and quantitatively cultured for recovery of viable bacteria.
 - The lower limit of detection was 2.6log₁₀ cfu/cm². Mean viable counts (log₁₀ cfu/cm²) after incubation at each time interval on each sample were compared for statistical analysis.
 - Reduction of viable counts by >3 log₁₀ from starting inoculum was characterized as bactericidal activity.

Results

- *S. aureus* exhibited an immediate reduction of at least 3 log₁₀ upon inoculation on copper-coated textiles A and C as compared to controls.
- Viable bacteria could not be recovered from any of the tested strains after contact of 1 hour or more with all copper-coated textiles.
- Bactericidal activity was documented immediately for textiles A and C and after 1h of contact for textiles B and D.
- The contact with any of the control textiles did not produce any reduction of viable bacteria even after 24 h of incubation.

Figure 1. Survival over time of 5 *S. aureus* clinical isolates

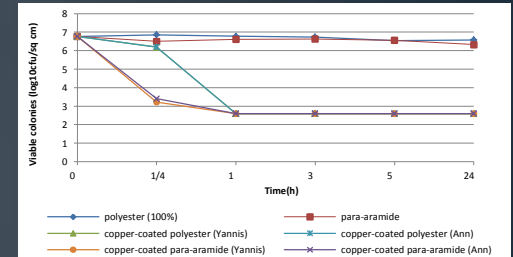


Table 1. Difference between mean starting inoculum and mean viable cell count ($\Delta \log_{10} \text{cfu/cm}^2$) of the five *S. aureus* isolates at each time interval

Textiles	Time (h)				
	1/4	1	3	5	24
	$\Delta \log_{10} \text{cfu/cm}^2$				
A. copper-coated para-aramide (I)	-3,54*	-4,17*	-4,17*	-4,17*	-4,17*
B. copper-coated polyester (I)	-0,58	-4,17*	-4,17*	-4,17*	-4,17*
C. copper-coated para-aramide (II)	-3,36*	-4,17*	-4,17*	-4,17*	-4,17*
D. copper-coated polyester (II)	-0,57	-4,17*	-4,17*	-4,17*	-4,17*
E. polyester	0,09	0,01	-0,04	-0,22	-0,19
F. para-aramide	-0,27	-0,15	-0,14	-0,20	-0,44

- A negative sign represents a reduction and a positive sign an increase from the inoculum at time 0.
* Asterisks denote differences that were statistically significant in the within-group comparisons.

Figure 2. Textile samples



Conclusion

- ❖ Copper-coated fabrics reduced quickly the number of viable multidrug-resistant *S. aureus* isolates and produced a consistent bactericidal effect.
- ❖ These data suggest that copper – coated textiles may have an important advantage when used in the hospital setting and offer an innovative approach to the reduction of environmental contamination by pathogenic bacteria.