

# Antimicrobial Efficacy of Silver Impregnated Activated Charcoal Wound Dressing

Tracy J Rennison, Simon Bayliff, Jason Knight and David J Greenhalgh, PhD, Johnson and Johnson Wound Management, Gargrave, UK

## OBJECTIVE

Two microbiological studies were performed to demonstrate the antimicrobial effect of a Silver Impregnated Activated Charcoal Dressing (SIAC). The first study performed was testing using a broad spectrum of microorganisms. The second study looked at the effect of wetting on the antimicrobial action of SIAC.

## Wound Colonisation

Recent theories on wound infection have focused around the concept of microbial balance when pathophysiological or external factors contribute to uncontrolled microbial proliferation or increase in microbial species the balance changes, resulting in infection and delayed healing.

The majority of wounds are contaminated with numerous types of aerobic and anaerobic microorganisms. The types and number of microorganisms are not sufficient to diagnose localised wound infection / critical colonisation, this depends on the loading and virulence of the microorganisms present.

## 150 Microorganisms study

Testing was performed using a broad spectrum of clinical isolates and two microbiological test methods.

### Aerobic Bacteria and Yeast

For the aerobic bacteria and the yeast, a log<sub>10</sub> reduction test method was employed. This involved shaking the SIAC dressing for 60 minutes in 10ml of a washed microorganism suspension. The initial time 0 and final time 60 samples were diluted and counts were determined using spread plates. Log<sub>10</sub> reductions were generated by subtracting the time 60 log<sub>10</sub> count from the time 0 log<sub>10</sub> count.

### Anaerobic Bacteria

For the anaerobic bacteria, a zone of inhibition test was performed in conjunction with a control dressing (TOPPER® 8 Swab). One 5 x 5cm SIAC dressing was placed onto the centre of a pre-inoculated agar plate incubated for 2 hours anaerobically. After the zones of inhibition had been documented a swab test was performed of the agar surface where the SIAC dressing had been. Growth was scored in comparison with the swab results from the inoculated lawn and the control dressing.

Results shown in figure 1, identify microorganisms that experienced a 10 fold decrease in the microbial population when exposed to the SIAC dressing.

Figure 1: SIAC Dressing Efficacious Against 150 Microorganisms *in-vitro*

### Aerobic Microorganisms

Gram Positive Rods	Gram Positive Cocci	Gram Negative Rods	Gram Negative Cocci
<i>Bacillus</i> spp. (7)	<i>Enterococcus</i> spp. all VRE (9)	<i>Acinetobacter</i> spp. (4)	<i>Branhamella</i> spp. (2)
<i>Corynebacterium</i> spp. (5)	<i>Micrococcus</i> spp. (2)	<i>Aeromonas</i> spp. (5)	
	<i>Staphylococcus</i> spp. (13)	<i>Bordetella</i> spp. (1)	
	MRSA (9)	<i>Burkholderia</i> spp. (2)	
	<i>Streptococcus</i> spp. (13)	<i>Citrobacter</i> spp. (5)	
		<i>Comomonas</i> spp. (1)	
		<i>Enterobacter</i> spp. (7)	
		<i>Escherichia</i> spp. (7)	
		<i>Klebsiella</i> spp. (5)	
		<i>Morganella</i> spp. (2)	
		<i>Proteus</i> spp. (4)	
		<i>Providencia</i> spp. (5)	
		<i>Pseudomonas</i> spp. (11)	
		<i>Salmonella</i> spp. (8)	
		<i>Serratia</i> spp. (5)	

### Anaerobic Microorganisms

Gram Positive Rods	Gram Positive Cocci	Gram Negative Rods
<i>Clostridium</i> spp. (3)	<i>Peptostreptococcus</i> spp. (4)	<i>Bacteroides</i> spp. (3)
		<i>Fusobacterium</i> spp. (2)
		<i>Porphyromonas</i> spp. (1)
		<i>Prevotella</i> spp. (3)

**Yeasts**

*Candida* spp. (3)

Number in ( ) refers to the number of strains tested

### References

- Poster Presentation at 35<sup>th</sup> Annual Wound Ostomy, Continence Conference (WOCN) – June 14 – 18, 2003. Clinical efficacy of a silver impregnated activated charcoal wound dressing. Presented by: Jon Warrick, Johnson and Johnson Wound Management, Somerville, USA; Libby Morrison, Craven Clinical, UK; Jean Delchambre, Ethicon S.A.S., France.
- Poster Presented at 13<sup>th</sup> Conference, European Wound management Association (EWMA) – May 22 – 24, 2003. The bacterial endotoxin binding activity of silver impregnated activated charcoal dressing. Presented by: Axel Kramer, Gerald Müller, PhD, Yvonne Winkler, Institute of Hygiene and Environmental Medicine, University of Greifswald, Germany.
- Poster Presented at 13<sup>th</sup> Annual Wound Healing Society Educational Symposium and Exhibition – May 4 – 7, 2003. Bacterial endotoxin binding activity of a silver impregnated activated charcoal dressing and gauze. Presented by: David J Greenhalgh, PhD, Johnson and Johnson Wound Management, Gargrave, UK; Marilyn Greenhalgh, Microbac Limited, Consett, UK.

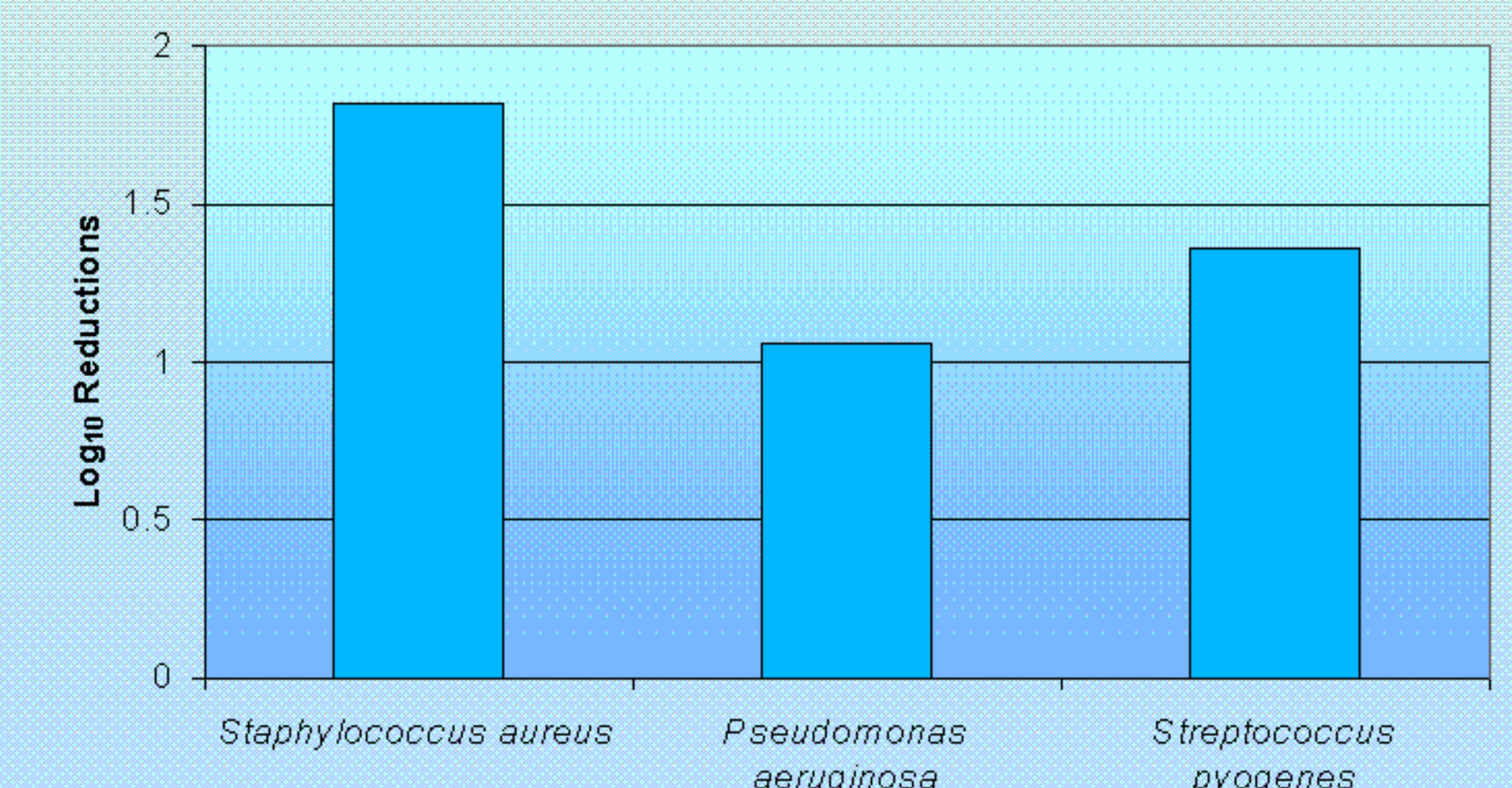
## Effect of Saline Pre-wetting on SIAC Dressing

Testing was performed using common wound isolates, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Streptococcus pyogenes*.

### Adsorption Efficacy Test Method

The SIAC dressing was saturated with sterile 0.85% saline solution prior to shaking with 10 ml of one of the washed test microorganism suspensions for 15 minutes. The initial time 0 and 15 minute samples were diluted and counts were determined using spread plates. Log<sub>10</sub> reductions were generated by subtracting the 15 minute log<sub>10</sub> count from the time 0 log<sub>10</sub> count.

Figure 2: Results for Pre-wet SIAC with three clinical relevant bacteria demonstrating a 1.00 log<sub>10</sub> Reduction



## Conclusion

SIAC shows a broad spectrum of antimicrobial efficacy *in-vitro* against numerous clinically relevant microorganisms associated with wound infection, including antibiotic resistant strains. SIAC also demonstrated *in-vitro* efficacy in the presence of physiological saline. Both these microbiological test methods, published clinical data<sup>1</sup> and bacterial toxin binding properties<sup>2,3</sup> support the suitability of SIAC as an effective antimicrobial wound dressing for use on infected wounds.

A silver impregnated activated charcoal dressing (SIAC) – ACTISORB® Silver 220 Dressing, Johnson and Johnson Wound Management Worldwide, a division of ETHICON, INC.

TOPPER®8 Swab, Johnson and Johnson Wound Management Worldwide, a division of ETHICON, INC.

\* Trademark of Johnson and Johnson