

## Investigation of fiteBac Germicidal Hand Gel Antimicrobial Properties

**Purpose:** The hands of health-care workers can readily become irritated and damaged as a result of frequent washing and other hand hygiene procedures. Subsequent development of irritation dermatitis can compromise infection control efforts by causing affected tissues to be more susceptible to colonization with transient bacteria, which are common causes of cross-contamination and cross-infection in healthcare settings. Routine use of hand lotions has been shown to reduce epithelial irritation and cracking by lubricating the skin and replacing tissue emollients lost from repeated hand hygiene procedures. Another efficacious property to consider when evaluating skin lotions is a possible antimicrobial benefit provided with application of the product. The overall purpose of this investigation was aimed at expanding findings collected from earlier experiments with *fiteBac Germicidal Hand Gel*, by studying any antimicrobial effects *in vitro* against representative, clinically important bacterial and fungal pathogens.

### Materials and Methods:

Two hand lotions were tested in this investigation and their results compared. These were *fiteBac Germicidal Hand Gel* (Kimmerling Holdings Group) and *VioNex Skin Lotion* (Metrex). Bacterial suspensions of stock *Staphylococcus aureus* ATCC #25923, and methicillin-resistant *Staphylococcus aureus* (MRSA) ATCC # 33591 were prepared by aerobically culturing bacteria in 10 mL of trypticase soy broth at 37C for 48 hours. Broth cultures of *Candida albicans* ATCC #10231, a common mycotic organism, were prepared in the same manner. The microbial concentrations determined for each of the stock cultures prior to any experimental dilution are presented in Table 1.

Table 1. Concentrations of test microorganisms calculated for baseline undiluted cultures.

Microorganism	Concentration/ mL
<i>S. aureus</i>	1.86x10 <sup>7</sup>
MRSA	2.05x10 <sup>8</sup>
<i>C. albicans</i>	3.20x10 <sup>7</sup>

Serial microbial dilutions were prepared in physiological saline from fresh cultures. Bacterial dilutions for experimentation were 1:10, 1:100, and 1:1,000 of original stock concentrations. Experimental microbial lawn cultures were prepared by aseptically swabbing approximately 0.3 mL of either undiluted or diluted preparations onto trypticase soy agar plates with 5% sheep blood and then allowed 5 minutes to sufficiently adhere and adsorb onto the agar. Subsequently, 0.2 mL of the test gel or lotion was dispensed from a sterile syringe and applied onto half of the agar's surface with a sterile swab. The seeded agar plates were then incubated at 37C for 24 hours.

### Results:

Staphylococcal assays: An antimicrobial effect was initially observed when *fiteBac Germicidal Hand Gel* was tested against *S. aureus* ATCC #25923. As shown in both Figure 1 and Table 2, application of hand gel onto freshly seeded staphylococcal cultures was able to significantly inhibit subsequent bacterial growth *in vitro*. This finding was consistent for all of the experimental replications using these bacteria and *fiteBac Germicidal Hand Gel*. Multiple dilutions of methicillin-resistant *S. aureus* ATCC # 33591 were subsequently exposed to *fiteBac Germicidal Hand Gel* *in vitro*, and similar patterns of microbial inhibition were noted when bacterial dilutions of 1:1,000 and 1:10,000 were applied (Figures 2-3 and Table 3). In contrast, experiments using the control hand lotion did not demonstrate any inhibitory activity against high concentrations of bacteria in both staphylococcal test systems (Figures 4-5).

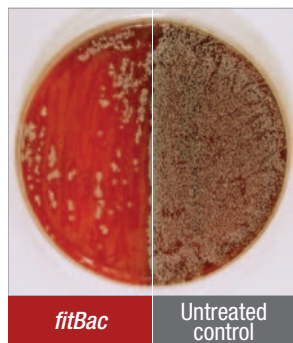


Figure 1: Representative plate of the interaction between a 1/10 dilution of *S. aureus* and 0.2 mL *fiteBac Germicidal Hand Gel*.

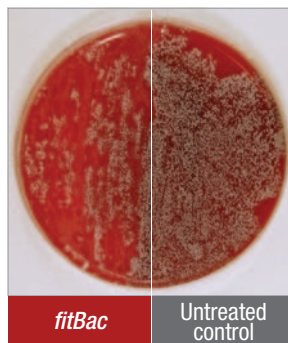


Figure 2: Representative plate of the interaction between a 1/1000 dilution of MRSA and 0.2 mL *fiteBac Germicidal Hand Gel*.

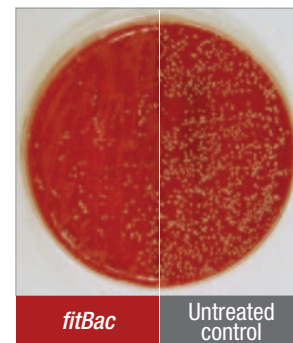


Figure 3: Representative plate of the interaction between a 1/10,000 dilution of MRSA and 0.2 mL *fiteBac Germicidal Hand Gel*.

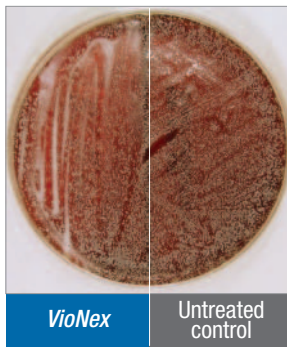


Figure 4: Representative plate of the interaction between a 1/10 dilution of *S.aureus* and 0.2 mL *VioNex Skin Lotion*.

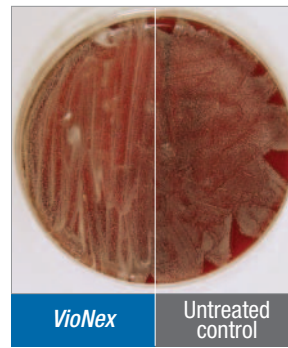


Figure 5: Representative plate of the interaction between a 1/10 dilution of *MRSA* and 0.2 mL *VioNex Skin Lotion*.

Table 2. *S.aureus* Results (cfu).

Dilution	fiteBac Germicidal Hand Gel	VioNex Skin Lotion
1:10	409	TNTC*
1:100	202	733

Table 3. *MRSA* Results (cfu).

Dilution	fiteBac Germicidal Hand Gel	VioNex Skin Lotion
1:1,000	896	1960
1:10,000	270	454

\*Too Numerous To Count

**Fungal assays:** Experiments utilizing *fiteBac Germicidal Hand Gel* and dilutions of *C. albicans*, a common, opportunistic mycotic pathogen, demonstrated pronounced antifungal activity (Figure 6 and Table 4). Control assays using *VioNex Skin Lotion* had little to no effect on *Candida* growth patterns (Figure 7).

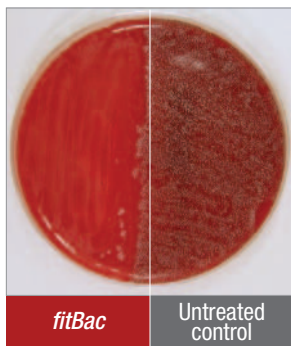


Figure 6: Representative plate of the interaction between a 1/100 dilution of *C.albicans* and 0.2 mL *fiteBac Germicidal Hand Gel*.

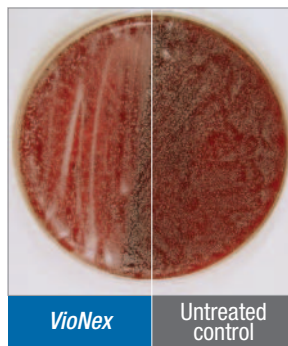


Figure 7: Representative plate of the interaction between a 1/100 dilution of *C.albicans* and 0.2 mL *VioNex Skin Lotion*.

Table 4. *C.albicans* Results (cfu).

Dilution	fiteBac Germicidal Hand Gel	VioNex Skin Lotion
1:100	55	2323
1:1,000	23	563

## Summary:

Multiple studies carried out in hospitals and other healthcare settings have reported that the most common adverse reaction to hand hygiene activities is development of dermatitis. Skin irritation caused by repeated exposure to liquid soaps and antiseptics remains a major barrier to infection control compliance. Proper maintenance of epithelial integrity can be enhanced with routine use of latex-compatible hand gels or lotions. A number of such agents are available and well tolerated by healthcare professionals. The findings of this investigation suggest that *fiteBac Germicidal Hand Gel* is able to prevent the growth of a variety of representative microorganisms of clinical significance, when tested *in vitro*. Diluted suspensions of *S. aureus*, *MRSA*, and *C. albicans* exposed to the gel on enriched agar plates were inhibited, as evidenced by a substantial reduction in the number of colonies. While the mechanism of antimicrobial activity remains to be elucidated, the inclusion of 0.1% benzalkonium chloride, a quaternary ammonium compound, along with the elastomer-based component in the product, appear to be major factors.

In summary, the present study demonstrated that *fiteBac Germicidal Hand Gel* exerted an inhibitory effect on the *in vitro* growth of selected preparations of *Staphylococcus aureus*, *methicillin-resistant S. aureus*, and *Candida albicans*. The antimicrobial effects were observable with both high and lower concentrations of the test organisms that were assayed.