

## A WEAPON AGAINST 'SUPERBUGS'

*James Ballard, MBA – Infection Prevention, Paul Hummel, MT(ASP,AMT) – Director Laboratory, Chuck Grimmitt MLT(AMT) – Microbiology, Katrina Bardsley – Director Environmental Services. Edited by Judy Ingala, MSN, RN, RPh – Vice President Patient Care Services* *March 3, 2007*

### EXECUTIVE SUMMARY

The United States Healthcare system is burdened with 3.2 billion dollars of added cost each year to battle multidrug-resistant organisms (MDROs). The two main culprits are Methicillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin-resistant *Enterococcus* (VRE); which account for about 63% of hospital reported infections. There is now an approved agent that provides residual killing properties to battle these so called 'Superbugs'. In order to effectively attack the bacteria that create such a large burden is to proactively treat the environmental surfaces in patient care areas. Byotrol, an antimicrobial technology company, produces a product titled Polysphere®. This disinfectant works on a molecular level with inanimate objects to provide a barrier where viruses, bacteria, fungi and spores cannot attach to the surface and cannot contaminate the surface. This study found it to be effective for up to three days post treatment. Residual disinfectants are the answer that will prove to be a valuable weapon against MRSA and VRE. Proactively focusing on the environment by utilizing residual disinfectants will enhance the effectiveness of Infection Control programs.

### INTRODUCTION

Multidrug-resistant organisms (MDROs) cost the United States Healthcare system approximately 3.2 billion dollars annually for increased treatment. The Centers for Disease Control and Prevention (CDC) indicates *methicillin-resistant Staphylococcus aureus* (MRSA) now accounts for 63% of staph infections reported in hospitals (1). MRSA along with *vancomycin-resistant Enterococcus* (VRE) are the two most troublesome drug resistant bacteria that healthcare facilities face today. These "Superbugs" can cause outbreaks of infections that increase mortality rates four fold. One method to attack these 'Superbugs' is through enhanced environmental measures. The CDC states "Clean and disinfect surfaces and equipment that may be contaminated with pathogens, including those that are in close proximity to the patient and frequently-touched surfaces in the patient care environment" (2).

### THE WEAPON

*"Results from the independently supervised study using the patented biocide developed by Byotrol which was recently registered with the Environmental Protection Agency (EPA) as an effective killer of methicillin-resistant Staphylococcus aureus (MRSA). A successful six month study at Glasgow Royal Infirmary reports that treatment of high-contact surfaces such as door handles, patient contact systems and bed rails account for a 75% reduction in MRSA throughout the ward; total elimination of MRSA was noted for several weeks during the trial". (3)*

The product POLYSPHERE®, by the manufacturer Byotrol, is a new anti-microbial technology that this study found to provide residual disinfecting properties to surfaces that may become contaminated by MDROs. This product uses polymer technology to entrap added biocides and adhere them to surfaces at a molecular level. Byotrol works at two levels: 1) initial kill on contact and 2) formation of a monolayer when wet and dry killing viral and bacterial cells, spores, fungi and algae. This product inhibits biofilm formation by interference with and disruption of microbial attachment. Byotrol's characteristics are: it provides an ongoing protection from micro-organisms by preventing attachment; it provides broad spectrum efficacy; it cannot create MDRO resistance; is low in toxicity; is easy to use and requires no specialized capital equipment.

## DISCUSSION

The fight against MDROs must continue. Infection Control Practitioners and Epidemiologists have often been in a reactive mode due to incubation periods and identification processes. There is an agreement that proactive factors to an effective Infection Control program should include appropriate antibiotic usage, physician and staff education, pre-treated medical supplies, effective hand washing programs and appropriate usage of isolation precautions. The most overlooked component of an effective Infection Control program is switching from a reactive state to a proactive state. Prevention is the primary component to hardware efficacy in any Infection Control program.

Environmental conditions are one measure on which to focus while trying to implement an effective program. Inanimate objects in the care setting are a major source of transmission of MDROs. Although it is true that healthcare workers are the primary mode of transmission, the objects that become contaminated in and around the patient care setting are the source for the transmission. Eradication must occur at the source to control or prevent transmission. The Association of Professionals in Infection Control and Epidemiology (APIC) indicates in a 2006 report that 70% of MRSA rooms had MRSA recovered from the environment. Sources where MRSA recovery occurred include: patient's gown, floor, bed linens, blood pressure cuffs, over-bed tables, stethoscopes and door handles (4). Various National reports indicate that 'Superbugs' are found on the television remote control, patient bed controls, door handles, light switches, curtains, commodes and patient room chairs. These environmental sources of MDROs require attention in order to 'prevent' the healthcare worker from contaminating him/herself every time he/she enters a patient care area.

Proactive actions include appropriate usage of disinfectants, scheduled and frequent environmental cleaning, appropriate usage of isolation and the inclusion of disinfectants with residual killing properties. If disinfectants could create a barrier on the surface of the inanimate object that prevented the microorganism from being able to attach, then transmission would not be possible. Even if this disinfectant only produced a residual effect for a day, the object would not instantly be re-contaminated after cleaning. There are currently two products on the market with claims of residual disinfecting properties.

Carrier manufactures a product called AgION® which is a silver based liquid designed to add a protective coating to inanimate surfaces. Byotrol manufactures a product called Polysphere® which is an anti-microbial treatment designed to add a protective coating on the molecular surface of the object.

Certainly, residual disinfectants sound like a win-win solution to the MDRO problem, but are they really? The only way to determine if a residual disinfectant would be an effective component to a proactive Prevention Program (PP) would be to put this product through a laboratory's test. Do either one of these products really work? That is the question posed to the laboratories microbiology department and environmental services director at Monroe Hospital in Bloomington, Indiana.

## THE TEST

### Environmental Services Director – Katrina Bardsley – February 1, 2007

The AgION® product was tested in a patient room on the Medical/Surgical Nursing Unit. While using this product per manufacturer's recommendations, a white film surfaced on the items being cleaned. This film represented a 'dirty' appearance on the furnishings and it was decided not to test this product any further.

The Byotrol® product was mixed per manufacturer's recommendations three ounces to five gallons of water. All surfaces were soaked and allowed to dry for the recommended ten minute time frame. Glass and mirror surfaces were wiped down and allowed to air dry and the result was no streaks on these products. The surfaces that were treated include: patient bed, remote control, patient bed side table, micro-fiber chair, nurse call hand held device, light switches, bathroom fixtures, curtains and dark wood closet panels. All surfaces in the patient rooms were allowed to air dry and the result was no residual film, no appearance of the product and no discoloration to the furnishings. From these results, it was decided to test the residual properties of the disinfectant in the laboratory.

The test was conducted in the Microbiology section of the Hospital Laboratory. The project plan was to test for a three (3) day consecutive residual study of the disinfectant. The product tested was Byotrol's Polysphere®.

### Report from Microbiology technician Chuck Grimmatt, MLT (AMT) February 22, 2007

Throughout the project life cycle, for three consecutive days, this disinfectant was tested for residual performance against Enterococcus faecalis (Vancomycin Resistant)(VRE) and Staphylococcus aureus (Methicillin Resistant)(MRSA). Utilizing a hard non-porous environmental surface measuring three inches by three inches, the product was evaluated at manufacturer's recommended concentration of three ounces of product to five gallons of water (18ml per gallon). Surfaces were treated with disinfectant and remained wet for ten minutes as per the manufacturer's specifications. Quality Control was performed using the same hard non-porous environmental surface moistened with sterile water and no disinfectant. All surfaces were inoculated using either MRSA or VRE with sterile

swabs. For three consecutive days, these surfaces were streaked with sterile swabs and then inoculated to blood agar plates to check for either Growth or No Growth. All results were recorded (see Table # 1).

## RESULTS

The objective of this report was to gather all relevant information for better disinfectant use, to improve implementation of product usage and to prevent or minimizing risks for nosocomial (Hospital Acquired) infections. This study concluded that the Byotrol Polysphere® disinfectant product has a residual effectiveness for at least three consecutive days when applied according to the manufacturer’s recommendations.

Table # 1

### Project Performance Report: 3 day disinfectant study for Byotrol Polysphere

Day #	Item Description	Growth/No Growth
	<b>Quality Control – MRSA</b>	
1	No disinfectant applied	Growth – light and sporadic at 24 hours
2	No disinfectant applied	Growth – moderate over test area at 48 hours
3	No disinfectant applied	Growth – almost covers area at 72 hours
	<b>Quality Control – VRE</b>	
1	No disinfectant applied	Growth – sporadic at 24 hours
2	No disinfectant applied	Growth – medium, spread over test area at 48 hours
3	No disinfectant applied	Growth – full – covers area at 72 hours
	<b>Product – MRSA</b>	
1	Polysphere® applied	Extremely Sparse Growth on leading edge of test streak at 24 hours, could be considered No Growth
2	Polysphere® applied	No advance in Growth at 48 hours
3	Polysphere® applied	No advance in Growth at 72 hours. No substantial Growth – could be considered No Growth
	<b>Product – VRE</b>	
1	Polysphere® applied	No Growth
2	Polysphere® applied	No Growth
3	Polysphere® applied	No Growth

## CONCLUSION

Since VRE and MRSA are both MDROs, if this product can kill VRE then it can be extrapolated that MRSA can also be killed. The laboratory results prove to be in favor of the Byotrol's residual disinfecting properties. The Polysphere® product can provide residual activity in killing VRE and MRSA on inanimate objects for at least three days. With this knowledge, a proactive Infection Control program can now attack the environmental factors that aid in the transmission of MRDOs. Along with appropriate antibiotic usage, hand washing effectiveness and isolation precautions, residual disinfectants can additionally increase a facility's chance of decreasing the transmission of MRSA and VRE respectively. The additional benefit of the Polysphere® product is that the cost of the disinfectant mixture is literally pennies per gallon (approximately .22 cents per gallon of mixture).

The final analysis of the test for Byotrol's Polysphere® is that for the cost and tested residual activity, this product can maximally benefit Infection Control and Prevention measures surrounding MRDOs and Hospital Acquired Infections. A follow up study is underway that will test the two products effectiveness when applying multiple layers and will test for the effectiveness of residual kill properties greater than three days.

## REFERENCES

1. Battling “Superbugs” in the Environment of Care (Feb 2007). The Joint Commission *Environment of Care News*, Vol 10, Num 2, pg 1-4.
2. Seigel, J.D., Rhinehart E., Jackson, M., Chiarello, L., et al. (2006). Management of Multidrug-Resistant Organisms In Healthcare Settings. Centers for Disease Control and Prevention. Sect V.A.6 pg 40.
3. Study Shows Cleaning Agent Reduces MRSA by Half. Retrieved on December 7, 2006 from <http://www.vpico.com/articlemanager/printerfriendly.aspx?article=129508>
4. Muto, C.A. (Dec 2006). Controlling Methicillin Resistant Staphylococcus aureus (MRSA). “Designing a Program to Eliminate MRSA Transmission Part I: Making the Clinical Case”. Association for Professionals in Infection Control and Epidemiology (APIC).