ANTIMICROBIAL TREATMENTS

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Part II: Types and Considerations for Use

Last month, Part 1 of our series on antimicrobial treatments described the role antimicrobials play in the cleaning industry. Specifically covered were the problems these compounds are capable of solving and what benefits the consumer can realize. This article focuses on the key differences among the products available in the marketplace. Topics addressed include a description of how the various compounds work, their range of effectiveness, and their toxicity.

As more and more antimicrobial treatments are introduced into the cleaning industry, the professional cleaner must choose the best one for a particular job. In order to make the right choice, it is important to understand the differences among the various products.

Antimicrobial treatments differ in:

- Chemical nature
- Mode of operation
- Durability
- Effectiveness
- Toxicity and safety
- Cost

Antimicrobials can be divided into two major categories: bound and unbound. These terms refer to whether or not the antimicrobial has the capability to chemically bond to the surface on which it is applied.

Unbound Antimicrobials

An unbound antimicrobial cannot be bonded to a surface in order to function properly. It must diffuse from the treated substrate and be consumed by the microorganism in order to be effective. Once inside the organism, the chemical agent will act like a poison interrupting some key metabolic, or life sustaining process of the cell, causing it to die. Once the antimicrobial is depleted or is washed away during regular maintenance, protection vanishes. Therefore, the degree of durability desired must be considered when choosing an antimicrobial treatment.

After application, an unbound antimicrobial continues to diffuse or leach from the substrate on which it has been applied. As this diffusion continues, the concentration of the active ingredient becomes diluted below effective levels. Under these conditions, microorganisms have the ability to adapt or build up a tolerance to these antimicrobials. Highly resistant strains can develop which are immune to what was once an effective treatment dose. Just such a phenomenon (genetic adaptation) occurred with the use of DDT to control flies during World War II. A resistant strain of flies developed rendering DDT ineffective for control. The adaptation process, as it is called, is of special concern to the healthcare industry due to the potential development of more potent and highly resistant strains of disease-causing microorganisms.

Conventional (unbound) antimicrobials can often be very effective against specific types of microorganisms, but are generally limited in their ability to offer broad-spectrum control. In other words, they may be effective against specific bacteria, but not all, or they may destroy all bacteria, but be ineffective against fungi, yeasts, or algae.

The safety and toxicity of “unbound” antibacterial treatments vary considerably depending on the specific chemistry involved. For example, many organotin antimicrobials must be handled with great care. Otherwise they can be a cause for concern by the operator during application and disposal of the treatment solutions, and to the consumer during use. In fact, some of these organotin compounds are currently under close scrutiny by the EPA and have been restricted in Japan and in some European countries. Each

professional cleaner should request sufficient information from his supplier concerning the proper safety and handling, storage, application, and disposal of any antimicrobial treatment.

Bound Antimicrobials

Bound antimicrobial agents, like the SYLGARD™ Antimicrobial Treatment manufactured by Dow Corning, remain chemically attached to the surface on which they are applied. They function by interrupting the organism's delicate cell membrane. This prevents microorganisms from carrying on vital life processes. These antimicrobials kill organisms on contact and can do so again and again. One can think of the bound antimicrobial treatment functioning like a sword which does the killing instead of a gun with limited ammunition as in the case of an unbound treatment.

Since a "bound" antimicrobial is fixed to the carpet fiber and is not continually diffusing off the surface leaving behind a level that is less and less effective, the adaptation process described earlier cannot and does not occur. The unique mechanism by which bound antimicrobials exhibit their activity permits them to effectively control a broad spectrum of microorganisms. Bacteria, molds, mildew, fungi, yeast, and algae can all be controlled with this type of antimicrobial.

As mentioned earlier, safety and toxicity of any antimicrobial agent is of prime importance because the safety to you, your operators, and your customers is at stake. Fortunately, all of the bound antimicrobials on the market today have a very favorable toxicological profile. The "bound" antimicrobial agent most commonly used in the marketplace today, an alkoxysilane quarternary ammonium compound, has undergone extensive toxicological testing to satisfy EPA requirements prior to it becoming registered for commercial use. And due to its unique chemistry, this particular compound can be rendered inactive in solution by simply adding an anionic detergent. This permits safe disposal of any extra treatment solution.

In summary, the professional cleaner must obtain answers to the following questions before deciding which antimicrobial treatment to purchase or which one he should use for a particular job:

1. Is the product safe for operators to apply, and is it safe for the customers, their children, plants, and pets? The professional cleaners should ask their supplier for summaries of all toxicological testing. This testing has been performed if the product is registered with the EPA.
2. What is the reason for applying an antimicrobial? Is it to disinfect a contaminated area, a sewer back up or floor situation where there is standing water? If so, then an "unbound," diffusing antimicrobial should be used because it will migrate through the water and organic debris killing the microbial contaminates. If, however, long-term effectiveness is required then a "bound" antimicrobial should be used.
3. Is the product effective against a wide range of microorganisms including gram negative and gram-positive bacteria, mold, mildew, fungi, yeast, and algae? Generally, a compound that is effective against the greatest variety of organisms is the one that should be used because microbial contaminates residing on any surface are made up of very diverse types.
4. Can excess antimicrobial solution be safely disposed? The next time the carpet is cleaned, does the solution removed from the carpet contain an antimicrobial residue which will make the wash water an environmental hazard? Antimicrobial agents which are not bound to the fiber can be extracted during the cleaning step.
5. Can microorganisms adapt and build up a resistance to the antimicrobial agent thereby creating subsequent generations of "superbugs?" Generally speaking microorganisms can readily adapt to diffusible compounds which act as metabolic poisons. They have a more difficult time building a resistance or adapting to bound antimicrobial agents which act as membrane inactivators.
6. Is the product registered with the Environmental Protection Agency (EPA) and is it approved for the intended use? Before any product can legally be marketed as a biologically active compound it must first be registered with the EPA. Additionally the EPA must approve the product for each intended application.

7. Has the product been proven effective in controlling the growth of microorganisms on surfaces and in preventing odor resulting from microbial growth in “real world” situations? Often the chemical supplier supports his efficacy claims with only laboratory data. It is easy to demonstrate product effectiveness under highly controlled laboratory conditions but most actual use situations are much less controlled and are more severe.

By answering these questions and considering the pros and cons of both “bound” and “unbound” antimicrobial agents, the professional cleaner will be in a better position to determine which antimicrobial agent is right for any particular job he encounters.

Parts I and II of this series have provided insights into the value of antimicrobials to the consumer, and a general review of the types of antimicrobials available. Next month, in Part III, we will take you one level deeper into the technology of antimicrobials by reviewing the critical methods used to determine antimicrobial effectiveness.

About the authors: Michael G. Hales, Martin E. Sorkin and W.C. White of Dow Corning combine years of experience in marketing and technical development for their antimicrobial treatments. They have published numerous papers in research journals.