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"A Demonstrated Layer of Protection–A Review of Antimicrobial Surface Protectants"

Tony Havics, PE, CIH

This week on IAQ Radio we welcome back one of our favorite guests Tony Havics, PE, CIH for a look at some recent work he has done on antimicrobial surface protectants (ASPs). In conjunction with a client who provides integrated facility services to more than 600 customers in the United States, Canada, and Puerto Rico; Mr. Havics, a certified industrial hygienist and engineer, collaborated in producing a thorough and leading-edge review of understanding products aimed at protecting against infection by the novel Coronavirus, COVID-19. Tony has invested 200+ hours in doing the ASPs review.

Their review consisted of selecting manufacturers of ASPs who have provided public review of their lab tests, lab studies, field studies and peer reviews. Each of the 15 products reviewed was evaluated for efficacy, applicability and potential drawbacks. The review is based on their first-hand experience with these products together with information supplied directly from the product manufacturers and summaries of third-party lab tests and studies. They believe this kind of clear-eyed analysis has been missing from the industry and as a leader in the field, and saw it as their responsibility to fill that void to improve end-user understanding of various applications.

Mr. Havics is an Honors graduate from Georgia Institute of Technology with a Bachelor's Degree in Mechanical Engineering and is a registered Professional Environmental Engineer (PE) with over 25 years of experience. He has provided front end investigation, development of plans & specifications, development of work plans, cost estimation, and oversight of numerous facilities for remediation, refurbishing, or decommissioning including a launch pad, dam gates, a baseball stadium, a tire factory with 59 buildings, a biologically contaminated L1011, a hospital, JP-6 fuel tanks, former mental institute, former military buildings, etc. In the field of microscopy, he has performed analysis for asbestos, contaminants in products, other minerals, fibers, fungi, engineering properties, and has testified in

federal court as an expert microscopist. Andrew has also performed failure analysis and forensic testing on numerous building products such as roofs, windows, flooring, drywall, piping, etc.

Nuggets mined from today's episode:

BACKGROUND

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is the Federal statute that governs the registration, distribution, sale, and use of pesticides in the United States.

WHAT IS THE FIFRA DEFINITION OF PEST? The term "pest" includes insects, rodents, nematodes, fungus, weeds, terrestrial and aquatic plants, viruses, bacteria, and any other living organism that EPA designates as a pest.

WHAT IS THE FIFRA DEFINITION OF PESTICIDE? The term "pesticide" is broadly defined within the meaning of FIFRA as (a) any substance used to regulate, prevent, repel, or destroy any pest or plant; (b) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant; or (c) any nitrogen stabilizer

PESTICIDE REGISTRATION REQUIREMENTS? The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires the registration of any substance intended to prevent, destroy, repel, or mitigate pests.

FIFRA TREATED ARTICLE EXEMPTION: However, the Code of Federal Regulations prescribes the conditions under which an exemption from registration is allowed for treated articles or substances. It allows an exemption for: An article or substance treated with or containing a pesticide to protect the article itself (for example, paint treated with a pesticide/preservative to protect the paint coating).

EPA grants the treated articles exemption for a non-public-health use of a pesticide that is intended to protect only the treated article or substance itself. Consumers may distinguish such products by the absence of the EPA's pesticide registration number of the registered pesticide used for protecting the article itself. An EPA registration number would be found on the product label. It should be noted that the EPA registration number would also be absent from an illegal product that

should be registered. Products that qualify for this exemption must display appropriate clarifying statements. For example:

- Claims for treated articles or substances are limited to statements like, "This product contains a preservative (e.g., fungicide or insecticide) built in or applied as a coating only to protect the product. An example of an acceptable label statement would be:
    - Antimicrobial properties are built in to inhibit the growth of bacteria that may affect this product. The antimicrobial properties do not protect users or others against bacteria, viruses, germs, or other disease organisms. Always clean and wash this product thoroughly before and after each use.
- In addition, it should be noted that:
    - The treated articles exemption is available only for the protection of the product and not for public health uses.
    - The preservative claim and qualifying statement on the product packaging (type, size and color) must be given no greater prominence than other described product features.

Articles or products that claim to be effective in controlling microorganisms such as E. coli, S. aureus, Salmonella sp. or Streptococcus sp. must be registered as a pesticide. These articles or products make a public health claim that goes beyond the preservation of the treated article itself. EPA requires the submission of chemical data in support of the public health labeling claims and patterns of use of the product.

If EPA determines that such a product is exempt from registration as a pesticide, the product may claim only that it contains a pesticidal preservative to protect the product itself. These pesticides are known as materials preservatives. In these cases, the pesticide is registered for the intended use, and the sole purpose of treatment is to protect the product itself. These pesticides are widely used in the manufacture of textiles, plastics, paper, adhesives and coatings.

Any pesticide-treated product that is not registered by EPA must not make public health claims, such as "fights germs, provides antibacterial protection, or controls fungus." EPA's policy is predicated on the fact that no scientific evidence exists that these products prevent the spread of germs and harmful microorganisms in humans.

COVID 19 opportunities? COVID 19 was a novel or new virus so while testing labs didn't have the actual COVID 19 virus on which to test, there was a public health demand for efficacious antimicrobial products. Manufacturers raced to have COVID 19 claims to their existing product labels and/or develop and register new antimicrobial products. The EPA is a government agency which requires time to evaluate data submitted by prospective product registrants.

EPA list N- EPA expects the products on List N to kill SARS-CoV-2, the coronavirus that causes COVID-19, because they:

- Demonstrate efficacy against a pathogen that is harder to kill than SARS-CoV-2 (COVID-19); or
- Demonstrate efficacy against a different human coronavirus similar to SARS-CoV-2 (COVID-19).
- Demonstrate efficacy against the coronavirus SARS-CoV-2 (COVID-19);

EPA expects all products on List N to be effective against SARS-CoV-2 (COVID-19) when used according to label directions.

What are Log Reductions?

- 1-Log reduction =90% 10x reduction,
- 2-Log =99% 100x reduction
- 3-Log= 99.9% 1,000x reduction (FIFRA sanitizer)
- 4-Log =99.99% 10,000x reduction
- 5-Log=99.999% 100,000x reduction
- 6-Log =99.9999% 1,000,000x reduction

Difference between disinfectants and ASPs? Disinfectants product high kill over a short duration. Antimicrobial Surface Protectants provide lower kill for longer time periods.

Product categorization? "The categorization is based on the type of product: solid, film or liquid. Solid products such as copper polymer

Application methods and limitations? How are products applied: built-in, spray on, roll on, electrostatic spraying, adhered?

Products working mechanism? SiQuats chemically micro-sword shaped molecules stick out and can puncture microbial cells, cationic ion exchange and phospholipid sponge.

Metals- both copper and silver are known to be antimicrobial. Silver ions bind to sulfur compounds and microbial cell walls. Copper self-replenishes. Metal leaching is considered undesirable!

Photocatalytic- titanium dioxide coating in conjunction with UV light creates reactive oxygen species. Rainwater self cleans when used outdoors. Indoors, the presence of dust inhibits product performance.

Physical structured materials (e.g. Sharklet®) - prevent organisms from attaching. The barrier is resistant to soil and microbial deposition, transfer and spread. High touch surfaces: door knobs, elevator buttons, push bars on doors, etc. "Our review suggests that these function primarily by limiting the transfer of microorganism to the surface, secondarily by limiting adhesion to the surface, and tertiarily by creating stress on the cell wall through bending or uneven surfaces"

In terms of extended use of Antimicrobial Surface Protectants (ASPs) [use beyond one day], they, in general, fall into three time periods: 0-30 days, 30-90 days, and greater than 90 days."

Depth of research: "The data we reviewed included manufacturer published or supplied product information and specs, third-party published literature and specific information filed for EPA registration. In some cases, we spoke with CEOs, COOs, chemists, patent holders, sales representatives, and/or technical support personnel". NDAs were signed to protect manufacturer's proprietary information. Both lab data and field data were reviewed as well as both US and Canadian products.

Is direct contact necessary? "Whether chemical or mechanical, the product needs direct contact with the organism in order to work, i.e. <10 um (approximately 1/10th of a human hair)."

Available Options include and are not limited to: Those grouped as Organosilane Quats (Si-Quats), Organometallics, Elemental Metals, Photocatalytic Oxidizing (PCO) Agents, Physically Structured Preventatives, and Other Organosilane-like Agents." SiQuats Cationic Quaternary Ammonium compounds bound to silicone.

Future Considerations (e.g. Material Properties)

- Acoustics (Sound Absorption Coefficients; Transmission Coefficient)*
- R-Value, if on exterior Wall
- Water Vapor Permeability, if on exterior Wall
- ASTM E 84 Flame Spread
- ASTM E 84 Smoke Developed Index
- ASTM E1678 Toxicity Evaluation of Smoke Produced
- Heat Aging Without Load, if > 1 year
- Wear resistance (if on floor, high contact surface, if >1 year...)
- Removability
- Compatibility with other materials
- Self-Cleaning vs Attractive
- Leaching
- Performance in the presence of water?

Tony's Take-Aways:

- Reductions in microbial loading tend to be far less than disinfectants.
- Disinfectant provides 3-6 log10 reduction.
- Self-cleaning surface protectants in general <1 log10 reduction. Self-cleaning products work on building exteriors where rain washes off particulate debris.
- Microban® products had the most performance data.
- Solid products have superior wear characteristics.
- Several products have HVAC component and ductwork as approved use sites. DON'T APPLY TO COILS!!!!
- Presence of dust and debris diminishes product performance.
- Residual antimicrobial efficacy is easier to demonstrate in high-risk areas such as hospitals.
- All reviewed products have efficacy time limits. The product performance of some products declines faster than others. After 90 days 40%-60% performance reduction should be expected.
- Reviewed products provide incremental improvement in reduction of bio-burden and are recommended for use in high risk areas and for clients in Class A buildings who want more. These products reduce other microbial risks such as MRSA.

ROUNDUP

- Pete Consigli -Global Restoration Watchdog

- Appreciative of Tony Havics' willingness to share knowledge and expertise on IAQ Radio broadcasts.
- Special interests of particular products has affected industry progress and impeded compliance in years past.
- The consequences of using or not using various products for specific applications requires more education backed by research.
- The second edition of IICRC S-500-99 had a larger and more diverse consensus body than the first edition published in 1994. The late Mark Hansen, IICRC's legal counsel in the 1990's created a 14 page opinion on FIFRA statues and compliance requirements published as an appendix in the S-500-99 edition.
- The closing paragraph on page 14 under the "Conclusions", pointed out the civil liability for breaking a law is subject to monetary penalty, as FIFRA was federal law. A violation of FIFRA is subject to both monetary and possibly criminal penalty including jail.
- The Hansen report and conclusions were a "wake-up" call for the industry in 1999; perhaps two decades later the industry should revisit the FIFRA issue in the context of developing industry standards and establishing certification criteria?
- It was pointed out during the Round-up in the IAQ Radio chat log by a respected Canadian scientist and contributor to CMH guidance documents (often analogous to EPA documents in the USA), that Canada has similar laws to FIFRA that also may involve jail time for infractions!

Tony Havics' Final Comments:

- Some products were excluded from the review due to poor customer service and inability to provide efficacy of product performance.
- Researchers are looking at the products and ignoring the processes.
- Some researchers are concerned that use of antimicrobial products contributes to creation of superbugs.
- AIHA has published a Cleaning and Disinfecting Guide; Tony will be sharing his research with the rewrite committee.

- Tony has also reviewed Antimicrobial Surface Protectants in use in Canada and the US.
- Tony is currently doing a deep dive into 222 Nanometer UV.
- Link to C&W Services Antimicrobial Surface Protectant report

Z-Man signing off

Trivia Question:

Unlike other types of product labels, what statement must appear on EPA registered pesticide labels?

Answer:

"It is a violation of Federal law to apply this product in a manner inconsistent with its labelling?

Answered by: Pete Consigli