Chapter 6: Equipment for Infection Control

Chapter 6.A. Introduction

Institutional cleaning technology has undergone rapid change over the past few years. New advances in device technology are providing environmentally friendly and safer ways to care for public buildings while protecting the health of the users and other occupants.

These technologies need to be combined with other infection-control strategies, such as personal hygiene strategies (e.g., hand washing for microbes transmitted by contact with surfaces, or cough etiquette for microbes transmitted by an airborne and/or droplet route).

Cleaning industry manufacturers have introduced water-based devices for surface cleaning, sanitizing and disinfecting in the past few years. Although the processes are different, they all use water as the basis for the technology. These innovations are possible because of advances in electrical engineering, software, and solid-state circuitry. Listed below are devices that have been proven effective as cleaners, sanitizers and/or disinfectants.

Antimicrobial pesticides (disinfectants) are required to be registered with the Environmental Protection Agency (EPA) to document the product's kill claims for specific microbes, and the product label must list this registration number. For antimicrobial devices, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires that they be registered with the EPA as a "pesticide device". These registered products have an EPA "establishment" number rather than a "registration" number.

Even though the EPA considers these technologies devices, not chemicals, the product must comply with the same standards for advertising, labeling, and efficacy testing to verify kill claims by an independent third-party organization.

Benefits of Using Disinfecting and Sanitizing Devices

- Reduced exposure to hazardous chemicals for custodians and building occupants
- Reduced cost of purchasing, storing, and disposing of chemicals
- Ease and effectiveness of use

Chapter 6.B. Using Devices to Clean

Introduction

The following products are now widely available and have been evaluated for their disinfecting efficacy. Check with equipment manufacturers and vendors for details.

Equipment and Vendor	Technology	Cleaning, Sanitizing, and Disinfecting Claims and EPA Registration	Independent Research and Third-Party Certification	Comments
Force of Nature	This device uses a capsule containing salt and vinegar. The capsule is then mixed with water inside the device, and electrolyzed. This creates a hypochlorous acid solution.	The capsule used is an EPA registered disinfectant active against the virus causing COVID-19 when used according to the label instructions.	The chemical produced has been Green Seal® certified as meeting their health, safety and performance standards.	The active ingredient produced by their device has not been evaluated by the DfE Safer Choice program.
Kaivac Cleaning Systems™	Multipurpose, no-touch cleaning systems (also known as spray-and-vac or high-flow fluid-extraction units) are designed to work on most surfaces. They can be used with just water, a cleaning chemical or a disinfectant. The system combines automatic chemical metering and injection, an indoor pressure washer, and a	Kaivac's disinfecting products are EPA registered as active against the virus causing COVID-19.	Kaivac's cleaning solution, KaiO ™ has been Green Seal® certified as meeting their health and safety standards as a cleaner.	The active ingredient in **their** disinfectants will not pass the DfE's Safer Choice standards. The system can also be used with an EPA registered product that meets DfE's Safer Choice standards.

Equipment and Vendor	Technology	Cleaning, Sanitizing, and Disinfecting Claims and EPA Registration	Independent Research and Third-Party Certification	Comments
	powerful wet vacuum into an integrated system.			
Liquefied ozone (e.g. Tersano products)	Liquid ozone is created by introducing an extra oxygen atom to an oxygen molecule and water molecules. The instability of the third oxygen atom creates a high-quality cleaning agent in which atoms of oxygen search for something to bond with. As it searches, the oxygen atoms break up dirt bonds and combine with hydrogen and oxygen to create more molecules of water and oxygen while cleaning the surface.	Meets EPA requirements as a disinfection device. Request test data on disinfectant efficacy from the device manufacturer. Aqueous ozone generators are approved by the US Food and Drug Administration (FDA) as sanitizers for food and non-food contact surfaces. Testing is in process for effectiveness against the virus causing COVID–19.	Green Seal® has certified the product as meeting their health, safety and performance standards. USDA/National Organic Program approved.	The contact time to eliminate salmonella and e coli is 30 seconds. There is no residue from the product so rinsing is not required.

Equipment and Vendor	Technology	Cleaning, Sanitizing, and Disinfecting Claims and EPA Registration	Independent Research and Third-Party Certification	Comments
Thermal Accelerated Nano Crystal Sanitation (TANCS®) Steam Vapor System Developed by Advanced Vapor Technologies, LLC Bauer Energy Design, Inc. holds the patent on this technology.	The TANCS Steam Vapor System technology (see Figure 2) works by facilitating the redistribution of charges between the water molecules and dissolved mineral components naturally found in tap water, which results, in part, in the development of nano crystals. This enhanced water is then transformed into super-heated, low-moisture steam. High-temperature, low-moisture steam vapor is applied at low pressure and low volume. It cleans by breaking the bond between the soils and the surface and destroys microorganisms by disrupting their cell membranes.	Meets EPA requirements as a disinfection device with claims to effectively kill a broad range of microorganisms within 3 to 5 seconds, reducing surface-mediated infection risks. Although the TANCS System is not listed on the EPA List N, it is effective against viruses that are more difficult to kill than the virus causing COVID–19 and therefore expected to be effective against the virus causing COVID–19.	Nelson Laboratories, Inc. of Utah certified that a 7-second exposure to TANCS steam vapor produced a 5-to7-log reduction in microbes, which was consistently achieved on all microbes tested. The TANCS System has also been tested by independent researchers and found to be very effective against a variety of microbes.	The System only uses tap water and is designed to get into hard to reach areas. Although it has a dry (6%) moisture content, the manufacturer recommends that to reduce risk for mold after use, all surfaces must be dried and rooms must be ventilated and not closed up. Claims to eliminate biofilms and mold. It has a number of attachments for cleaning various surfaces, such as tile, carpet, and more.

Ultraviolet Light (UV)

Ultraviolet light (UV) has been used for decades to destroy airborne microbes (germs). Short-wave ultraviolet light (UV-C) has been used to destroy bacteria and viruses in hospital wards and operating theaters to control super-bugs. This must be done overnight or when the areas are unoccupied because of the danger to human health.

UV-C can cause cancer, affects the corneas and destroys DNA. It uses short-wavelength ultraviolet light (UV-C) to disrupt the viruses' DNA and inactivate essential acids. Although studies verify that it can destroy SARS and other corona viruses and is likely to be effective against the virus causing COVID-19, *it has not been verified at this time and should not be relied upon for destroying the virus causing COVID-19.*

Due to the lack of uniform performance standards and the highly variable degree of validation testing performed on different devices, consideration of any UV-C should include a review of third-party testing and certifications of device materials and electrical components by organizations such as NSF, UL, CSA, DVGW-OVGW, etc.

The International Ultraviolet Association (IUVA) has a website dedicated to UV and COVID-19. It provides a fact sheet, FAQs, guidance on the selection and operation of equipment for the UV disinfection of air and surfaces. To receive alerts on website postings, send an email to info@iuva.org.

Researchers have identified Far-UVC, a form of UV, as having the same ability to destroy microbes without harming human health. More studies are forthcoming but it is anticipated new technologies will be developed for this technology.

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Chapter 6.C. Using Microfiber Cloths and Mops for Infection Control

Introduction

Microfiber cloths and mops are considered an essential tool in an infection-control program. They are superior at capturing microbes and other organic matter (dirt, food, liquid, etc.) while requiring less cleaning solution and water.

What is Microfiber?

Microfiber is a polyester and nylon (polyamide) fiber that is split many times smaller than a human hair and used to make cleaning cloths and mop heads. The small-size fiber is able to penetrate cracks and crevasses that cotton cloths or paper towels are not able to reach. The increased surface area of the fibers and their star shape enable them to absorb up to 7 to 8 times their weight in liquid. This capillary action is mechanically increased by the scrubbing movements during cleaning. These features also enable the microfiber to pick up grease and oil better than other alternatives.[1]

The fibers have a static electric charge that attracts dust and holds it in a superior manner, rather than spreading it around or releasing it into the air when dry dusting.

The cloths and mops can be washed and reused hundreds of times; however, there is current research underway to determine the efficacy of microfiber after being washed numerous times.

Microfiber comes in different grades for a variety of uses. The term microfiber technically applies to fiber that is 1.0 denier or smaller, but some being sold under the microfiber name has not been split and has a larger denier measurement. The smaller the denier measurement, the finer and more effective the microfiber. Superior microfiber measures 0.13 denier.

When purchasing microfiber, make sure it is from a reputable manufacturer and that the fibers are split and are a smaller denier measurement.

Benefits of Using Microfiber

Infection-control benefits

1. *Ability to capture microbes and minimize microbial growth:* Microfiber is more effective at capturing microbes and dries (sheds water) more quickly than traditional cloths and mops, which helps to prevent the growth of microbes inside the fabric. Several studies have determined that microfiber is better at capturing bacteria than cotton:

   The University of California, Davis Medical Center compared the amount of bacteria picked up by a cotton-loop mop and by a microfiber mop. The cotton-loop mop reduced bacteria on the floors by 30%, whereas the microfiber mop reduced bacteria by 99%.[2]

2. *Prevention of cross-contamination:* This common problem in facilities can be reduced by using microfiber mops and cloths. Changing mop pads after each room avoids the opportunity for cross-contamination. Microfiber cloths and mops are available in different colors so that a color-coding system can be implemented for specific uses. For instance, in bathrooms, pink cloths can be used for toilets and yellow cloths for sinks.

Green cloths can be used for classroom cleaning. See *Chapter 3.H. Preventing Cross-Contamination*.

Cost-saving benefits

1. The University of California Davis Medical Center study[2] found that initiating a microfiber mopping system also resulted in the following cost benefits:
    - 60% lifetime cost savings for mops
    - 95% reduction in chemical and water usage associated with mopping tasks
    - 20% labor savings per day
2. The Sustainable Hospitals Project at the University of Massachusetts Lowell[3] found similar cost savings:
    - a reduction in water and chemical usage
    - microfiber mop pads last 10 times longer than a cotton-loop mop
    - improved worker productivity

Ergonomic benefits of microfiber mop systems

Microfiber mopping systems consists of a handle and mop pads. Microfiber mop pads are easily detachable using Velcro® or snap-on fastening systems.

The University of Massachusetts Lowell study[3] determined that because the microfiber mopping system uses less water and chemicals, it reduced strain associated with handling water and chemicals and eliminated the need to wring the heavy cotton mops, resulting in less potential for worker injury.

1. *Less weight to handle:* Microfiber mops reduce the amount of weight to be handled because
    - The handles are ergonomically designed using light-weight metals.
    - A typical cotton-loop mop may weigh 60 pounds when saturated with water, whereas a microfiber mop weighs just over 2 pounds.
    - The mop solution does not need to be changed between rooms, because the dirty mop pad is not immersed in the clean solution. This reduces the need to lift an approximately 30-pound bucket of solution several times a day.
2. *No wringing heavy mops:* Mop heads are changed after cleaning each room, eliminating the need to wring out a conventional mop. Also, due to their higher water-retention capacity, microfiber mop heads do not need to be wrung out.

Advantages: Due to microfiber's numerous advantages, including its long-lasting profile, ability to remove microbes, ergonomic benefits, superior cleaning capability, and reduction in the amount of chemical and water needed, it is considered to be preferable to conventional cotton cloths or paper towels for cleaning tasks.

Washing Instructions

- *Washing:* Microfiber should be washed only with other microfiber materials because it can pull the lint out of cotton or other materials during the washing and drying process. Use a mild laundry detergent, and never use bleach, fabric softener, or dryer sheets because they can degrade the fabric.
- *Drying:* Microfiber can be line dried or dried using the low setting of an automatic drier.
- *Caution:* Microfiber is flammable, and burning microfiber can emit toxic fumes. Therefore, microfiber should be dried only using low heat. Follow the manufacturer's cleaning and management instructions.

Microfiber for Different Tasks

In general, look for microfiber from a reputable company. There are different weaves and weave densities for specific tasks. Ask the vendor about the grading system and which grade is best for specific cleaning tasks.

Hand tasks: dry and wet cleaning and dusting				

- *Glass:* Glass cleaning cloths have a much tighter weave than a dusting or wet cleaning cloth. Many schools have found that using a wet microfiber glass cloth for cleaning the surface and then a dry glass cloth for polishing is effective. In many cases, water is all that is needed. These cloths are also useful for cleaning and polishing stainless steel.
- *Dusting:* These soft fiber cloths require no polish or other chemical while removing up to 99% of dust, dirt, and other materials.
- *Wet cleaning:* Used for all wet cleaning tasks, these require a reduced amount of chemical for effective cleaning. Start by spraying the cloth with a minimal amount of all-purpose cleaner and add more product as needed or dip into a container of cleaning solution. These cloths can be used by teachers instead of wipes.
- *High-dusting wands:* Wands reach places that are difficult to access and remove the dirt and dust that has accumulated.

Floor tasks: dry and wet mopping, dust mopping, and scrubbing			

- *Wet mopping:* Use wet mops for classrooms, bathrooms, and tiled areas within carpeted spaces. Some microfiber mopping systems have an on-handle solution reservoir for accurate measurement.
- *Dust mopping:* Using microfiber mops can eliminate the need for petrochemical-based dust-mop treatment. Microfiber dust mops with a fringe around the edge are now available. These more closely resemble the conventional loop mops and pick up larger pieces of debris.
- *Floor finishing:* Use microfiber to apply floor finish with a specially designed flat mop that reduces fatigue and that does a better job at applying the product.
- *Scrubbing:* Microfiber floor pads are available for auto scrubbers use less water and chemicals, while cleaning and polishing more effectively.

For More Information

Green Cleaning for Dummies, by Stephen Ashkin and David Holly, is a comprehensive resource on Green Cleaning.

References

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