iCleanse

GOING BEYOND THE SURFACE

The difference between cleaning, sanitation, disinfection & sterilization

Introduction

A range of words used to describe the process of removing dirt, grime, and bacteria from the surfaces of objects are often used interchangeably and incorrectly. However, the differences between cleaning, disinfection, sterilization, and sanitation in germ sensitive environments such as healthcare and food service can be critical.

Each of these terms has a specific definition that outlines what the process does in terms of killing germs and bacteria and how effectively it does so. Just because something is clean does not mean that it is disinfected, and just because something is sanitized does not mean that it is sterilized. In germ sensitive environments such as healthcare, understanding the differentiation between each of these terms could be the difference between life and death.

So, what are the differences between cleaning, disinfecting, sanitizing, and sterilizing?

In general, reviewing the definition of each of these terms should help determine which process best suits your environment's needs:

Cleaning
The process by which foreign material such as dirt and grime are removed from the surface of an object[1]

Sanitation
The process of reducing the number of germs and pathogens to an acceptable level that is not dangerous to one's health[2]

Disinfection
The process of killing or rendering pathogenic microorganisms inert to a level that is not harmful to human health[3]

Sterilization
A process that completely destroys all microbial life, including transmissible agents (i.e. spore forms) from the surface of an object[4]

1 http://www.ific.narod.ru/Manual/Clean.html
2 http://www.ific.narod.ru/Manual/Clean.html
3 http://www.ph.ucla.edu/epi/bioter/anthapha_def_a.html
4 http://www.ph.ucla.edu/epi/bioter/anthapha_def_a.html

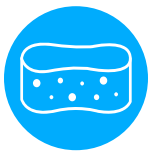
In terms of killing germs, cleaning alone is the least effective of all of the methods outlined above. The purpose of cleaning is to remove physical, visible surface contaminants such as dirt and grime. Some germs are killed in the process of cleaning, but this typically depends on the cleaning agent being used. In some cases, the tools used for cleaning such as sponges and paper towels can transfer germs from surface to surface. For this reason, it is very important to properly disinfect, sterilize, or dispose of cleaning tools and supplies after use.

From an infection control standpoint, cleaning can be appropriate for decontaminating environmental cleaning of surfaces like sinks, floors, drains and counters[5]. For equipment that is handled by patients or anyone else with very high germ sensitivity, cleaning is only appropriate as a first step to remove visible dirt and fingerprints before sanitizing, disinfecting, or sterilizing the device.

5 http://www.ific.narod.ru/Manual/Clean.html

Methods of Cleaning

Cleaning is accomplished through the use of soap or detergent and water. There are two primary methods of cleaning the surfaces of environmental surfaces — manual and mechanical.



Manual Cleaning
Manual cleaning is typically performed in areas where mechanical cleaning methods are not available, or when dealing with equipment that is potentially fragile. It is accomplished by scrubbing the surface of an object with a brush to produce friction to remove dirt, or by rinsing the object with enough water pressure to remove surface buildup.

Mechanical Cleaning
Mechanical cleaning varies based on the desired level of germ control, but the most common types are ultrasonic and washer–decontaminators. Ultrasonic cleaning solutions use waves of acoustic energy in an aqueous solution to break down the bonds holding dirt to the surface. Washer–decontaminators act like a dishwasher and use water circulation, detergents, and sometimes, heat to remove grime from the objects.

6 http://www.cdc.gov/hicpac/Disinfection_Sterilization/5_0cleaning.html

Sanitation

Sanitation is the most ambiguous of the terms, Unlike cleaning, sanitation is most often considered a combination of cleaning and disinfection without a specified disinfection outcome. It is generally defined as a process that will reduce the number of germs on a device to a level that is deemed "acceptable for human health."

The term sanitation is most widely used in the food service industry as a cleaning process with a disinfecting agent to prevent the spread of germs among patrons.

The efficacy of sanitation depends on a combination of the disinfecting agents being used and the exposure time.

Typically, sanitation of some objects is achieved through either thermal or chemical methods. Targeted equipment may each have its own suggested method and the maintenance guide should be referenced to understand what is appropriate for your needs.

Disinfection

Disinfection is similar to sanitation in many aspects, but there are a few key characteristics that differentiate the terms. The selection of disinfection agents is often part of a disinfection strategy that takes into account these data among others.

The ***Spaulding Criteria*** is a classification of medical devices and surfaces in terms of their intended use in patient environments. It considers if an item will be used upon in-tact skin, open wounds, or enter sterile tissue. There are three classifications: **non-critical, semi-critical,** and **critical** – each having their own disinfection recommendations[7].

Environment
The World Health Organization, the NIH, and others, have classifications of the types of pathogens that exist within an environment. Further, hospital information systems provide epidemiologists with reports on what pathogens have caused infection in their environments and thus live in their facility. Insuring the appropriate disinfection agents are used to combat the pathogens is important in reducing all possible infections.

The Risk
The patient, the clinician, and others have different levels of risk based on the status of their immune system, the class of pathogen they can be exposed to, and the effectiveness or prevalence of organism reduction strategies.

The Appropriateness
What is the best process for the item to be disinfected – for instance, you may not wish to put your tablet in an autoclave because of the necessary heat used would destroy it.

Considering all of the factors above, among others, a disinfection strategy can be defined. Disinfection methods themselves are also classified and can be broken down into three main levels, as outlined by the CDC.

7 http://www.cdc.gov/biosafety/publications/bmbl5/bmbl5_appendixb.pdf

Levels of Disinfection

High–Level Disinfection

This method kills vegetative microorganisms and inactivates viruses, with the exception of Bacterial spores. These types of disinfectants are capable of sterilization when the contact time 6 to 10 hours. As high–level disinfectants, they are used for relatively short periods of time around 10 to 30 minutes. These are potent sporicides and are classified by the FDA as sterilant/disinfectants. They are made to be used on medical devices, but not on environmental surfaces such as laboratory benches or floors[7].

Intermediate–Level Disinfection

In this level, vegetative microorganisms, including Mycobacterium Tuberculosis and all fungi are killed while most viruses are inactivated. Chemical germicides used in this procedure often correspond to The Environmental Protection Agency (EPA) gives approval to the chemical germicides used in this procedure. They can often be found in laboratories to disinfect laboratory benches and as part of detergent germicides used for housekeeping purposes[7].

Low–Level Disinfection

The low level eliminates most vegetative bacteria except M. tuberculosis, some fungi, and inactivates some viruses. The EPA approves chemical germicides used in this procedure in the U.S. as “hospital disinfectants” or “sanitizers7.” The CDC defines hospital disinfectants as a “germicide that is registered by EPA for use on inanimate objects in hospitals, clinics, dental offices, or any other medical–related facility. Efficacy is demonstrated against Salmonella choleraesuis, Staphylococcus aureus, and Pseudomonas aeruginosa[8].

8 http://www.cdc.gov/OralHealth/infectioncontrol/glossary.htm#D

Methods of Disinfection

Disinfection can be performed using a variation of three main methods: thermal, ultraviolet, and chemical disinfection. Each of these methods are explained below:

Thermal Disinfection

The process of thermal disinfection is performed by heating water to a high enough temperature to destroy bacteria. For high-level disinfection, water is boiled (minimum temperature 212°F) for at least five minutes from the time the water boils. Items that may be damaged by boiling can be disinfected at a temperature of 176°F for at least five minutes, but these items will only achieve a low to intermediate level of disinfection depending on how the process is carried out. Disinfection at lower temperatures (i.e. using specially constructed washing machines) is possible, but typically can only achieve low-level disinfection[9].

Chemical Disinfection

Chemical disinfection is generally used on equipment that is sensitive to heat. Many of the chemicals that are used for disinfection are also toxic to humans, so concentrations and control of these chemicals must be carefully monitored. Chemicals available for disinfection include alcohols, chlorine and chlorine compounds, formaldehyde, glutaraldehyde, ortho-phthalaldehyde, hydrogen peroxide, iodophors, peracetic acid, phenolics, and quaternary ammonium compounds[10].

9 http://www.ific.narod.ru/Manual/Clean.htm
10 http://www.cdc.gov/hicpac/disinfection_sterilization/6_0disinfection.html

The effectiveness and safety requirements for each of these chemicals vary based on the concentration (most require some dilution in water) and the temperature at which they are being applied (heat will generally speed up the reaction time). Regardless of which of these chemicals you are using, for true disinfection the chemical must be applied for the amount of time specified in the instructions for use (usually at least 10 minutes). Under-exposure will result in a lower level of disinfection, and could leave dangerous pathogens on your equipment.

Ultraviolet Light

An alternative to chemical and thermal disinfection, UV disinfection uses short- range wavelengths to deactivate the DNA of bacteria, viruses, and other pathogens. This UV-C light is classified as "germicidal light," and damages the nucleic acid of the microorganisms to the point that it renders an organism unable to reproduce[11].

11 http://www.ultraviolet.com/whatis.htm

Sterilization

Sterilization delivers the most absolute result out of all the terms discussed here. Unlike disinfection, there is no differentiation among levels of sterilization; once an object is sterilized, all bacteria have been eliminated. The process of sterilization kills 100% of microorganisms on an object, including all bacterial spores, but can only be proven through culturing. From an infection control standpoint, sterilization is acceptable for high-risk equipment, which includes items that penetrate sterile tissues such as surgical instruments[12].

Methods of Sterilization

Sterilization can be accomplished through **one of five methods; steam, dry heat, chemicals, filtering,** and **ultraviolet light.** The specifics of these approaches are detailed below:

Steam Sterilization

The process of pressurized steam sterilization is the most common method employed since it is reliable and non-toxic. To achieve sterilization, the steam must be applied under pressure at an adequate temperature for a specific period of time. For unwrapped items, 30 minutes at a temperature of 250 degrees Fahrenheit will achieve sterilization, whereas unwrapped items only require four minutes of exposure at a minimum temperature of 273 degrees Fahrenheit[13].

12 http://www.ific.narod.ru/Manual/Clean.htm
13 http://www.cdc.gov/hicpac/Disinfection_Sterilization/13_0Sterilization.html#a1

Dry Heat Sterilization

Dry heat sterilization is the preferred method of sterilization for objects that are not sensitive to heat, but may be damaged in some way by pressurized steam, such as glassware, powders, and oils. These items are heated in an oven for a minimum time of 30 minutes at 356 degrees Fahrenheit (alternative options are 60 minutes at 338 degrees and 180 minutes at 320 degrees). To ensure effectiveness, it is a good idea to have a forced air system equipped to guarantee an even distribution of heat[14].

Chemical Sterilization

Chemical sterilization can be achieved using specific chemicals in a liquid or gaseous form. Both ethylene oxide and steam formaldehyde are effective modes of sterilization in gas form. These methods can also be performed at lower temperatures, but due to the toxicity of the gases proper adherence to safety precautions is required. This process can take anywhere between 2–5 hours depending on the concentration and temperature of the gases being used, and all objects should be left to aerate following exposure to these chemicals[15].

In liquid form, peracetic acid and hydrogen peroxide are able to perform sterilization. Prior to performing a liquid based chemical sterilization, it is important to pre-clean any equipment to ensure efficiency. When using these methods, objects must be immersed in liquid for some period of 'soaking' time, so be sure to check for any leaks that may cause damage. to the items you are processing[16].

14 http://apps.who.int/phint/en/p/docf/
15 http://www.ific.narod.ru/Manual/Clean.htm
16 http://nsdl.niscair.res.in/bitstream/123456789/704/1/ revised+sterilization+methods+and+Principles.pdf

Filtration Sterilization

Filtration is only used for the sterilization of liquids and gases and works by removing the microorganisms from an object rather than destroying them. The process is achieved through the use of sterilization grade filters. This method is the most effective for treating solutions that are heat-sensitive and venting systems for medical equipment[17].

Ultraviolet Light

Ultraviolet light, in combination with a cleaning protocol where appropriate, can be used to safely sterilize food, water, and medical equipment by disrupting the DNA of pathogenic microorganisms, rendering them inert. Traditionally mercury lamps are used to achieve the necessary power generation, but current initiatives have seen LED lights emitting light at the desired wavelength[18].

The only way to truly understand the effectiveness of sterilization is through a biological indicator (BI)[19] microorganisms. There are different variations of this monitoring method. It is noted as the most reliable way to verify sterilization.

17 http://nsdl.niscair.res.in/bitstream/123456789/704/1/revised+sterilization+methods+and+Principles.pdf
18 http://www.sciencedaily.com/releases/2011/04/110426160133.htm
19 http://www.cdc.gov/oralhealth/infectioncontrol/faq/sterilization_monitoring.htm

Takeaway

Properly decontaminating objects through the process of cleaning, sanitizing, disinfecting, or sterilizing is important in many germ-sensitive industries; specifically healthcare and food service. The easiest way to understand these terms is to remember the order of effectiveness:

Cleaning
Least effective; simply removes dirt and grime

Sanitation
Reduces the number of germs to an acceptable level that is not harmful to human health; this is generally seen in households

Disinfection
Renders pathogenic microorganisms inert to a level that is not dangerous to human health

Sterilization
An absolute process where 100% of bacteria and spores are killed

Regardless of which method you choose to utilize in your work environment, it is important to do the following:

- Adhere to all cleaning/ decontamination instructions that come with your equipment and decontamination products.

- Pre-clean equipment prior to using a method of sanitation, disinfection, and sterilization to ensure effectiveness.

- Review and develop policies to properly decontaminate objects appropriately according to risk, use pattern, and ensure the disposal of cleaning tools that are used during any of these processes.

- Provide proper training for all employees to ensure their safety when using thermal and chemical methods.

- The ability to differentiate between each of these terms and understand what method is appropriate for your needs is critical to ensuring the safety of staff, patients, and guests.

Schedule your free consultation

See what iCleanse can do for you!

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