Lesson No. 78  
October 2004
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Learning Objectives:
1. List the ideal properties of effective cleaning agents.
2. Review the use of water in cleaning instruments and equipment.
3. Discuss detergents as effective cleaning agents.
4. Discuss the use of enzymes as cleaning agents.
5. Describe the use of enzymatic detergents as effective cleaning agents.
6. Discuss procedures for manually cleaning instruments.
7. Review basic equipment used for mechanical cleaning.
8. Review the basics of instrument lubrication.
9. Review procedures to verify the cleaning process.

Central Service technicians are not scientists. They must, however, know a great deal about the “science” of cleaning agents used to prepare surgical instruments and other materials for disinfection and sterilization. They must also have a significant amount of knowledge about and skills in procedures required for cleaning and decontamination. These important tasks may require either manual procedures and mechanical equipment, or both. Central Service personnel must know and consistently use the correct protocols regardless of whether these first steps in processing are done by hand or by machine. This Self-Study Lesson will explore the cleaning agents and methods used in cleaning and decontamination.

Objective 1:
List the ideal properties of effective cleaning agents.

Effective cleaning agents share several things in common. These cleaners:
• are non-abrasive
• are low-foaming
• can be free-rinsing (can be rinsed away without leaving a residue)
• are biodegradable
• allow for rapid soil dispersion
• are non-toxic
• are effective on all types of soil
• have long shelf-life
• are cost-effective
• can be monitored for effective concentration and use life

Objective 2:
Review the use of water in cleaning instruments and equipment.

Water quality relates to several characteristics, including pH level, hardness, alkalinity, temperature, and purity (microbial contamination). The pH level of water influences the effectiveness of enzyme and detergent cleaners. Hard water containing calcium and magnesium, for example, can cause deposits or scale formation during cleaning because of the minerals’ lower solubility at higher temperatures. The use of specific agents to minimize the formulation of insoluble deposits by “softening” the water helps prevent instrument spotting and equipment scaling.

One method to minimize the formation of insoluble scale is to use softened water to wash and to install steam line filters on washer-decontaminator equipment. The use of steam filters prevents steam contaminants from being carried into the washer-decontaminator and being deposited on instruments and equipment. A final rinse with distilled or deionized water will remove mineral deposits.

Objective 3:
Discuss detergents as effective cleaning agents.

Soap compounds are traditionally made from animal fats combined with a mineral alkali—such as sodium or potassium hydroxide—and should never be used for cleaning instruments. Unlike soap, detergents can dislodge, remove, and disperse solid and liquid soils from a surface being cleaned. There are also detergents that are formulated for specialized applications, such as use in ultrasonic cleaners or for hard water.

It is essential that the detergents are compatible with the cleaning equipment in which they are used. For example, a foaming detergent might hinder the operation of a washer-disinfector that uses high-pressure jets. Detergents should also be compatible with the materials from which both the medical device and the cleaning equipment are constructed.

The pH level of a detergent measures its acidity or alkalinity. A detergent with a low pH is acidic; one with a high pH is alkaline. For most cleaning applications, neutral pH or mildly alkaline detergents are preferred.
Objective 4: Discuss the use of enzymes as cleaning agents.

Enzyme products are commonly used to process difficult-to-clean devices including instruments with lumens. Enzymes work by breaking down (“digesting”) large organic molecules to help with their removal. They are very specific in their action. For example, the protein enzyme will recognize only proteins in their natural state, not those that have been chemically altered.

Popularly-used enzymes include:
- Protease enzymes which break down blood, mucous, feces, and albumin
- Lipases which break down fatty deposits such as bone marrow and adipose tissue
- Amylase which catalyzes starch

Dried soil on a device can gradually degrade enzymes during use and decrease their efficiency. This soil must be re-hydrated before an enzyme can be effective. Re-hydration is time-dependent and will limit the enzyme’s soil contact time. Pre-cleaning can help reduce these problems. After pre-cleaning, the instrument should be kept moist to help optimize the enzyme’s efficiency.

Objective 5: Describe the use of enzymatic detergents as effective cleaning agents.

Enzymatic detergents usually consist of a detergent base with a neutral pH to which one or more enzymes and a surfactant is added.

Note: A surfactant is a surface-acting agent that lowers the surface tension of the liquid so the liquid can penetrate deeper and prevent debris from being re-deposited. After the organic material is broken down, the detergent removes the dissolved particles from the instrument’s surface. Enzymatic detergents are biodegradable and can be used in place of high alkaline or acidic products that may harm instruments. The manufacturer’s recommendations concerning the proper amount and correct temperature of the water must always be followed.

Note: Temperatures above 40°C (104°F) can affect the chemical reaction. Temperatures that are too cool may not activate the enzyme. Therefore, it is important to monitor water temperature.

When selecting an enzymatic detergent, it is important to know:
- Water temperature in the decontamination area
- Room temperature in the decontamination area
- Lifetime and stability of the product to be cleaned
- The product’s expiration date

Objective 6: Discuss procedures for manually cleaning instruments.

The purpose of manual cleaning is to physically remove deposits that were not completely removed, or were only softened during the presoak. Cleaning is done by use of friction. If detergents are used, they will only bind the soil that is to be removed. Manual cleaning may be done:
- Before mechanical cleaning
- When the decontamination area does not have an ultrasonic cleaner or washer-sterilizer/washer-decontaminator
- For delicate or complex instruments that cannot be processed in mechanical equipment
- To clean powered equipment that cannot be immersed
- For instruments with lumens

Water temperature is important to effective cleaning. Below 43°C (109°F), water may not activate the detergent, and water hotter than 60°C (140°F) may coagulate (denature) the protein. Water hardness, temperature, and the type of soil to be removed can change the detergent’s effectiveness.

Be sure to use the amount of detergent specified by the manufacturer. Excessive amounts of detergent can be difficult to rinse off, and will eventually begin to deteriorate the instruments.

When cleaning aluminum or stainless steel, use a “to-and-fro” motion in the direction of the metal’s grain to avoid scratching the surface of the device. All instruments should be cleaned in a wide-open position to allow cleaning of the box-lock or hinged areas. When brushing instruments, hold them under the water’s surface to prevent aerosol contamination.

A three-sink arrangement used for manual cleaning should consist of:
- A wash sink with water and a detergent solution
- A second (intermediate) rinse sink which should contain plain or softened (deionized) water
- A third sink for the final rinse; this sink should contain distilled deionized water to help prevent instrument spotting

Items not sterilized within four hours after washing should be re-rinsed in distilled deionized water to remove pyrogens.

Brushes are a very important part of proper cleaning. It is essential that the correct-sized brush is used. Consider, for example, the need to clean a lumen. If the brush is too large, it will not fit into the lumen. If it is too small, it will not have complete contact with the lumen’s walls and will not thoroughly clean them. When reusable brushes are used to decontaminate, they must be cleaned and disinfected/sterilized at the end of the shift or when they are heavily soiled. Brushes that show wear, and disposable brushes, should be discarded.

Prompt cleaning of brushes and cleaning tools eliminates, or reduces biofilm-forming microorganisms, preventing the formation of biofilm. Biofilm is a structure made of polysaccharides formed by bacteria clinging to a surface. Once found, direct friction or oxidizing chemicals are required to remove them.

Objective 7: Review basic equipment used for mechanical cleaning.

Equipment with an automated cleaning/rinsing process can be used to remove soil and microorganisms. Ultrasonic cleaners are designed to remove soil from joints, crevices, lumens, or other areas that cannot be cleaned effectively by other methods. They should not be used for disinfection or sterilization. Some principles for their use include:
- Remove soil from items before placing them in the cleaner.
- Water and cleaning solutions should be changed before they become heavily soiled.
- Ultrasonic cleaning, rinse devices thoroughly to remove dislodged soils.
Follow the manufacturers’ instructions for using the ultrasonic cleaning equipment and the medical devices being cleaned. This will prevent damage to both the medical device and the cleaning equipment.

Automated equipment can also be used for thermal (hot water) disinfection. The level of disinfection achieved depends upon the water temperature and contact time. Types of automated thermal disinfection equipment include:

- Washer-sanitizers of varying sizes and load capacities, which provide wash/rinse cycles and a hot water bath for soiled items.
- Washer-pasteurizers, which are used to clean reusable anesthesia and respiratory tubing, masks, bags, and similar items. These systems typically use separate units for cleaning and disinfection.

Note: Some washer-pasteurizers provide a final bath in a cold chemical disinfectant solution to achieve high-level disinfection. Items must be rinsed thoroughly to remove potentially-toxic residues of the disinfectant.

- Automatic Endoscope Reprocessors (AERs) are used to clean, disinfect, and rinse flexible endoscopes.
- Washer-disinfectors or washer-decontaminators can be used to clean, decontaminate, or low-, intermediate-, or high-level disinfect and dry medical devices. Washer-disinfectors clean with a spray-force action called impingement. This process uses several successive steps including cold water pre-rinse, detergent wash and rinse, and a final steam-heat cycle.
- Washer-sterilizers clean with a high-shearing and physical agitation and are used with a high-velocity steam or fluid spray in a detergent solution. Following a rinse step, devices are processed with a steam cycle.

It is always important to follow the manufacturer’s instructions for the use of all mechanical cleaning equipment.

**Objective 8:**

**Review the basics of instrument lubrication.**

Lubricants are an important aspect of the instrument maintenance program. These lubricants help maintain the integrity of instruments and keep them in good working order. Instrument lubrication also prolongs the life and action of stainless steel and tungsten carbide scissors, prevents abrasion on blades moving against each other, and increases their cutting action.

Lubrication is done after instruments are cleaned. The instruments are dipped in a lubrication solution which resembles milk. It is important to use the lubricant according to the manufacturer’s recommendations to assure the proper soak time and dilution. Automatic tunnel washers have a pre-programmed lubrication cycle to facilitate routine lubrication.

**Objective 9:**

**Review procedures to verify the cleaning process.**

The most common method to verify the cleaning process is a meticulous visual inspection after the process is complete. This can be difficult in complex devices. Device manufacturers must provide instructions for inspection and verification; refer to these instructions for help with this process.

With increased awareness of the importance of cleaning, manufacturers are beginning to market commercial monitoring products that will help verify cleaning effectiveness. The use of these types of monitors may become the standard in the future.

**Endnotes**


2. This information is from: Association for the Advancement of Medical Instrumentation. American National Standard. Safe Handling and Biological Decontamination of Reusable Medical Devices in Healthcare Facilities and in Non-Clinical Settings. ANSI/AAMI FTP3:2003.
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CIRCLE THE CORRECT ANSWER

Objective 1
1. Effective cleaning agents are typically:
   a. high-foaming.
   b. non-biodegradable.
   c. toxic.
   d. cost effective.

Objective 2
2. Hard water causes:
   a. deposits.
   b. scale formation.
   c. higher solubility at higher temperatures.
   d. a and b above

3. Hard water ______ instrument spotting and equipment scaling.
   a. helps to prevent
   b. causes

Objective 3
5. Soap compounds made from animal fats ______ be used for cleaning instruments.
   a. should
   b. should never

6. Detergents that are used should be compatible with:
   a. cleaning equipment.
   b. devices to be cleaned.
   c. the quality of water in which they will be used.
   d. all the above

7. Detergents with a ______ pH level are typically preferred.
   a. high
   b. low
   c. neutral
   d. mildly acidic

Objective 4
9. Which of the following statements is true?
   a. Protease enzymes break down fatty deposits.
   b. Amylase catalyzes starch.
   c. Lipases break down dried soil.
   d. Enzymes work best on dried soil.

10. Pre-cleaning is used for what purpose?
    a. to reduce the need for device lubrication.
    b. to re-hydrate devices so that enzymes are effective.
    c. to reduce the need for instruments to remain moist.
    d. all the above

Objective 5
11. Enzymatic detergents consist of:
    a. a detergent base.
    b. one or more enzymes.
    c. a surfactant.
    d. all the above
    e. a and c above

12. Which of the following statements is true?
    a. Enzymatic detergents are biodegradable.
    b. Enzymatic detergents cannot replace high alkaline products.
    c. Enzymatic detergents cannot replace acidic products.
    d. Water temperature has no impact upon the chemical reaction of enzymatic detergents.

13. Enzymatic detergents:
    a. kill microorganisms.
    b. remove dissolved particles from the instrument’s surface.
    c. are effective at any water temperature.
    d. are effective at any room temperature.

Objective 6
14. The final rinse sink should contain:
    a. plain water.
    b. softened water.
    c. distilled water.
    d. any of the above

15. Which of the following statements about manual cleaning is correct?
    a. It should be done after mechanical cleaning.
    b. It should be done at temperatures cooler than 60°C (140°F).
    c. Instruments should be cleaned in a closed position.
    d. Instruments should be brushed above the water surface.

Objective 7
16. Ultrasonic cleaners can be used for:
    a. disinfection.
    b. to remove soil from areas that cannot be cleaned effectively by other methods.
    c. for sterilization.
    d. to eliminate the need to rinse items after cleaning.

17. Which of the following is used to clean re-usable anesthesia and respiratory tubing, masks, and bags?
    a. washer-sanitizers
    b. washer-disinfectors
    c. washer-pasteurizers
    d. washer-decontaminators

18. Which of the following cleans with impingement?
    a. washer-disinfectors
    b. washer-decontaminators
    c. washer-pasteurizers
    d. ultrasonic cleaners

Objective 8
19. Lubrication is done ______ instruments are cleaned.
    a. before
    b. after

Objective 9
20. Which of the following is most commonly used to verify the cleaning process?
    a. statistical standards
    b. commercial monitoring products
    c. meticulous visual inspection
    d. cleaning verification equipment

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