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LEARNING OBJECTIVES

1. *Articulate the reasons for minimum dry times within device instructions for use*
2. *List three applications for moisture-absorbent devices*
3. *Identify key considerations when selecting and using moisture-absorbent devices*

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Moisture Absorption Devices …

No This Is Not a Wet Pack Article

by Delores O'Connell

Drying steam-sterilized items is more complex than it first appears. Effective drying happens by following the instructions for use (IFU) created for the devices used during the process. This requires sterile processing professionals to balance and reconcile several instructions including that of the devices, wraps, pouches, container systems, sterilization accessories, and the sterilizer. Despite full reconciliation of all instructions, residual moisture may remain in and on some packages creating a wet pack situation. But this is not a study guide on wet packs. This is a study guide on optimizing drying with moisture-absorption devices.

Minimum dry times

Residual moisture can be created through a variety of system faults and failures. However, a perfect system could still have moisture events. When moisture events happen, the first place to look is the dry time.

Steam sterilizers dry items by drawing a vacuum at the end of the sterilization phase. During this time, the sterilizer's vacuum draws out the water vapor and steam from the packs. The combination of the vacuum and hot items in the load evaporates the condensate within the items drying them.

The instructions for use of the device lists the minimum dry time needed to thoroughly dry the items. This dry time is validated by the original equipment manufacturer (OEM) of the device as a single device within a specified packaging material. If the device is part of a set supplied by the manufacturer, such as an orthopedic set, the dry time for the full set including the tray and any containers is validated. The sterilization load configuration that the OEM validates is different from that of a healthcare facility.

Photo courtesy: STERIS

Facilities can use a variety of packaging options. They can process the device as a single device, include the device tray having many devices, or place it within a multi-layer set. The load configuration may vary from a small chamber sterilizer with a couple of packs, to a large floor-loading sterilizer that might allow 25 sets up to 25-pounds each having a total load weight of 625 pounds. The combination of packs from sterilization pouches to containerized items can vary from sterilizer cycle to sterilizer cycle. The OEM provides a minimum dry time with the expectation that the facility will verify that the minimum dry time is acceptable for their process and, if necessary, lengthen the dry time to achieve dryness.

Before lengthening the dry time, it is important to ensure all items are compatible with a longer dry time, the sterilizer can support longer dry times, and the impact that running cycles with longer dry times can have on productivity and utility usage.

Managing condensate to promote drying

Lengthening dry times may not be possible for many facilities. The extended drying needed may damage the devices or packages and create delays in processing that impact the operating room schedule. A better solution is to manage the condensate produced to improve drying.

Three things improve drying. The first is heat. Applying heat to condensate can increase the evaporation rate, allowing things to dry faster. This is done during the drying phase as the devices are kept hot during drying.

The second is by removing the water vapor from the immediate area of the condensate. As water evaporates, its crowds the air space around it. Too much water vapor and there isn't enough room for the evaporating water. The evaporating water stays trapped in the condensate. The sterilizer's drying phase actively removes water vapor with its vacuum. This active removal continues as items are cooling in a lower-humidity environment. The hot moist air within the items rises out, replaced with cooler drier air.

The third thing that improves drying is increasing the surface area of the condensate. As water evaporates, water molecules must exit the condensate droplets. The surface area of the droplet is like a doorway. The smaller the surface area the smaller the doorway. Few water molecules can leave at one time, waiting their turn at the door. Increasing the surface area makes the doorway bigger, allowing more water molecules to exit at one time and speeding up drying.(See Figure 1.)

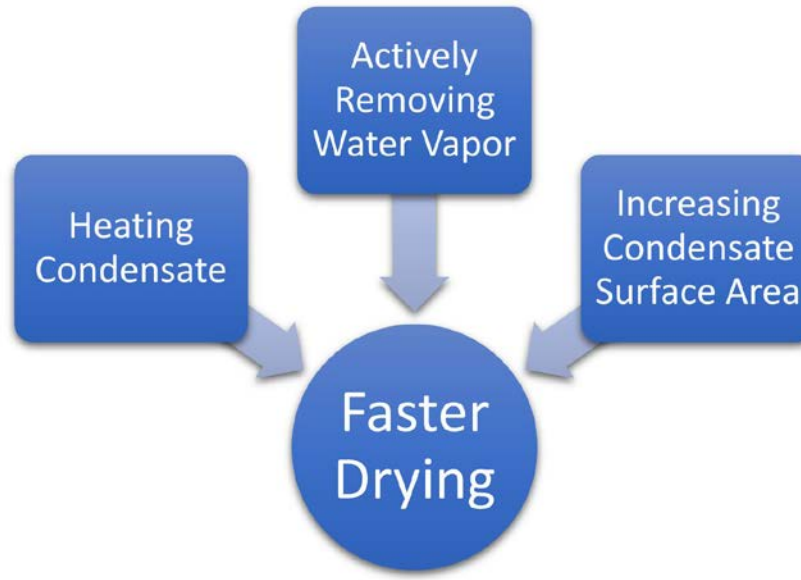

Figure 1 - Drying can be improved by applying one of three elements.

Heating condensate and changing how water vapor is actively removed within the sterilizer's dry time is not easily accessible to healthcare facilities. However, managing moisture by increasing the surface area of the condensate is easy for healthcare facilities. All that's needed is a moisture-absorbing device designed for this task.

How does moisture absorption improve drying?

Moisture-absorptive devices work on two principles. The first principle is that water evaporates faster with greater surface area. The second principle is two things combined, absorption and wicking. Absorption is the ability of a material to take up liquids into itself. In this case, the liquid is water. Absorptive devices are designed with materials that attract and soak up water. As the water is absorbed, the material moves the water along the fiber network within it. That movement is called wicking. Absorptive materials absorb and then spread the water over the many fibers within it, spreading out the water and increasing the overall surface area of water exposed to the air. This significantly increases the rate of evaporation.

Typically, natural materials like cellulose or cotton are used to construct moisture-absorbent devices. Natural fibers have an affinity for water and good wicking properties. Synthetic materials naturally repel water. When synthetic materials are used as an absorptive material, they are specially treated to increase the material's absorption and wicking capabilities.

When should moisture-absorbent devices be used?

There are three situations where moisture-absorbent devices work well. The first involves complex multi-component devices; instruments designed with a significant amount of weight at concentrated areas; and devices with deep concave areas or broad angles. These devices can create condensate pools directly beneath or within the concave surfaces. Properly placed moisture-absorbent devices can spread the localized condensate over a larger surface area, speeding up the drying process.

The second use for moisture-absorbent devices comes with trays and devices made of polymers and silicone that do not transfer heat well, impeding evaporation of pooled condensate. The increased surface created during absorption can compensate for the poor heating characteristic of these materials.

Unreliable steam quality is the third use for moisture-absorbent devices. Steam obtained from a third party or inefficient steam-generation systems may, at times, create steam with a higher moisture content

Self-Study Test Answers: 1.C, 2.C, 3.A, 4.D, 5.A, 6.D, 7.D, 8.D, 9.C, 10.B

than acceptable. Typically called wet steam, the steam overproduces condensate in both the items undergoing sterilization and the sterilizer chamber. The resulting internal and external moisture is best managed with moisture-absorbent devices both in the items undergoing sterilization and on the sterilizer racks holding the items.

There are situations in which moisture-absorbent devices will not help drying. When the pooling condensate is caused by improper assembly, moisture-absorption devices cannot compensate. A common assembly error is packaging heavy metal instruments within a small tray, creating a situation in which the high volume of condensate produced doesn't drain fast enough through the bottom of the small tray, creating a pool of condensate that is difficult to dry. Adding a moisture-absorbent device may help dry the tray, but the small tray in combination with the moisture device and heavy metal instruments could impede steam, preventing sterilization.

Choice and use of moisture-absorption devices

Moisture-absorptive devices are typically sheets of material that are placed directly on a sterilizer rack or in packages to be steam-sterilized. They often have direct contact with the medical instrumentation. As such, it is important that they are intended for this use. Moisture-absorptive devices should be composed of a non-linting or low-linting material and be non-toxic. Dyes and pigments should be color-fast, meaning that they will not transfer to the instruments that they touch. They should also be compatible with, and validated for, the specific steam-sterilization cycles that they will be used in.

Most commercially available moisture-absorbent devices are single-use disposable items. Reusable devices will change with reuse, reducing the absorption and wicking properties each time. When using reusable moisture-absorbent devices, ensure that procedures are in place for inspection and criteria for disposal listed.

Moisture-absorptive devices come as sheets. Some are placed on sterilizer racks while others are included within the packaging and are often referred to as tray liners. Tray liners can have different absorbencies and be recommended for different situations. For example, a multi-layer orthopedic set will create a substantial amount of condensation secondary to size, configuration, and weight. In this instance, a high-absorbency or wicking material would be used. A small microsurgical set would create less condensate and require a light absorbency product.

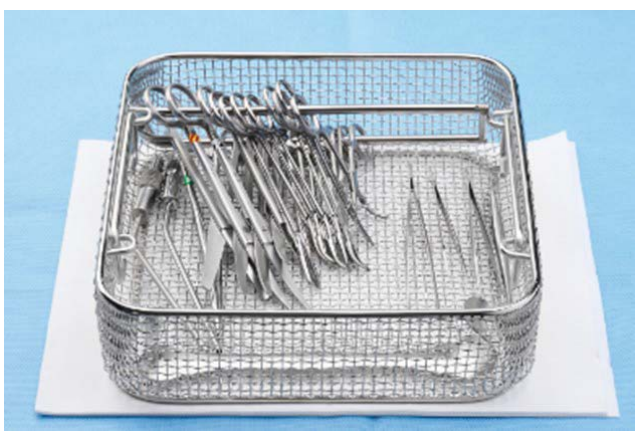

Figure 2 - Some tray liners placed between the tray and wrap may offer corner protection.

Tray liner placement varies with the items being sterilized and the packaging configuration used. Typical placement is on the floor of the tray or basket directly beneath the instrument. Tray liners should lay flat on the bottom but may curve up the side walls of the tray or basket. Tray liners should not be used to wrap instrumentation or be placed on top of instrumentation. (See Figure 2.)

Silicone mats should not be used as these can prevent condensate from reaching the absorptive material. When a silicone mat is used, the tray liner should be placed between the tray and the sterilization wrap or beneath the basket on the floor of the container base. Always confirm placement of the tray liner with the tray liner's and packaging material's instructions for use. Some container systems may contraindicate the use of tray liners or specify where tray liners should be placed.

Some tray liners may double as a corner protection device for wrapped sets. These may be used in place of synthetic corner protectors. Always follow the manufacturer's instructions for selection and proper use of these products.

Product evaluation

Adding tray and rack liners to the sterilization process should help drying of the load. They can also inadvertently create challenges to the sterilization process. It's important to include an evaluation of the moisture-absorbent products before adoption. Items to consider include:

- Validated and listed sterilization cycles.
- Compatibility with the sterilization wrap and rigid container systems at the facility.
- Trial results at the facility. Were items dry? Was staining or discoloration experienced?
- Availability on purchasing contracts.
- Does it solve the condensate problem?

Through careful review and adoption, moisture-absorptive devices can provide the drying solution needed for the heavy condensate conditions experienced by many sterile processing departments. HPN

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CONTINUING EDUCATION TEST • JULY 2023

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Circle the one correct answer:

1. **Why do instrument manufacturer's give minimum dry times?**
   A. Sterile processing departments only process single instruments
   B. Sterilization pouches cause problems with drying
   C. The manufacturer does not use the same load configuration
   D. Instruments do not need to be dry

2. **Which is a concern of increasing the dry time?**
   A. It stays hot longer and requires additional cool down time
   B. Dry time can be as long or short as the department determines is appropriate
   C. Wrappers, containers and sterilizers may not be compatible
   D. The instructions for use lists minimum dry times

3. **Which is used to speed up drying of steam-sterilized items?**
   A. Increasing the condensate's surface area
   B. Shortening the dry time
   C. Warm the load prior to sterilization
   D. A hair dryer

4. **Which properties are necessary in a good moisture-absorptive device?**
   A. Rapid heating and sponginess
   B. Temperature and thickness
   C. Unification and uptake
   D. Absorption and wicking

5. **This is the movement of water across a fiber matrix?**
   A. Wicking
   B. Absorption
   C. Travocity
   D. Vector Force

6. **When should a moisture-absorbent device be used?**
   A. When placing many heavy metal mass instruments in a small container
   B. When wrapping a towel pack
   C. To reduce the dry time in the sterilizer
   D. For unreliable or borderline steam quality

7. **What is meant by "color fast?"**
   A. Dyes and pigments can rinse out of the fabric
   B. Dyes and pigments stain soft materials
   C. Dyes and pigments are non-toxic
   D. Dyes and pigments will not transfer to other items

8. **When should a moisture-absorptive towel be used in a tray?**
   A. When a tray liner is not available
   B. When instruments need to be secured
   C. When a heavy metal instrument could break through the wrap
   D. When instructions for use are provided by the manufacturer

9. **Which statement is false about tray liners?**
   A. They come in different absorption volumes
   B. They go between the instruments and the tray bottom
   C. They can be used to wrap instruments
   D. Some can provide absorption and corner protection

10. **Moisture-absorbent devices do not need to be trialed because they are simple devices.**
    A. True
    B. False

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