



apparent that infection prevention within the scope of the laundry process needs is vital.

The role of healthcare textiles in patient care is an important one. With the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey results playing a pivotal role in receiving value-based incentive payments through the Inpatient Prospective Payment System (IPPS) by Centers for Medicare and Medicaid Services (CMS), patient perception of care is key.<sup>4</sup> One of the most tangible aspects of a patient stay is their linens; from bed sheets to hospital gowns and everything in between, patients are in constant contact with various textiles. Because of the opportunity for linens to contribute to HAIs, following proper disinfection protocols the laundry is imperative. However, not only does the linen need to be safe and infection free, it must fulfill the role of comfort. Rough, stained, torn, or otherwise distasteful textiles will lower a patient's perception of quality. Because of this, the process that disinfects the textiles must also not degrade them in anyway. This can become a tough balance to negotiate.

### **The Laundry Process**

The five main components of the laundry process – water quality, chemical, mechanical, time and temperature – work together in different combinations to render a textile clean and disinfected for patient use. Any change to one of these components requires adjustments in the others. In the past, the two components of chemical and temperature were simply chlorine bleach and hot water.

While chlorine bleach is relatively inexpensive, hot water is not, and both will cost more in the long run due to shortened linen life.<sup>5</sup> Chlorine bleach must be carefully controlled within the wash process due to the risk of loss of textile strength, discoloring of colored linens, and damage to specialized finishes such as flame retardants. Another issue with chlorine bleach is staining, such as its interaction with chlorhexidine gluconate (CHG). CHG is an antibacterial antiseptic agent

with multiple uses within healthcare facilities. Because of this, it is frequently present on healthcare textiles, although invisible unless laundered with chlorine bleach. It then becomes a permanent brown or red stain, and while the textile may be free of debris and disinfected, it will be considered ruined because of its appearance. It becomes apparent, then, that chlorine bleach is not appropriate for all applications within healthcare laundry.

It's important to note that claims of disinfection can only be made when following the guidelines of the Environmental Protection Agency (EPA). Angela Becker of Ecolab explains:

"Thermal and chemical disinfection can be achieved through Environmental Protection Agency (EPA) proof of disinfection of textiles methodology. The EPA requires a product to be registered with the Federal U.S. Government with specific use instructions, which include time, temperature, and chemical concentration in order to produce disinfected textiles. If the EPA registered product provides these guidelines for use on textiles, and these guidelines are followed in the wash process, then one can claim disinfected textiles. Chlorine bleach does not "generally" have a disinfection claim by the EPA. There are only very specific chlorine bleach(es) or other oxidizers, such as peroxyacetic acid(s) that have been registered with the EPA that have textile disinfection claims; therefore, if disinfection is being claimed in the laundering process, care must be taken to use an EPA registered disinfectant and to follow the EPA label use instructions. And, disinfection claims can only be made if the EPA product with the EPA registration label is the product being utilized on the textiles in the laundering process. Meaning, even if the chemistry is the same or similar to an EPA registered product, a claim cannot be made that similar chemistry will provide the same disinfected results, as there is no supporting data to show this."

In the CDC's "Guidelines for Environmental Infection Control in Health-Care Facilities," under the section "Parameters of the Laundry Process" it provides the following guidelines: "Hot water provides

an effective means of destroying microorganisms. A temperature of at least 160°F (71°C) for a minimum of 25 minutes is commonly recommended for hot-water washing. The use of chlorine bleach assures an extra margin of safety. A total available chlorine residual of 50–150 ppm is usually achieved during the bleach cycle. Chlorine bleach becomes activated at water temperatures of 135°F–145°F (57.2°C–62.7°C).<sup>5</sup>

However, Becker further warns that the CDC's guideline for thermal only cleaning "does not state that the textile has been disinfected through the laundering process... Currently there are recommended guidelines around thermal techniques for removal of microorganisms, but no specific level of organism kill claimed, meaning, no disinfection claim is made." In short, only through use of an EPA registered disinfectant can a laundry claim that their process truly renders their product infection free.

### **Chemical Alternatives to Chlorine Bleach**

There are many oxidating bleaches, such as hydrogen peroxide and sodium perborate, which are effective in eliminating stains, and other bleaches which have very specific applications. However, these do not meet the EPA guidelines for claims of disinfection as noted above.

Peroxyacetic (or peracetic) acid is an oxidating bleach that can be considered a disinfectant in laundry applications. "Peroxyacetic acid can have a disinfection claim," Becker says, "however, it must be registered with the EPA for the wash process, as the EPA requires the proof that the product is designed, stable, and able to deliver the proper kill rates for microorganisms to meet EPA disinfection requirements." Although more expensive than chlorine bleach, it does have advantages in other areas. Its disinfectant properties activate at lower temperatures, meaning savings on utilities. It is color safe, and linens treated with peroxyacetic acid retain whiteness and tensile strength better than with chlorine bleach, meaning increased savings in linen replacement

costs. It also has less negative impact on the environment than chlorine bleach, which releases chloroforms into the wastewater. However, peroxyacetic acid has strong corrosive and etching properties, so care must be used with regards to equipment. To avoid damage, the parts of the equipment that will come into contact with the peroxyacetic acid should be constructed with high grade stainless steel.<sup>6</sup>

Laundry chemical companies are developing products utilizing formulations of peroxyacetic acid with other oxidating bleaches, such as hydrogen peroxide, to satisfy both the need for disinfection with the ability to whiten and fight stains. Additionally, sanitizers are available for the final rinse cycle which aid in the disinfection process. Also, heat from the finishing process – drying and ironing – will also work in this regard. However, as noted, any chemicals used must be specifically registered as disinfectants with the EPA and thermal processing alone cannot be relied upon for disinfection.

### **Ozone and Linen Disinfection**

The use of ozone in laundry processes is becoming increasingly popular for a variety of reasons. Ozone works to disinfect, in some ways better than chlorine bleach. It has the added benefit of saving money in that it uses less water and energy, and increases linen life.

Marc DeBrum of Clearwater Tech explains how it works: “Ozone is a great oxidizer and disinfectant, a stronger oxidizer than chlorine and faster acting in destroying microbes. Created from oxygen, the ozone laundry system will provide oxygen and ozone to the wash process. The Oxygen will help to open the fibers, while the mixture of ozone and oxygen will help provide oxidation of soils allowing them to loosen from textiles making it easier for the detergent (bubbles) to encapsulate that soil, so that it can then be rinsed away by the water. The ozone then provides the disinfection of microbes within the textiles.”

DeBrum points out that using ozone requires modification to the traditional wash process, or it will be a futile



exercise in improvements. Equipment programming and formulations must be adjusted to the ozone laundering system. It becomes vital then to work closely with the vendor installing the system to develop these alterations.

Since ozone provides disinfection at cold water temperatures, this saves money in electricity used to provide the hot water that is used in traditional processes. “Further,” DeBrum says, “ozone wash programs do not require high pH levels, often 8 to 10.5 pH, whereas traditional wash programs may be as high as 12 or even 13 pH. Therefore, it is often (but not always the case) that less detergent and other chemicals can be used to achieve these levels. In addition, less souring (acid) chemical would be needed to neutralize the linen at the end of the wash process.” Because ozone is so effective, it can replace chlorine bleach as a disinfectant, although a type of oxidating bleach it may still be used for stain reduction and whiteness retention. Additionally, ozone has no effect on CHG; it will not cause the telltale red or rust stains, but neither will it improve those stains if they are already there.

A study conducted by Clearwater Tech on their EcoTex ozone system, with chemicals provided by Ecolab and textile testing conducted by the College of Textiles at North Carolina State University, shows the success of ozone in prolonging linen life versus traditional processes. The study tested pillow cases and towels. The three areas

tested Whiteness Index measurement, Martindale pill resistance, and tear strength evaluation by the tongue tear method. In all three areas, the ozone system outperformed traditional laundry processes.<sup>7</sup>

In terms of disinfection, ozone systems again outperform traditional processes. The paper “Microbiological Benefits of Ozone in Laundering Systems,” published in *Ozone: Science and Engineering Journal*, showed extensive microbiological testing revealed ozone systems eradicated twelve usual microorganisms, such as Methicillin-Resistant *Staphylococcus aureus* and *Clostridium difficile*, faster and/or better than conventional methods.<sup>8</sup>

Another benefit of using ozone is that the installation of the system is typically quite simple, requiring very little in the way of downtime or modification of existing equipment. The delivery system ties into existing electrical lines for the washer. DeBrum says their customers can see return on investment within 8 to 18 months, depending on their work load.

It is apparent that whatever process is used, patient care and reduction of HAIs is of paramount importance. However, in light of the alternatives measures available in terms of chemicals and processes, producing disinfected textiles while retaining full linen life and reducing losses can be cost effective to both the laundry processor and the end-user. No one process is a fit for every facility



and situation, and anytime there is change some adjustments and risks must be assumed if considering these alternatives. Additionally, there is always some initial upfront costs to trying something new, but in the end the gains will be worth it.

\*The disinfected (or hygienically clean) textiles discussed here are those uses for general healthcare purposes. Surgical textiles must conform to higher standards of sterility and are not addressed in this article. ●

**Sources**

- <sup>1</sup> <http://www.cdc.gov/HAI/surveillance/>
- <sup>2</sup> <http://media.jamanetwork.com/news-item/study-estimates-costs-of-health-care-associated-infections/>
- <sup>3</sup> <https://shea.confex.com/shea/2010/webprogram/Paper2072.html>
- <sup>4</sup> <http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalHCAHPS.html>
- <sup>5</sup> [http://www.cdc.gov/hicpac/pdf/guidelines/eic\\_in\\_HCF\\_03.pdf](http://www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf)
- <sup>6</sup> <http://www.laundryandcleaningnews.com/news/newsclarifying-the-use-of-peracetic-acid-4308754>
- <sup>7</sup> "Cold Facts: Textile/Linen Wear Study of Traditional versus EcoTex Ozone Laundry Wash Practices." ClearWater Tech LLC, 2013.
- <sup>8</sup> <http://www.tandfonline.com/doi/abs/10.1080/01919510903170419#.VOpBqfnF8e0>



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