Reasons to integrate antimicrobial protection into hatchery surfaces

By the nature of the hatchery environment, facilities and equipment surfaces are readily contaminated by microbes from various sources. Hatching eggs are recognised as the predominant reservoir and potential vehicles of pathogenic microbes like E. coli, Salmonella spp. and Aspergillus spp.

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A practical solution requires a system-based approach that includes hygienic design of all aspects of the hatchery coupled with equipment and facilities surface hygiene.

Integration of Microban anti-microbial technology with current regulations and practices can enhance what is already being done right.

Hatchery hygiene plays an important role in protecting the commercial poultry industry. The hatchery environment can be a source of microbial contamination, resulting in the spread of diseases to poultry farms causing significant economic losses.

Walls, floors, drains of egg-receiving rooms, egg handling rooms, setter rooms, candling/transfer rooms, hatcher rooms and chick counting rooms have been shown to reflect microbial contaminants of the air in these areas.

Survey results

A hatchery survey indicated that there were significantly higher microbial counts (aerobic plate count, Enterobacteriaceae, coliform) on floor surfaces compared to walls. The highest microbial contamination was found in hatchers, followed by the setters and lastly by the egg receiving room.

The overall prevalence of E. coli and salmonella in all examined samples [infertile, dead in shell eggs, hatching eggs, air, floor and walls swabs from the hatchery and chick droppings (288 samples)] were 11.5 and 6.3%, respectively.

Hatchery facility and equipment surfaces are routinely subjected to microbial contamination due to a complex of various sources and factors such as air, water, soil, fluff, and personnel.

These factors impact the composition of the organic dirt (egg contents, fluff, meconium), the nature of microbes as well as the microbial load that land, survive, and potentially grow on hatchery surfaces.

Dirt and microbial contamination may be derived from a single soiling event, like transferring of a batch of eggs from setter to hatcher or from a particular hatch, or maybe gradually build up over time from several events as a result of inadequate cleaning and sanitisation processes in between, or, in rare instances, via microbial persistence.

Egg and chick contamination occur via various pathways including external contamination through the pores and hairline cracks in the shell, vertical transmission (from infected flocks), internal contamination (of yolk and albumen), and vectors such as hands, trays, vermin, and transport equipment.

Micro-organisms such as E. coli and Salmonella spp. that are found on hatching egg surfaces and fluff could be distributed throughout the facility, potentially affecting other chicks within the hatchery.

Salmonella is a bacterium of great concern because it affects the poultry industry through its ability to be transmitted throughout commercial production and processing facilities.

Studies have shown that the environment to which eggs are exposed can be a source of a variety of micro-organisms and cause disease in the poultry industry.

Acknowledging the microbiological risks associated with the hatchery environment, it is important to take steps to mitigate the risk of egg, equipment, and overall facility contamination, as well as the impacts such contamination could potentially have on the hatchlings.

The importance of cleaning to reduce potential risks associated with the transfer of microbes to and from a surface, even a visually clean surface, cannot be overemphasised.

A practical solution requires a system-based approach that includes hygiene practices (cleaning, sanitisation, and disinfection), coupled with hygienic design of all aspects of the hatchery such as equipment and facilities surface hygiene.

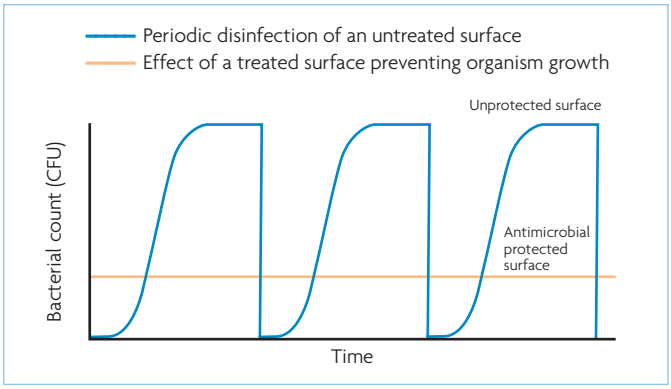

Fig. 1. Bacterial populations rebound on unprotected surfaces.

What are the risks with hatchery-contact surfaces?

- Hatcheries are routinely subjected to biocontamination. Eggs, fluffs, walls, floors, drains of egg-receiving rooms, egg-sorting rooms, setter rooms, candling-sorting rooms, hatcher rooms, chick counting rooms, and the air have been shown to have microbial contaminants.

- Surfaces may contain residues of fats, proteins, carbohydrates and/or assorted micro-organisms. Hatchery contact surfaces often have residues that persist after washing. These residues provide nutrients for contaminating microbes to utilise and multiply.

- Bioaerosols are created from multiple sources such as high-power washes and from respiratory/nasal droplets that settle and contaminate surfaces. Airborne microbes have been determined to be capable of survival on hatchery surfaces.

- The hatchery environment contains equipment and utensils constructed from different surface materials with varied characteristics that can make them vehicles for microbial attachment and survival.

There is a complex relationship between the nature of surface materials and microbial surface properties in the attachment of micro-organisms to abiotic surfaces.

- Difficult to clean surfaces. Inability to effectively wash, rinse and sanitise the surfaces of equipment may lead to the buildup of biofilms. Studies regarding the rigor required to remove biofilms from smooth surfaces highlight the need for materials of optimal quality in multiuse equipment.

Biofilm formation has been documented on a wide variety of surfaces of which the material and microtopography of surfaces can influence biofilm structure and density. There is evidence that the density of biofilm formation varies with substratum. When compared in a study, biofilm growth of Salmonella spp. on tile was denser than on the other substrata that were evaluated (glass, steel, and concrete).

- Surfaces may be marked with scratches or crevices due to wear and tear, as well as polishing with abrasive powders or substances. These crevices or channels may serve to entrap micro-organisms.

Continued on page 8

Continued from page 7

● Poorly executed or inadequate cleaning and sanitising regimes can induce stress responses making microbes more prone to adhering to solid surfaces. Physical and chemical treatments of hatchery surfaces are used to eliminate and control the presence of microbes. When cleaning and sanitising regimes are poorly executed or inadequate, micro-organisms may remain in the processing environment in an injured state. Sub-lethal treatments or stresses (heat, anaerobiosis, oxidation, starvation, cold shock, ethanol) can result in unique adaptive responses by bacteria, whereby the organism becomes more resilient.

● Residual moisture. Moisture is retained on surfaces and in pockets when trays and baskets are stacked after washing. Among the important factors in bacterial transfer from one surface to another are moisture, contact time and pressure which can result in higher transfer between surfaces.

● Cleaning tools, such as scrubbers, may harbour and spread microbes to equipment and surfaces. Cleaning tools such as scrubbers, sponges, and cloths harbour large numbers of bacteria and are therefore a potential source of spreading micro-organisms throughout the facility during use.

Measures to control microbial contamination

Survey data identified various factors that repeatedly contribute to microbial contamination in the hatchery facilities. There are several measures that can be implemented to control microbial contamination of hatchery surfaces.

● **Hatchery facilities and equipment surface materials:**
Materials that are used in the construction of equipment and facilities surfaces must be safe, durable, be able to withstand repeated washing, and finished to have a smooth, easily cleanable surface.

● **Cleaning to remove residues:**
Physical and chemical cleaning of hatchery surfaces is a prerequisite for effective sanitisation. Cleaning involves use of appropriate detergent chemicals for removal of organic matter to enable sanitisers to come into physical contact with the surface to be sanitised.

● **Sanitisation and disinfection after cleaning:**
Sanitisation refers to application of chemicals, such as quaternary ammonium compounds, to surfaces after thorough cleaning and rinsing to yield a 99.999% reduction of representative pathogenic micro-organisms.

The two disinfection methods commonly used in hatcheries are ultraviolet radiation and chemicals (formaldehyde, quaternary ammonium compounds, and hydrogen peroxide).

● **Avoid cross-contamination:**
Cross contamination is the transfer of bacteria from one surface or medium to another. In hatcheries, it is a primary goal to conduct critical activities in separate areas and avoid transfer of residual micro-organisms.

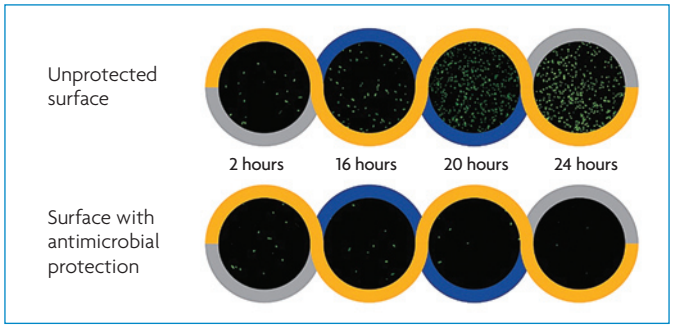

Fig. 2. Survival of bacteria on unprotected and antimicrobial-protected surfaces (internal Microban study, confocal fluorescence microscopy).

The benefits of Microban antimicrobial protection

Hatchery workers and equipment often perform as expected to keep surfaces clean. However, there can be lapses that result in conditions that support microbial attachment, survival, and growth. These include:

● Poor hygiene and handwashing practices by personnel that can leave equipment and facility surfaces with higher than expected microbial loads.

● Over time, the materials from which hatchery equipment and facilities are made begin to age and are no longer effective in maintaining the cleanliness of surfaces.

Under these conditions, incorporated antimicrobial technology to support existing regulations, procedures, and protocols is valuable.

Use in industry

Microban antimicrobial technology is permanently incorporated into Pas Reform products such as hatchery baskets and setter trays at the point of manufacturing and is not lost even if the surface is scratched.

The antimicrobial effect is certified with ISO 22196-2011, a proven industrial antibacterial test method that has shown the antibacterial efficacy of Microban-treated Pas Reform products to be >99% for Escherichia coli (ATCC #8739), Salmonella enterica (ATCC #10708), and Staphylococcus aureus (ATCC 6538).

Fig. 1. shows that Microban's antimicrobial technology integrated into Pas Reform products is not meant to be an alternative to or a replacement of proper hygiene practices discussed in the previous sections.

Rather, the technology provides an additional safeguard by complementing good hygiene practices with a novel means of protection.

Conclusion

The value of incorporated antimicrobials into the surfaces of hatchery facilities and equipment is that they support microbiological clean surfaces between visual cleanings and protect day-old-chicks from microbial contaminants that could cause infected chicks, poor performance in the farm and/or the risk of (foodborne) disease outbreaks (Fig. 2).

Some bacteria can replicate rapidly and when unhindered they can double their population in 20 minutes. Hatchery products with built-in antimicrobial protection are continuously challenging the ability of microbes to survive on surfaces, therefore these surfaces are microbiologically cleaner than unprotected surfaces.

In a systems-based approach to maintaining microbiologically clean surfaces in the hatchery environment, cleaning is effective when routinely conducted and supported by antimicrobial protected surfaces that keeps the surface microbial population low. ■

References are available from the author on request