The importance of hygiene and disinfection

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Single stage setters allow for a thorough clean out and disinfection after every 18 days.

Nevertheless, a setter room with single stage setters is still a multi-stage operation that normally never stops running. There are eggs from many flocks, there are embryos in different stages of development. So even in a setter room with single stage incubators, cross contamination from setter to setter may occur!

The setter room is considered the 'clean zone'.

However, exploders (often caused by pseudomonas) can cause serious contamination. They are the biggest threat of the clean zone in the hatchery.

The incubators do not only incubate embryos, but also many bacteria. In multi-stage setters, this growth of bacteria is uninterrupted, unless regular spray or mist disinfection is carried out and exploded eggs are removed and their debris is cleared up.

Fumigation in the setter with formaldehyde, a carcinogenic product, cannot be done between 24 and 96 hours of embryo development. Moreover, formaldehyde has no residual action so does not prevent recontamination.

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and foot dips at the entrance and foot dips between every production zone for the personnel. Truck drivers should never enter the building. Offices, showers and toilets should ideally be separated.

- Airflow: positive pressure in the clean zone with no air intake near a dirty zone exhaust.
- Waste water flow: separate drains for clean and dirty area.

Floors, walls and setters can be washed with a 'universal' cleaner, designed specifically to remove the typical debris of the 'clean zone' (yolk, albumen, blood).

This detergent should also be suitable for application with a foam lance or scrubbing machine and, therefore, have good adhesion. It is advisable to alternate once per month with an acid foam.

A good foam formulation will cling to ceilings and vertical surfaces, allowing a longer contact time for the chemical to act.

The terminal disinfection should also be versatile enough to be applied by spraying, foaming and fogging. Room fogging (or misting) in the setter (and hatcher) rooms allows the product to enter the machines through the air inlets and to disinfect the incubators at the same time.

Food	Yolk and albumen	Remove waste, keep clean
Water	In egg and via humidifier	Avoid leakage, treat water
Temperature	In incubator	Store eggs in cool and clean area
Shelter	In eggshell, fittings, ducts	Clean and disinfect eggs, rooms, machines and equipment
Air	Ventilation of machines and building	Spray or fog in machines, mist in rooms, renew filters

Table 4. Bacterial needs, sources and solutions.

Remember that bacteria can double every 20 minutes!

Table 4 shows what bacteria need for growth and how we can reduce this growth.

The hatchery layout should consider four flows:

- Product flow: no crossing of eggs and chicks.
- People flow: from clean (egg) zone to dirty (chick) zone, ideally with colour coded areas, with showers, hand washing facilities

Microbiological environment

Four important groups of pathogens can be problematic in the hatchery:

- Salmonella. Apart from vertical transmission, there can be cross contamination in the setter by contaminated exploders and in the hatcher by contaminated chicks (with open navels).
- Staphylococcus can be transmitted by the egg and by the staff. Hence the importance of personal hygiene, especially hand hygiene.
- Pseudomonas cause the bangers (by gas) or rots. Pseudomonas can cause yolk sac infection in the chick. They are not so easy to kill and research showed resistance against quaternary ammonia compounds.
- Aspergillus fumigatus is a fungus that can cause fungal aircells and brooder pneumonia. It spreads easily in warm environments (and at times like harvest).

The last two can be easily spread when doing in-ovo vaccination.

Hatcher room biosecurity

In the dirty zone (hatcher room, chick room, wash room, reception and storage of dirty boxes), stronger cleaning products are advised; especially for cleaning the hatchers and plenums, where lots of fluff needs to be removed -- salmonella can live for years in fluff!

An alkaline foaming product, or even better, an alkaline, non corrosive gel with higher viscosity will do the job properly. Instead of relying on 'elbow grease', it is better to rely on the chemistry of specially designed products, allowing for a long enough contact time and thus saving on water consumption, energy costs and cleaning time (labour cost).

Again, it is advisable to rotate on a monthly basis with an acid foaming detergent. Especially in the dirty zone, it is important to follow the correct procedures:

- Remove all visible debris manually (with shovel and brush).
- High pressure wash with (foaming) detergent (by foam lance).
- Rinse.
- Allow to dry.
- Disinfect.

Often, the drying step is forgotten. When the disinfectant is sprayed on a wet surface, it may become diluted more than it should.

Moreover, the surface tension of water that is still present in cracks and holes will impede good penetration of the disinfectant solution (even if it does contain surfactants).

A well formulated product with good surfactants will penetrate dry cracks more easily.

You will have noticed that there is no need for rinsing the disinfectant from the hatcher cabinet. When the product has a residual action of at least three days, you can simply spray, or (even better) foam it on all surfaces, load in the transferred eggs and close the doors.

The product will keep on working throughout the hatching process! Excellent results have been observed by fogging in hatcher cabinets. The germ counts increase logarithmically when the chicks start pipping.

The use of a 'plenum' or 'fluff tunnel' behind the hatchers (equally to be cleaned and disinfected after every hatch) avoids fluff re-entering other machines or just flying around. Hence the importance of negative pressure in the 'dirty area'.

Chick room biosecurity

Automation equipment can be washed and disinfected like the hatchers. Trays, crates and baskets can be washed with alkaline detergents and eventually chlorinated (which will sanitise them).

It is important that the products do not foam when machine washing. Obviously, temperatures should be higher (50-60°C or 110-140°F) but not so high as to damage the plastic.

Ideally, these alkaline products, which remove mainly fat and proteins, should be rotated with an acid, non foaming detergent to remove mineral deposits (limescale, iron), egg shell residues and residues from the

Continued on page 15

Continued from page 13
alkaline cleaners. The acid product will unblock the nozzles and descale the inside of the tunnel washer.

However, it is advisable to disinfect the interior of the tunnel washer by spraying and even to wash your washer regularly!

Hatcher baskets and chick boxes should be disinfected immediately after washing by spraying.

If setter trolleys and trays go back to the farm, they must be disinfected. If farm buggies are being used, they should equally be disinfected.

When a vacuum waste removal and silo system is not available, the offal containers also need cleaning (with a universal detergent) and disinfecting afterwards.

Vehicle biosecurity

Vehicles transporting hatching eggs, day old chicks, feed, broilers, manure and meat are crossing all over the place, worldwide! Vehicles are 'mobile vectors' that can bring contact between the 'source' (the reservoir) and the 'target' (the bird or the egg).

Trucks should have been washed (inside and outside) and disinfected after every delivery, whether it is hatching egg, chick, broilers or feed transport.

A slightly alkaline, foaming truck shampoo should remove the outside 'traffic film' (a build up of dust, grease, petroleum and exhaust residues, dead insects) and the same product for cleaning the setter can be used for cleaning the inside of the vehicle.

This product should not be corrosive (and definitely not contain chlorine nor be too concentrated on sodium hydroxide that corrodes aluminium).

Ideally, the truck shampoo should be applied as a foam, starting from the bottom and going up with the lance. Washing vehicles in the sun should be avoided.

After cleaning, the vehicle should be rinsed off. Start at the bottom, going up and move the pressure lance from left to right. Apply a final rinse from the front towards the end, to remove the remaining foam before disinfecting. The disinfectant should obviously not be corrosive (it should ideally have a neutral pH) and it should equally work in cold temperatures where they occur.

Livestock transport has often been defined as the primary disease vector, such as in the recent AI outbreaks on three continents and in the FMD outbreak in the UK some years ago.

Often, critical places are forgotten to treat, such as the underneath of the vehicle, the inside of the wheel arches and the driver's cabin. Equally important is the replenishment of farm gate wheel dips.

Last but not least, we have observed wheel disinfectant pads that were smaller than the circumference of the vehicle's wheels! Automatic spraying installations, reaching the underneath and the arches deliver a better job.

They also assure 'fresh' disinfectant to be used. But they cannot operate when freezing. When freezing, a manual disinfection is required. Eventually, a glycol mixture (a good anti-freeze agent) can be added to the water to dilute the disinfectant, provided the disinfectant is compatible with glycols.

If plastic chick boxes are used, they usually go back to the hatchery. There, they can be washed (and disinfected) in the tray washing machine (tunnel). The same procedure is required as for hatcher trays.

The other vector is obviously the crates in which the broilers are being transported. Research on 72 containers which had been used for transporting 12 flocks has shown that broilers, leaving the farm salmonella free, can be positive when arriving at the processing plant.

Dr De Zutter et al concluded that "Insufficiently disinfected transport containers can easily infect birds with salmonella and campylobacter." Again, automated washing tunnels are preferred for the crates. Chemicals and procedures are similar to those of hatching trays and chick boxes.

Farm biosecurity

Apart from rodent control and insect control (to be done immediately after bird removal), we will strictly focus on cleaning and disinfection.

The Dutch ICC (Integrated Chain Control) system describes the procedures for poultry houses as follows:

- Remove litter, empty drinkers and clean dry all visible dirt.
- Wash down with a cleaning agent and allow for enough contact time (20 minutes) and clean drinker lines (and flush them afterwards).
- Rinse and let dry.
- Disinfect (by spray or foam; foaming will visualise better where the product has been applied and stays longer on vertical surfaces and ceilings, allowing for a longer residual action).
- Install new litter, re-install and fill the feeders and drinkers.
- Do a terminal disinfection by (thermo) fogging.

Do a continuous disinfection of trucks (wheel dips,) people (hand hygiene, foot dips) and drinking water. In some countries, like the USA, the reality is far away from this concept and litter is used time and time again, sometimes called 'dirt floors'.

But then again, the University of Georgia writes: "Because most (US) broiler houses have dirt floors, Clostridium perfringens has the opportunity to flourish and cause physiological problems to the birds, high flock mortality rates and financial losses for the farmer and the poultry company".

A clean out and disinfection of the feed silos is equally advised. On the foot dips, let us remember the importance of regular replacement of the disinfectant and of washing the boots first!

The cleaning agent should be alkaline and ideally applied as a foam, allowing for better contact time. But today, a new generation of cleaners has been developed in the form of gel. It should also be chemically compatible with the disinfectant (anionic surfactants neutralise cationics).

Drinking water treatment

Not only is the cleaning and disinfection of surfaces important, but your waterlines should also be cleaned and disinfected!

Cleaning means removing the scale and the biofilm. The biofilm is a polysaccharide layer, caused by adding vitamins and medication. through the water. It harbours mainly enterobacteria (salmonella, E. coli) and impedes the good functioning of medicine and vaccines.

It will, as scale, block the nipples and reduce the water flow. Chlorine (that gets neutralised by organic matter) will not remove the scale and not even penetrate the biofilm. Removing the biofilm is only possible by oxidation.

Stabilised hydrogen peroxide will do the job! In combination with organic acids, it will also remove scale.

And, if the products do not contain heavy metals (like silver), it can also be given during production until the last day, avoiding a new build up and sanitising the drinking water.

All this without leaving residues in the meat or eggs.

Conclusions

In this article, we have followed the embryo from the breeder farm through the hatchery, to the farm. Every phase needs an integrated biosecurity approach with different products (summarised in Table 5) and different procedures.

But it does not finish there. The stringent rules of processing biosecurity, storage biosecurity, transport biosecurity and biosecurity at the processing plant and during transport and storage in the shop will have to be implemented as well.

Always pay attention to the 4 V's – visitors, veterinarians, vehicles and vermin.

Last but not least, basic hygiene rules will have to be implemented to take the piece of poultry meat home or to the restaurant, to store it and to prepare that delicious, healthy meal. ■

Table 5. Summary of hygiene product needs.

	Cleaning	Disinfection	Automated traywash
HATCHERY	1-2 alkaline foaming 1 acid foaming	1 disinfectant (spray/foam/fog)	1 alkaline non foaming 1 acid non foaming
FARM	1 alkaline foaming or gel forming detergent	1 disinfectant (spray/foam/fog)	
VEHICLES	1 alkaline foaming detergent, non chlorinated	1 disinfectant (spray/foam/fog)	
HAND HYGIENE	1 hand soap,	1 hand disinfectant (liquid or gel)	
SHOWERS	1 body soap, 1 shampoo		
WATERLINES	1 sanitiser	same sanitiser	