Effective hygiene within the hatchery

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A hatchery is a central place where the hatching egg is transformed into a one day old chick, during 21 days. The conditions to make this transformation possible are also ideal for the growth of bacteria and moulds:

In the setter, the dry bulb temperature is around 99.70°F (~36.5°C), which is ideal for microbiological growth. There is heating (by water or electricity) and cooling process (by air or water). When cooling occurs with water, condensation is formed, which again encourages bacterial growth.

Moreover, there is ventilation in order to optimise the oxygen:carbon dioxide ratio.

In the hatcher, a lot of micro-organisms appear in the air at pipping. At hatching, there are even more micro-organism plus fluff and excrement.

It is more than obvious that efficient hygiene is important in order to minimise detrimental bacteria and mould exposure on the egg or the chick.

Growth of micro-organisms

Under optimal conditions (which are present in hatchery) bacteria can divide every 20 minutes. In 24 hours (72 divisions) one bacteria can theoretically become 4,700,000,000,000,000,000,000,000 cells. That means that one bacteria goes from being invisible to the naked eye to a readily visible colony of bacterial cells.

In a hatchery there are some important groups of pathogen which can be problematic – bacteria, E. coli, salmonella, Staphylococcus aureus, pseudomonas and the fungus Aspergillus fumigatus.

Contamination with E. coli can occur in the breeding farm via faeces from hens, vermin, insects, wild birds (trolleys standing outside) and people (toilet hygiene).

Also, staphylococcus can be transmitted by the staff (for example infected wounds, sneezing) as well as by the egg itself. Hence the importance of personal hygiene, especially hand hygiene.

Pseudomonas cause the bangers (by gas) or rots and can cause yolk sac infection in the chick.

Apart from vertical transmission, cross contamination with salmonella can occur by contaminated exploders in the setter and by contaminated chicks (with open navels) in the hatcher.

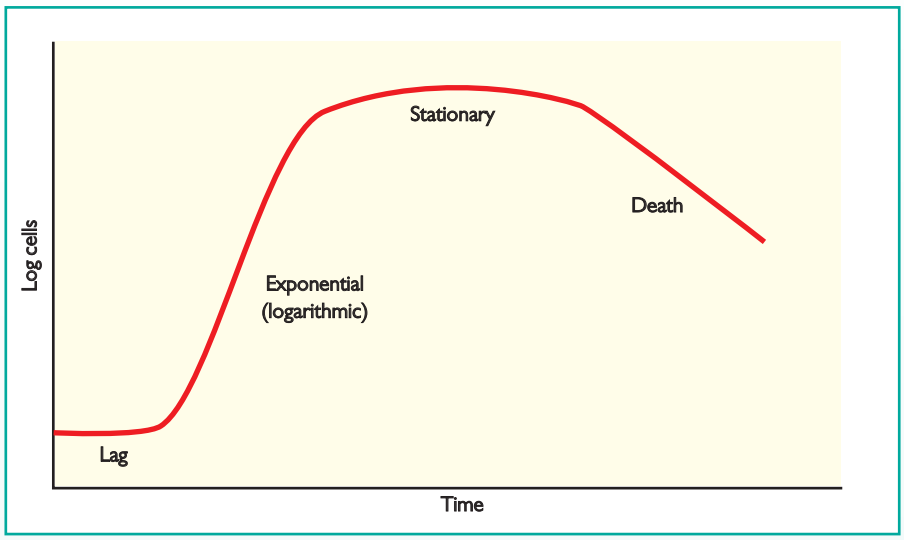

Fig. 1. Phases of microbial growth (batch culture).

Aspergillus fumigatus spreads easily in warm environments and at times such as harvest. It is a fungus that can cause fungal aircells and brooder pneumonia.

To achieve minimium contamination, the hatchery not only relies on its own hatchery cleaning and disinfecting programme, which should reduce previous hatch contamination, but it also relies on the breeder department, which has to supply clean, hatchable eggs.

Critical control points

● **Hatching egg hygiene at the breeder farm.**

The starting point of hatchery hygiene is obviously a healthy breeder flock. This should be combined with optimal biosecurity (including thorough farm cleaning and disinfection programmes) and also precautions regarding all the vectors that threaten the eggs before they arrive in the hatchery.

With the exception of cases involving ovarian infection, the hatching egg (or 'pregnant egg') is free of micro-organisms when it leaves the oviduct.

This presumes a clean cloaca, that is not affected by diarrhoea, since wet droppings will contaminate the shell. Then it may face many challenges. If the egg is laid in the nest (floor eggs and eggs laid on slats are 'dirty' by definition), a dirty nest or litter will immediately contaminate the egg, as will dirty egg belts in the case of mechanical or automatic nests.

Thus, eggs laid in nests or transported on belts contaminated with droppings, broken eggs or wet shavings may be as contaminated as floor eggs, or even more!

Next, non-sanitised hands may put them on contaminated flats, trays or cartons. The egg storage room in the breeder farms also stores many micro-organisms as does the truck that brings them to the hatchery. Once there, they may again be contaminated.

Moreover, a 'rough ride' to the hatchery can cause cracks in the shell, which makes it easier for bacteria to penetrate and affect hatchability.

Needless to say, the vehicle transporting the eggs should also be clean and disinfected. A non-chlorinated alkaline foaming detergent, followed by a broad spectrum disinfectant is ideal. The vehicle disinfectant should obviously be non corrosive (in other words it should have a neutral pH).

In addition to all that, other biological vectors, such as insects, rodents or wild birds, can contaminate the eggs should they be in

contact with them. Last but not least, wide temperature changes can make the eggs sweat, which allows rapid multiplication and easier access of micro-organisms to the highly nutritious egg content.

So, egg storage both on the farm and in the hatchery should be in a cool (around 18°C), clean and disinfected area.

There is room for hygiene measures at each of the above critical control points. In addition, frequent egg collection will help reduce contamination (and 'spontaneous incubation' in hot climates)

Hygiene on arrival at the hatchery.

On arrival in the hatchery, hatching eggs should be washed and disinfected. Even if an egg appears clean, it can carry over 100,000 micro-organisms on the shell surface.

Washing only dirty eggs is not the total answer, as clean eggs can be recontaminated in the setters by bacteria from unwashed eggs which appeared to be clean.

Dry cleaning with sand paper is not a good option, as this will remove the cuticle that protects the egg. The biggest problem with egg washing and disinfecting is that there should be a proper temperature and concentration control.

Hatching eggs can be washed with alkaline products (based on potassium hydroxide), to remove mainly fat and protein, which can be either chlorinated or non-chlorinated. Proper temperature control (42-45°C) is crucial. The water should be warmer than the egg contents throughout the cleaning cycle.

This will result in a positive pressure in the egg, causing the inner membrane to expand against the shell to help prevent anything from entering the egg. Contact time should be limited to approximately five minutes, in order not to damage the cuticle.

The washing machine should be temperature and concentration controlled (automatically stopping when either are not optimal).

Disinfection afterwards should be at a slightly higher temperature, to prevent the product from entering the pores (45-47°C); after rinsing at the same temperature. Use only disinfectants chemically compatible with the cleaning product.

There must be no conflict between the surfactants in the cleaning product (anionic surfactants neutralise cationic). Use only recommended disinfecting products at the correct concentration or penetration of the cuticle can occur.

Ideally, a disinfectant with a residual action should be used, to prevent early re-contamination. This is not the case with formaldehyde fumigation.

As an alternative to formaldehyde fumigation, the Dutch Research Institute 'Praktijkonderzoek Pluimveehouderij Beekbergen' found CID 2000 in an ultrasonic fogger 'as efficient as formaldehyde', without affecting hatchability.

Other hatcheries obtain excellent results by spraying (non formalin based) disinfectant solutions on the eggs.

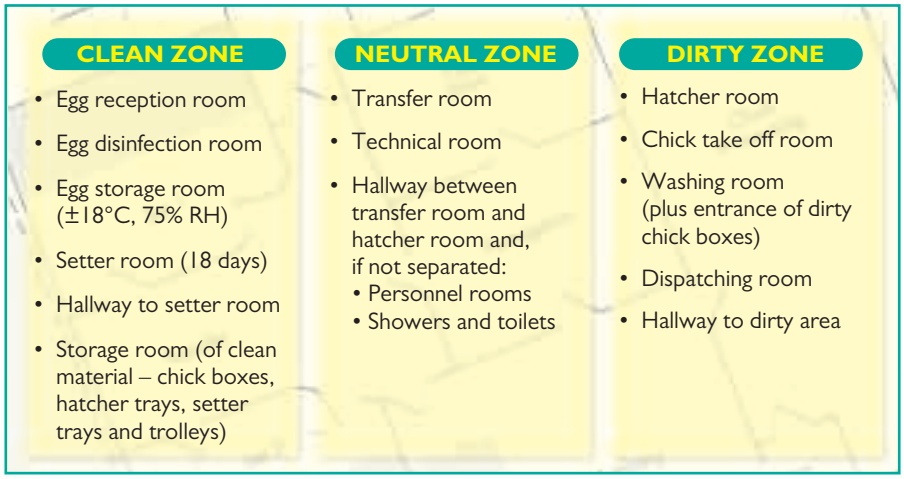

Fig. 2. The lay out and infrastructure of a hatchery contains three zones.

So, there are alternatives to formalin fumigation!

Hatchery lay out.

The lay out and infrastructure of a hatchery (see Fig. 2) has a strong influence on the efficacy of the hygiene measures. There should be a strict separation of clean and dirty zones. Those zones should be well indicated, ideally with colour coded areas, with showers, hand washing facilities and foot dips at the entrance and also foot dips between every production zone for the personnel. Truck drivers should never enter the building. Offices, showers and toilets should ideally be separated.

People flow should go from the clean (eggs) zone to the dirty (chicks) zone, while for product flow, crossing of eggs and chicks should be avoided.

A positive air pressure in the clean zone with no air intake near a dirty zone exhaust should also help prevent contaminated air from the dirty zone coming into the clean zone.

Ideally, there should be also separate waste water drains for clean and dirty area.

Hygiene in the setters.

Although the setter belongs to the clean zone, many bacteria are incubated, as conditions for microbiological growth is ideal.

Exploders (often caused by pseudomonas) can cause serious contamination. They are the biggest threat to the clean zone in the hatchery.

When using single stage setters, thorough cleaning and disinfecting can be done every 18 days. Nevertheless, cross contamination between the different single stage setters in the setter room may occur!

Cleaning of setters should be done 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. A good foam formulation will cling to the ceilings and vertical surfaces, allowing a longer contact time for the chemical to act.

It is advisable to alternate once with an acid foamer, in order to remove mineral scale build-up.

It is important to check that the products you are using are not corrosive for your setter equipment. Pure raw materials in too high concentration can have a drastic effect on your setter.

Therefore, using a quality product, especially developed for hatcheries, at the manufacturer recommended dilutions will give you excellent cleaning results. Well formulated cleaning products also contains stabilisers, sequestering, and surfacting agents, which result in an even better cleaning action.

After cleaning, rinse with water and allow to dry. A dry surface is important in order to make sure that the correct dilution rate of disinfectant is applied.

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).

Thereafter, disinfecting can be carried out. There is no need to rinse afterwards. That way a disinfectant with residual action will prevent recontamination.

Disinfectants should be compatible with cleaning agents. It also needs to cover a broad spectrum so that all bacteria and fungi will be killed.

This can be checked by looking at the test results of the product. Please take into account that only tests which simulates field conditions (by adding organic load and using hard water), done by international standards, such as ENE (European Norms – Normes Européennes) and AOAC (Association of American Chemists) give you adequate information about the quality of your disinfectant. A versatile use, so that foaming and fogging is also possible, and of course a safe product for the people who are using it is also recommendable.

During production in single stage setters, a disinfectant (for example Virocid) can also be sprayed, preferable through a separate disinfection nozzle and eventually through the humidification nozzle, but in that case

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not as frequent as the humidity sensor requires.

To prevent algae and slime build up in your cupper cooling coils, you can use a disinfectant which kills algae and Tricoderma, and which has a neutral pH when diluted (to prevent corrosion), in a closed circuit.

As multi-stage setters are never empty, regular cleaning and disinfecting as done in single stage setters is not possible. Here, a regular spraying or misting 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. Alternative non toxic disinfectants (such as Virocid) can be used.

● **Hygiene in the hatchers.**
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 may persist 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.

Hygiene procedure and choice of disinfectant is the same as that described for single stage setters. Here, there is also no need for rinsing after disinfecting 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 from 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 air pressure in the dirty zone.

● **Chick room and wash 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), 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 alkaline cleaners.

The acid product will unblock the nozzles and de-scale 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.

● **Personal hygiene.**
The number of external visitors should definitely be limited, but people can not always be excluded. Therefore, controlled points of entry will be needed for the farm personnel and for any visitors permitted.

Modern hatcheries usually provide shower-in facilities and insist that everybody puts on clean coveralls and boots (which are preferably kept in the hatchery) after showering and washing the hands (as micro-organisms are easily transmitted via hands).

A disinfecting soap, for example one based on chlorehexidine or quaternary ammonia, will remove the dirt and sanitise the skin in one step.

Another possibility is remove the dirt first by using a normal soap and disinfecting the hands afterwards with a product such as one based on alcohol. Remember too that personal comfort demands a soap which is effective without being aggressive to the skin.

Conclusion

It is not only in the hatchery that a strict biosecurity plan has to be followed precisely, but also on the breeding farm, broiler farm, processing unit, transport, catering, restaurants and other selling points of processed chicks.

That is the only way to guarantee safe food to the consumer.

Therefore, managers and workers need to be trained and informed so that they are aware of all measures, facts and procedures. It is important that everybody involved in one phase of the feed chain understands the importance of hygiene!

Remember, hygiene is not a cost, but an investment! ■