Hatchery Expertise Online
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DECONTAMINATION OF THE HATCHERIES - ROOMS AND EQUIPMENTS -

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INTRODUCTION

Decontamination is a crucial element for sanitary risk control by continuously lowering the microbial load inside the hatchery. In this paper, cleaning and disinfection, the essential points required to succeed in this task will be detailed.

Example of room and equipment decontamination frequency

Areas to be disinfected		Frequency
Rooms	Storage room	Every week
	Incubation room	After each load (every week, at the least)
	Transfer room	After each transfer
	Hatching and shipping room	After each hatch
Machines	Incubators	Disinfection on a rotation basis (depending on the number of rooms available)
	Hatchers	After each hatch
Materials	Flats, trays, trolleys	After each use
Vehicles		At each return to the hatchery

A. CLEANING

Cleaning is an absolutely necessary step to the quality of decontamination as it allows elimination of 90% of the germs present on surfaces. So, it is needless to say that all surfaces must be as smooth as possible in order to achieve the desirable results.

However, one should be aware of the sanitary hazard that cleaning can represent: the residues lying on surfaces (dust, down, egg shell fragments) are pushed aside, sometimes spread out, in the hatchery, where they are a source of contamination. It is therefore necessary to clearly define the methods and rules to be followed.

1. Dust Removal, or Mechanical Cleaning

The various debris lying on surfaces should be first eliminated manually, as soon as possible, after each work session in order to avoid that they adhere to surfaces while drying.

Dry-sweeping should not be used as this operation would lift dust in suspension; scraping of the floor previously humidified, or even vacuuming debris, must be preferred.

2. Washing or Chemical Cleaning

The objective of this second step is to make surfaces clean, and thus to remove any organic matter in order to allow effective disinfection.

To this purpose, a detergent solution is used in order to soak organic matter and, through surface-active agents, to remove biofilms.

Most organic soiling is acid and must be cleaned with an alkaline detergent (pH above 7, a domestic detergent). Mineral sediments (fur), which house micro-organisms in their anfractuosities, are alkaline and must be destroyed with an acid detergent (pH under 7). In the case of hard water, it is recommended to alternate an alkaline detergent and an acid disinfectant to eliminate all bacteria.

What is a biofilm and how is it formed?

Bacteria attach to the support by means of adherence factors within a biofilm, which is a true shelter for bacteria as it allows them to survive.

1. Organic matter settles on surfaces, where it neutralizes surface loads. It facilitates the adherence of bacteria by being a support as well as a source of nutrients for them.
2. Attached bacteria create a permanent network, consolidated by substances they excrete and which also protect them against the action of biocides.
3. This network (glycocalyx) makes it in turn possible for new microorganisms to adhere; a true ecosystem then builds up: the biofilm is born!

It is always important to check the existence of possible antagonisms between the detergents and disinfectants that will be used afterwards: in particular, the use of soaps (anionic) should be avoided before disinfecting with quaternary ammonium compounds (cationic), unless the surface is well rinsed between the two operations.

The detergent solution can be applied by spraying at a low pressure (10-20 bars). The formation of foam makes it possible to view treated areas while allowing the product to adhere to surfaces without running. A tepid water temperature (25 to 35°C) should preferably be used in order to improve the effectiveness of the detergent. The detergent must be left to act for 15 to 30 minutes, while being very careful that it does not dry off.

Surfaces must then be rinsed off with hot water under moderate pressure (20-40 bars) in order to remove all the organic matter.

Finally, rinsing waters are directed toward exhaust vents, possibly using low pressure to avoid projections and therefore a new dissemination of contaminants.

B. DISINFECTION

1. Rules to Follow

The success of this second step depends on the cleaning quality: there must not be any organic matter left. However, as good as it may be, cleaning still “leaves” around a million microorganisms per cm², not counting fungus and viruses!

The first disinfection will reduce this population by a factor 1000 and the second disinfection by a factor of 10,000 to finally reach less than 100 germs per cm².

In addition to the compliance with the two phases previously described, disinfection must be operated:

- ☑ **quickly:** the disinfectant is applied to slightly damp surfaces, i. e., immediately after cleaning, which can be followed by renewed drying.

- ☑ **with an approved disinfectant and according to the manufacturer's instructions for use:** Some disinfectants have a reduced efficacy in the presence of organic matter. Water quality, hardness and pH in particular, can also influence the efficacy; e. g., the alkalinity of the environment reduces the activity of phenolic compounds whereas it favors that of quaternary ammonium compounds. Temperature also has an influence on efficacy; e. g., for a temperature increase of 10°C, a phenolic derivative is 6 times more active and a chlorine derivative is 4 times more active. Finally, as previously mentioned, there are also interferences between detergents and disinfectants.

- ☑ **following a methodical protocol:** cleaning/disinfection operations should be described in written procedures such as Standard Operation Procedure (SOP). It should be simple and easily understandable and moreover adapted to the conditions of the hatchery, rooms and equipment to be treated, entry chambers and building surroundings;

- ☑ **with adapted equipment:** appropriate materials for the application of the disinfectant must be used, as well as gloves and safety masks.

2. First Disinfection: Spraying, Application of Foam

Similarly to cleaning, the disinfecting solution can be applied by spraying surfaces under moderate pressure (20-40 bars), at a water temperature above 25°C to optimize its activity.

Three to four liters of solution will be sprayed to treat a 10 m^2 surface, using an angled hose to make it possible to reach all nooks.

It should then be necessary to wait for the complete drying of surfaces before starting gas disinfection. Indeed, a dry and disinfected surface is a lot more difficult to colonize for a bacterial population than a damp surface.

3. Second Disinfection: Fumigation or Fogging

This second disinfection in gas phase allows optimal diffusion of biocide molecules, before putting the room back into service.

Fumigation is very widespread, essentially with formalin or other bactericidal substances and/or fungicides. This technique allows biochemical as well as mechanical purification of the air through the large diffusion of biocidal substances, and aggregation and sedimentation of airborne particles by smoke microparticles.

Thermo-fogging uses a cannon that projects the disinfectant, which is sprayed under the action of the heat. This technique is well adapted to breeding farms, but often proves unsuitable for hatcheries because of the insufficient size of premises. Moreover, this type of equipment always carries a risk of fire contrary to other techniques.

Cold fogging, which consists in projecting the disinfectant through the action of compressed air, should eventually be the reference method in hatcheries. It gathers at the same time the usefulness of gas diffusion of biocidal molecules, ease of use (even in small premises) and safety for the personnel. Some hatcheries are equipped with equipments that make it possible to disinfect each room during the night.

Note: Disinfection of the environment of the various rooms regularly closed in the absence of the personnel is an economical and effective solution. If this disinfection takes place in the presence of hatching eggs, embryos should to be checked for the absence of negative effects on their development (early embryonic mortality).

C. DISINFECTING SUBSTANCES AND FORMULATIONS

1. Formalin

Due to its low cost and constant efficacy, gas formalin is the main disinfectant used in hatcheries.

However, this product is irritant and carcinogenic. It must be imperatively used with safety respiratory masks.

In addition, consequences on chicks' health must not be disregarded:

- ☑ Sometimes applied several times (on the farm, upon arrival at the hatchery, during incubation, sometimes even in the hatcher), this leads to cumulative toxic effects resulting in fragility during early growth, which will in turn result in growth retardation.
- ☑ The use of gas formalin in the hatcher can cause damage to the respiratory epithelium, with disappearance of eyelashes and inflammation (excessive contact time / too strong concentration). This last fumigation is sometimes used because it gives chicks a nice yellow color, which reflects their good health. This over-coloration disappears after 4 to 5 days.

Production of gas formalin is achieved through a chemical reaction (liquid formalin and sodium permanganate) or by heating a formalin tablet (sublimation), which requires strict application conditions of temperature and relative humidity:

- ☑ Temperature above 20°C (ideally 24° to 35°C)
- ☑ Relative humidity above 70% (ideally 85 to 90%).

If these conditions are not fulfilled, formalin microcrystals can sediment on egg shells. If the air in incubators or hatchers is warmer, it will then induce their transformation into gas formalin, with a risk of toxicity for embryos.

Practical use of formalin:

- ☑ On hatching eggs: sublimation of paraformaldehyde crystals (10 g/m^3 heated in an electrical fumigator) or reaction between formaldehyde and potassium permanganate (for 1 m^3 air: 45ml formalin 30% + 30g permanganate + 40ml water). The recommended contact time is 20 minutes.
- ☑ In a loaded incubator: 3.5 g/m^3 – it must be avoided between the 1st and 4th day of incubation because of the fragility of embryos.
- ☑ In a loaded hatcher: 2.5 g/m^3 at the beginning of pipping. The contact time must be short because of the important air extraction at the level of machines. Formalin must be used with precaution as an excessive contact time (e. g., in the event of an accidental blockage of the air extraction system) can lead to an irreversible alteration of the respiratory tract.
- ☑ For empty machines: 10 g/m^3; cut off ventilation and let the room closed for 12 hours.

Note: an excess of formaldehyde gas can be neutralized by the introduction of concentrated liquid ammonia at 20 ml/m^3.

Fumigation chambers must be sufficiently hermetic to avoid any pollution of adjoining rooms. Extraction is necessary to evacuate gas formalin before any handling of the eggs by the personnel.