Role of disinfectants in biosecurity

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As antibiotics and medication are coming under more and more pressure, disease prevention is the only way forward. Since there are already many examples that vaccines can not follow the fast mutating micro-organisms, it is becoming more and more clear that hygiene, which is integrated in a complete biosecurity plan, will be the prevention action of the future.

This article focuses on the importance of disinfectants in an efficient hygiene programme. But as a hygiene programme can only be fully effective when integrated into a complete biosecurity plan, there is also an overview of the most important biosecurity measures.

Biosecurity can be described as the whole range of non-medicinal measures with the goal to improve the health status of the animals and to prevent diseases in order to optimise the production results and minimise the medication costs. We distinguish 'external' and 'internal' safety measures.

External measures

External measures are those which help to keep out micro-organisms from outside:

● **Purchasing policy.**
External measures start with buying pigs only with a known health status and preferably from the same farm or at least purchasing sources should be minimised.

● **Quarantine.**
When new animals are brought on the farm, they should be kept in quarantine for veterinary observation. In some countries, this is even a legal obligation. Practically, this period is four to six weeks. When a fattening farm is run on a strict 'all in-all out' base, the whole cycle can be seen as a quarantine.

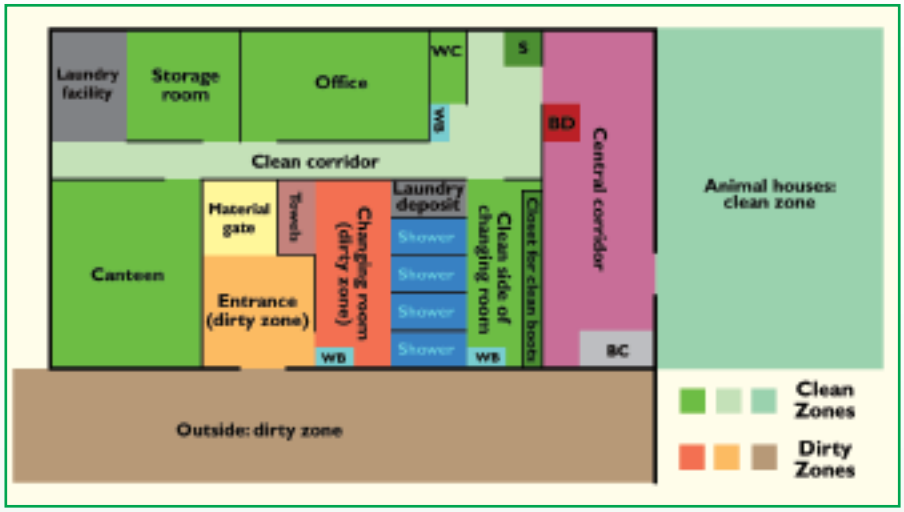

Fig. 1. Building layout plan for a personal hygiene centre, including showers (WB = Water basin BC = Boot cleaner BD = boot dips S = Closet for clean boots).

● **Location of the farm.**
Some infectious particles can be spread through the air over short distances. The farm should be far enough away from other farms and other sources of possible infection, such as slaughterhouses and highways along which animal transport travels.

● **Vehicles.**
Trucks entering your farm can easily bring in diseases from their previous destinations. Therefore, it is necessary to clean and disinfect all vehicles and to have a well maintained wheel dip at the farm's perimeter. The vehicle disinfectant should obviously be non-corrosive, in other words it should have a neutral pH.

● **Pest control.**
Entering birds, pet animals, vermin and insects are also effective disease carriers. Therefore, it, is good practice to erect barricades and nets to keep them out. Also implementation of an efficient pest control programme is necessary.

● **Visitors and farm personnel.**
The number of external visitors should 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 enterprises usually provide shower-in facilities and insist that everybody puts on clean coveralls and boots (which preferably do not leave the farm) after showering and washing their 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.

However, location and the infrastructure of the shower zone can have a strong influence on the efficacy of the measurements of personal hygiene, there should be a strict separation of clean and dirty zones.

Continued on page 8

Table 1. Bacterial reductions at North Carolina State University test farms.

House status	Bacteria per inch² (cfus)	Reduction from previous step (%)
Dirty	3,000,000	–
Blown down (air)	2,900,000	3.4
Air out	2,000 000	31
Washed with water	500,000	75
Washed with detergent	100,000	80
Disinfected	<1,000	>99

Continued from page 7

In the pig unit context the dirty zone extends outwards from the farm's perimeter fence. The clean zone is inside the fence and centres on the part where the barns are located.

Regard the changing room for personnel as a hinge between the dirty and clean zones. The staff changing room itself needs to be split into dirty and clean areas.

While the dirty zone of the room is accessed by the dirty zone of the farm, the clean zone room leads out to the farm's clean zone. This internal division can be made by a simple barrier, such as a bench, but ideally has walk-through shower stalls at the edge.

- **Booth dips.**

Cleaning and disinfecting booths should be used before entering the animal houses and compartments. So at the entrance of every house, a footbath should be installed.

The disinfectant should have a broad spectrum to kill all micro-organisms, even in the presence of organic material, be fast working and should retain its activities at lower temperatures and at all pH values (which is not the case with chlorine, for example).

Well formulated and buffered products based on a combination of aldehydes and quaternary ammonia or peracetic acid and hydrogen peroxide normally meet these requirements.

Just as important, is to be sure that not only do you follow the dilution rate advised by the manufacturer, but also that the liquid is renewed regularly. Of course, the bath must contain enough diluted disinfectant, with a depth of at least 10cm.

Internal measures

Internal measures are needed to prevent development and transmission of pathogens within the farm:

- **All-in/all out system.**

Instead of a continuous flow, allow time to clean and disinfect thoroughly after every cycle. That is the only way to ensure that newly arriving animals enter a clean and disease free environment.

- **General hygiene.**

After every cycle, cleaning, disinfection and sanitary stops are essential. A long sanitary stop or 'downtime' will never kill the eggs of worms or coccidia, nor will it eliminate rotaviruses or the bacteria that cause dysenteria.

Cleaning first

Disinfection without cleaning is a waste of money, as it is impossible to disinfect dirt. Dirt harbours micro-organisms, so you may disinfect the outside layer of the dirt, but not kill the bugs inside it.

Cleaning is the removal of the dirt. This part is mainly visible with the human eye, you can see the litter, excrement and mineral scale build-up (caused by calcium or other mineral deposits of hard water). As dirt is a shelter for micro-organisms, many of them can be removed by cleaning.

A study at North Carolina State University (see Table 1) stresses the importance of using detergents (and disinfectants afterwards).

Four factors will determine the functioning of a detergent:

- Chemical energy, pH and concentration. (Alkaline detergents remove proteins and fat; acid detergents remove mineral deposits like scale).
- Thermal energy (fat starts to dissolve from 95°F).
- Physical energy (for example, a high pressure washer).
- Contact time, will enable the chemical energy to do its job. Moreover, it is the only factor that does not cost any energy, it is free of charge.

Therefore, often foam is used instead of a 'classical detergent', since it adheres longer. But today, a new generation of cleaners has been developed in the form of gel (Bio-gel).

Increasing the contact time will allow savings on water consumption, labour and energy, as shown in Fig. 2.

A good cleaning job should allow for an 80% reduction of micro-organisms, generally

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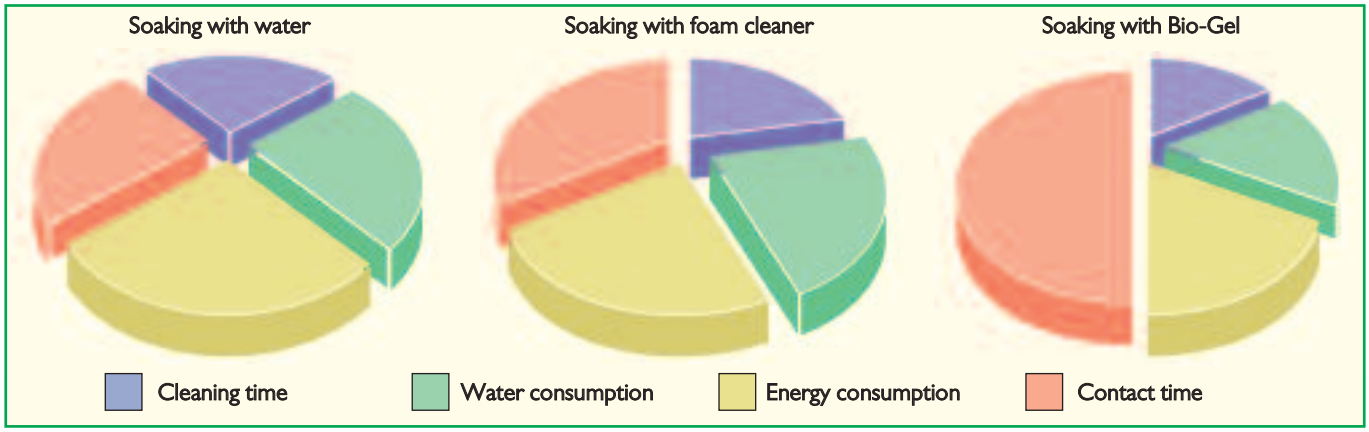

Fig. 2. Results of different soaking methods.

known as a 'sanitised' situation. This will allow the disinfectant to reduce the rest of the pathogens easier.

Disinfecting

After thorough cleaning, terminal disinfecting should be done, in order to reduce the number of micro-organisms, ideally with log4 (99.99%). Therefore, the disinfectant should comply with a number of characteristics. First of all, it should be compatible with the detergent, foam or gel cleaner.

This means that if your cleaning agent contains surfactants, your disinfectant should not contain anionics. (phenols and especially their derivatives like cresolics are known not to be compatible with non-ionic surfactants and cationics like quaternary ammonia). Not only the conscientiousness by which disinfecting is carried out, but also the quality of the disinfectant will determine the result.

Well formulated and contemporary disinfectants comply with a number of characteristics – Composition, Opportunity, Safety and Tested (COST).

● **Composition.**

How many different active ingredients compose the product, so that it assures a maximum synergy? How many grams/L or % active ingredients does the product have?

This concentration will determine the dilution. Not only active ingredients but also buffering, sequestering, wetting, surfacting and stabilising agents will determine the quality of a disinfectant! These ingredients allow the disinfectant to be effective in the presence of organic material, at all pH, in hard water, in cold and warm water, and assures a minimum of two years shelf life.

Is the disinfectant produced by a reliable manufacturer which applies the most stringent quality norms such as ISO and GMP, in order to assure a perfect product.

● **Opportunity.**

Does the product have the full spectrum: bactericide, fungicide, virucide and sporicide? (Be aware of statics, like bacteristatics: they stop their development, but do not reduce their number). Is it also versatile to be sprayed, foamed and fogged without adding any additives, ready to use?

● **Safety.**

Safe for the people (for example, not containing carcinogenic substances like formaldehyde).

Safe for the animals.

Safe for the equipment (not being corrosive on galvanised feeder lines and fans, or aluminium drinker supports).

Safe for the environment (being biodegradable and, therefore, not containing heavy metals such as tin or silver).

● **Tested.**

By international standards such as the new ENE (European Norms-Normes Européennes) and the AOAC (Association of American Chemists, that work with 5% organic load and in 400ppm hard water in order to simulate field conditions) rather than only national standards (such as DEFRA, DVG and AFNOR) that will be replaced by the ENE.

This acronym (COST) is more relevant than the perceived cost: the price per litre. The real COST is the cost in dilution, determined by the concentration and the synergy.

Farrowing hygiene

Pay extra attention to hygiene in farrowing houses, as the better the environment in which the new piglets are born, the better their production start will be!

Besides cleaning and disinfecting the farrowing pens well, make sure that the sow has been treated against mange and lice and washed. For efficient washing of the sow, a shampoo which both cleans and disinfects and also conditions the skin is ideal.

Drinking water hygiene

Not only is cleaning and disinfection of surfaces are important, but your water lines should also be cleaned and disinfected!

Cleaning means removing the scale and the biofilm. The biofilm is a polysaccharide layer, caused by adding vitamins or medication through the water. It harbours mainly enterobacteria (salmonella, E. coli, etc) 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.

In addition, 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. Ideally for pig farms besides cleaning the pipes between the batches, is treating the drinking water with organic acid. Acidifying of drinking water significantly reduces weaning diarrhoea.

Organic acids are preferable to inorganic acids, as the latter, can cause damage, have a bad taste and are relatively toxic. It is also advisable to use a mix of organic acids instead of a single acid, such as acetic acid.

Mixes normally consist of fast dissociating acids, which lower the pH, and slow dissociating acids, which have an anti bacterial and anti-fungal effect. A decreased pH results in a better digestion by activating of enzymes and it also has an inhibiting effect on the growth of pathogenic bacteria. Ideal pH for drinking water of pigs is 5.5-6.0. Do not lower it more, as this will reduce the water intake, and can lead to stomach ulcers.

Also, make sure that the acidifier you are using is stable, works at all pH ranges and preferably also prevents growth of algae in the pipes.

Conclusion

Disinfection and hygiene need to be integrated in a total biosecurity plan. This whole biosecurity plan has to be followed precisely, without skipping a step. So, communication on all levels is an absolute necessity.

Managers and workers need to be trained and informed so that they are aware of all measures, facts and procedures.

And last, but not least, it is important that everybody involved in the production understands the importance of hygiene. Because hygiene is not a cost, but an investment! ■