

## Stop Contamination at the Door in Food Processing Plants

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With a lot of diseases which cause a risk to human health and security, as well as the welfare of poultry being frequently emphasized in the media, the need for biosecurity has become increasingly important nowadays. In a global study of interventions and strategies to reduce *Campylobacter* in poultry farms in 2008, contaminated boots were identified as a reason of *Campylobacter* entering poultry houses.

The study stressed the need for regular replenishment of footbath disinfectants and also indicated to the impact that organic matter can have on the disinfectant's ability. However, this is not the only illness that can be walked on the farm. *Salmonella*, coccidial oocysts and most of the important diseases can use the humble wellington boot as a form of transport. Yet footbaths have almost overlooked in terms of quality assurance.



**Figure 1:** 1- dirty boots 2- rinsed with water 3- disinfected.

This post takes a detailed look at the footbath and offers some simple advice that should improve its efficacy and help to improve biosecurity on the farm. Illness-causing organisms have the potential to survive for a few days - and, at times, even weeks - in soiling on footwear. The use of a footbath can greatly lessen and, hopefully, eliminate these organisms. Failure to do so can be extremely costly if an outbreak of disease appears! To ensure a footbath is effective several key aspects need to be understood.

### Location

The footbath should be placed on a compact surface (concrete or similar, not soil), close to the first point of entry to the site and/or plant to be entered. The direction of passage of the user should be from the less clean area and only pass through to the clean area after dipping to disinfect the footwear.

It may prove useful and prudent to have a tap and brushes nearby so that boots can be washed off before using the footbath. Forgetting to do so can put in danger the efficacy of the disinfectant which can be seriously affected.



*Figure 2*

The area around the footbath should be disinfected at appropriate intervals with a suitable disinfectant to reduce the risk of disease transmission. Footbaths should be clearly signed and highly visible to act as a reminder that they need to be used! A location should be selected so that everyone who goes onto the farm has to pass through, and use, the foot dip. When on the farm it makes common sense to locate additional footbaths at the entrance to each building. The area around the footbath should remain as dry as possible as organisms can and will migrate and disperse in water.

### Suitable footbaths

Makeshift containers of various shapes and sizes, mostly without lids, are commonly seen. Lids keep out rain and dirt and also minimize evaporation. Sunlight can affect the activity of the disinfectant's ingredients, so this is another consideration. This makes the provision of a lid essential. Whatever the container's shape or style, the volume needs to be known and marked to ensure the correct concentration is achieved. To aid safety the footbath should be stable and large enough to enable both feet to be dipped in the disinfectant as part of the stepping-through process.



Figure 3

A new purpose-made and patented design of footbath, footcheck, has recently become available. This allows the user to measure accurately the concentration of disinfectant used. It has a cover to avoid evaporation, or inactivation by sunlight and this also prevents dilution from rain.

It is stable and strong to help prevent accidents and has a label to allow the user to note when the disinfectant was replenished, so aiding HACCP (Hazard Awareness and Critical Control Point) in this much-neglected part of biosecurity.

**How to use footbaths correctly**

Although apparently obvious and simple to use, personal need to know that the footbath is not designed as a footwear washing point! Boots should first be cleaned and then disinfected - the disinfectant needs to come into contact with the organisms to kill them. Best practice would dictate that the idea is to create a 'barrier', with passage of footwear from the potentially contaminated area through to a cleaner area, thus preventing the transfer of organisms and reduce the risk of disease.



Figure 4

### Management/auditing



*Figure 5*

Staff and visitors should be made aware that use of the footbath is obligatory and not optional, as is the need to record what disinfectant is being used, at what concentration and how frequently the contents need to be renewed, and who was responsible for this process. Most quality assurance schemes include a record keeping system for audit purposes. It makes sense to wash the footbath inside and out each time the contents are replenished to remove the dirt and the sediment which accumulates.

If a measuring container is required, this should be accurate and marked. Care should be taken when dispensing chemicals. The manufacturer's recommendations for protective precautions should be adhered to.

Footcheck has integral chambers to measure disinfectant concentrate directly from the dispensing container, improving safety and avoiding ad-hoc guesswork as to the amount of concentrate needed to ensure the right dilution is applied.

Standard Operating Procedures (SOPs) should be in place and staff needs to be made aware that these should be adhered to. As with most things in life if procedures are simple and easy to follow the likelihood of compliance is increased significantly.

### Choosing a disinfectant

This is a whole area in itself and requires some background knowledge to make an appropriate choice and minimize the risk of biosecurity being compromised.

Not all disinfectants are suitable for all purposes. Table 1 provides a general guide and there may be specific disinfectants that differ in some details.

**Table 1** illustrates the range of approved rates under the German Veterinary Industry (DVG) scheme. The German test methodology is useful as a model for footbaths as it requires higher levels of organic matter as part of their test criteria and therefore mimics conditions in which disinfectants will be expected to work when used in footbaths.

### Glutaraldehyde + formaldehyde disinfectants

These are the least sensitive to the presence of organic matter and are ideal for use in footbaths, providing the outside temperature stays above 5°C. A 1% solution in a footbath should be sufficient to protect poultry houses against all viruses, bacteria and fungi.

Disinfectant type	Non - enveloped viruses	Enveloped viruses	Bacteria	Fungi	Sensitivity to Organic matter	Sensitivity Temp. <4°C
Glutaraldehyde + Formaldehyde	1%	1%	1%	1%	😊	😞😞😞
Quat. Ammonium salts	0.5 – 1%	1 – 3%	2 – 4%	2 – 6%	😊😊	😊😊
Chlorocresols (phenol)	4%	2%	0.50%	2%	😊	😊😊
Oxidising disinfectants <i>Winter useful?</i>	0.2 – 1%	0.5 – 3%	1 – 2%	0.5 – 5%	😞😞😞	😊
Iodophores	2%	2%	2%	-	😊😊	😊
Quat. ammonium salts	Not very effective	1%	1%	0.1 – 0.5%	😊😊	😊

**Table 1:** General guide to disinfectants.

### Glutaraldehyde + quaternary ammonium salts

The combination of ‘gluts’ and ‘quats’ as a disinfectant is quite common. Although improving performance at lower temperatures, efficacy against non-enveloped viruses is sacrificed (See quaternary ammonium salts). There are 25 glut/quat disinfectants approved under the DVG test criteria and all would require a footbath concentration of 2 - 6% to be effective against all viruses, bacteria and fungi.

### Chlorocresols

This type of modern phenol works well as a footbath disinfectant and can also be used to help prevent coccidial oocysts being walked into cleaned poultry housing. These disinfectants have to be used at relatively high concentrations of 2 - 4% against viruses but are extremely effective against bacteria at 0.5% even in the presence of high levels of organic matter (test method EN 14349). Some farms have used a chlorocresol disinfectant in the footbath of pullet housing to prevent field strains of coccidial oocyst being walked in and interfering with coccidiosis vaccination.

### Oxidizing disinfectants

This group of disinfectants is sensitive to the presence of organic matter and generally has to be used at a concentration of 1 - 2% in combination, although there are some well known products in this class which should be used between 3 - 5% to ensure complete disinfection. When using oxidizing disinfectants, the operator should make sure that the solution is changed frequently to avoid loss of efficacy. Oxidizing disinfectants are excellent in cold weather, when temperatures are near zero, and can be useful as an alternative to glutaraldehydes and chlorocresols during cold winters.

### Iodophores

Iodophores are not sensitive to low temperatures and have a similar tolerance to organic matter as the glutaraldehyde plus quaternary ammonium salt type disinfectants. Their chemical basis is iodine which tends to discolour materials with which it comes into contact. They have generally fallen out of favour as a mainstream disinfectant. In general, a 2% solution, changed frequently, should provide a useful concentration for a footbath.

### Quaternary ammonium salts

This group of compounds is excellent against bacteria and fungi, but not effective against non-enveloped viruses such as Gumboro virus and chicken anaemia virus. These disinfectants are relatively insensitive to temperature and organic matter, do not usually have a

pungent odour and are excellent in areas where viral kill is not too important i.e. hatcheries and food preparation environments. They are generally used in foot mats rather than footbaths and are effective against bacteria and fungi at low concentrations of 0.5%.

**What concentration of disinfectant should be used?**



**Figure 6**

The preceding paragraphs looked at the various product groups and generalized dilution rates. A quick flick through the literature of disinfectant manufacturers may soon prompt the user to ask some very basic and important questions, such as “Why is the manufacturer recommending a concentration which is lower than the DEFRA approval rate?” This is a good question which is almost never asked!

Let’s select a widely available disinfectant to illustrate the point. The product is promoted to the farmer at a concentration of up to 0.5%. The DEFRA approval for the product indicates that it should, ideally, be used at 2% in the UK poultry industry. Under the German DVG testing criteria, the product should be used at 3% to kill all microorganisms.

So, if the product in question was used according to the manufacturer’s recommendations, it would be ineffective against all bacteria, viruses and fungi under the test conditions set by DEFRA and the DVG. It simply would not work effectively and may put the farm’s biosecurity at risk! Another interesting approach used by some manufacturers is to say that the products have been tested by an independent laboratory.

Unfortunately, this does not mean anything, unless the independent laboratory is testing the product according to official government protocols and the laboratory is accredited to do such tests by the approval bodies. So, the rules are:

- Always use disinfectants as if there is a real disease threat on the farm.

- Always use the concentration recommended by the approval body in the country of manufacture (if in the EU) or trust the European Norm (EN) tests. Better still, use the officially approved rate in the country of use. In the UK DEFRA is the official approval body.
- If using a disinfectant that is sensitive to organic matter, double the normal concentration when using it in footbaths.
- Change the disinfectant in the footbaths regularly, especially if it is sensitive to organic matter.
- If the temperature falls below 4°C on a regular basis and a glutaraldehyde-based product is being used, increase the concentration, or change to a product group that is insensitive to low temperatures.

(Note: the DEFRA listed products are tested at 4°C and will work in 30 minutes at this temperature).

### When should disinfectant be renewed in a footbath?

The simple answer is 'nobody knows!' It depends upon the amount of organic matter which has ended up in the footbath, the type of disinfectant used, whether the footbath has a cover and whether the disinfectant has been further diluted by rain or affected by sunlight. Even the water quality used to fill the footbath may affect the efficacy of the disinfectant.

Some manufacturers will offer a strip of paper that is sensitive to pH change to enable users to see if the disinfectant is still useable. At best this will only tell the user the pH of the footbath, and nothing else. The pH of the disinfectant is meaningless unless extensive tests have been carried out by the manufacturer to show how pH affects the disinfectant's ability to pass the DEFRA tests.

There would also have to be tests using different water qualities and alkalinities. The only reliable way to maintain effective biosecurity using a footbath is to ensure that the correct concentration of disinfectant is used in the footbath and that it is changed regularly [1-3].

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