STORING CHEMICALS SAFELY

By Dr Jenny Ekman

The contents of a chemical shed is not unlike someone's garage. A messy garage gives a different message from one that's swept, with neatly ordered tools and equipment, not unlike sheds for storing chemicals.

A chemical shed may not be the most glamorous, action packed or exciting place on farm, but it can certainly give a strong impression as to how the business is run.

A well-kept, clean, and orderly chemical shed suggests a clean and orderly business. An auditor encountering a dirty, disorganised shed may well expect other aspects of the food safety system to be likewise, viewing the business through red – as opposed to rose – tinted glasses.

Compared to some other horticultural businesses, mushroom farms are light chemical users. There might be some herbicide to keep the weeds down around the property, insecticide to manage flies, and a few specific products for weed mould. And, of course, salt for disease management.

However, it is cleaners and sanitisers where many farms will have a large volume of chemicals. High standards of farm hygiene are not only essential to keep mushrooms free of human pathogens, but also to control pests and disease. Keeping farm equipment and facilities clean and sanitised is clearly core business.

It is easy to become casual about cleaners and sanitisers. Most people have a bottle of bleach in their laundry, tablets for a dishwasher and alcohol-based hand sanitiser somewhere around the house. However, in their concentrated form all of these are powerful chemicals.

Powerful cleaning agents such as 'truck wash' and other detergents act by lowering the surface tension of water, allowing it to bind more easily with dirt and grease. They can be either alkaline or acidic. Some products can contain formaldehyde. Care should always be taken to avoid contact with eyes, mouth and skin.

Sanitisers work by reacting with organic compounds. Organic compounds include human pathogens such as E. coli, fungal spores like Trichoderma, compost and algae. Human skin, eyes and lungs are also organic compounds. While sanitisers are safe once diluted, in their concentrated form they can adversely affect the human body very fast indeed. They are also corrosive to equipment, especially at strong concentrations.

Oxidiser or corrosive?

Some sanitisers, such as hydrogen peroxide and calcium hypochlorite granules, are powerful oxidisers. They can release toxic gases if they contact other chemicals, as well as potentially increase the risk of a fire or explosion.

Other sanitisers are corrosive. Sodium hypochlorite (bleach) is a corrosive chemical. Concentrated bleach can burn skin, causing red welts. Inhaling the vapour can burn the eyes and throat, while any contact with the eyes requires urgent medical attention. Some people are allergic to chlorine, or develop allergies after repeated exposure.

Even dilute sodium hypochlorite reacts with skin – the "soapy" feeling you get after contacting bleach is due to a reaction between sodium hypochlorite and the natural oils on your skin.

Figure 1. Chemical stores should separate sanitisers from pesticides with products stacked on shelving - not piled on top of each other.

Like many cleaning agents, sodium hypochlorite is highly alkaline. Contact with an acid releases poisonous chlorine gas, which can burn eyes, throat and lungs, and generates heat, leading to the potential for fire or explosion.

Simply adding water to concentrated bleach also triggers the formation of chlorine gas. This is why concentrated bleach should ALWAYS be added to water; NEVER add water to bleach.

Tips for storing sodium hypochlorite

- Store below 20°C in airtight containers; high storage temperatures can lead to release of oxygen, resulting in build-up of pressure and increased possibility of spills.
- Ensure the shed is well ventilated and weatherproof.
- Install bunding around the edge of the store to capture any leaks or spills, with the volume sufficient to retain the entire volume of the largest container stored (e.g. 20L drum).
- Never store liquid bleach above dry products, such as calcium hypochlorite.

Another sanitiser likely to be found on many mushroom farms is San-I-Mush. San-I-Mush is registered for a wide range of purposes, including sanitising growing trays, walls, and floors.

San-I-Mush is a mixture of iodine, agents to make iodine soluble in water, and 85% phosphoric acid. Iodine is a potent sanitiser against most microbes, including bacteria, yeasts, and moulds. It is most effective when combined with an acid, and San-I-Mush has a pH of approximately 3. It is therefore important not to mix San-I-Mush with alkaline cleaner or bleach.

Quaternary ammonium compounds (Quats) may also be sometimes found on mushroom farms. These are highly effective at killing bacteria, fungi, and viruses. They can disinfect water and control algae and are included in many household detergents and all-purpose cleaners.

While they can be used very safely, they must NEVER be ingested. Quats are poisonous if absorbed by skin contact, inhalation of fumes or eye exposure. Equipment sanitised with quats should be washed down with clean water.

Both Quats and San-I-Mush need to be stored below 30°C and out of direct sunlight.

Sanitisers need to be kept separately to pesticides and other chemicals, including fertilisers and other nutritional amendments. Ideally they should be separated by a wall dividing the shed, or stored in a different shed altogether.

A good chemical shed

The shed itself

- Lockable, with appropriate signage (e.g. flammable, toxic)
- Fire and weather resistant, so as to keep products away from direct sunlight and as cool as possible
- Well ventilated, preferably with cross flow as well as a roof exhaust vent
- Bunded floor, with enough capacity to contain 25%

of the total volume or 100% of the largest drum of liquid

- Strong metal shelving, so that drums don't need to be piled on top of each other

Inside and around the shed

- Emergency plan with contact numbers on shed wall or door
- Fire extinguisher
- Spill kit with absorbent material, as well as broom, mop and other cleaning items
- First aid kit, safety shower and eyewash station

In the office

- File containing Safety Data Sheets for all stored chemicals (never store in shed)
- Extra copy of emergency plan with contact numbers

Stored products

As previously stated, sanitisers should be kept separately from other chemicals. Separate flammable materials from non-flammables and keep them away from materials that burn easily – like oil or cardboard.

Liquids should be placed below any solid products, such as granules.

The shed should be organised so that herbicides, insecticides and fungicides are placed on different shelves or racks, preferably labelled to make it easy for staff to find the correct product.

Products must always be stored in their original packaging with label intact: NEVER decant into unlabelled containers, especially ones that were previously used for food or drink.

If you have any highly toxic or flammable chemicals, they need to be stored in a purpose-built metal cabinet.

A regular stocktake is important to identify and remove products that are past their use-by date, or with

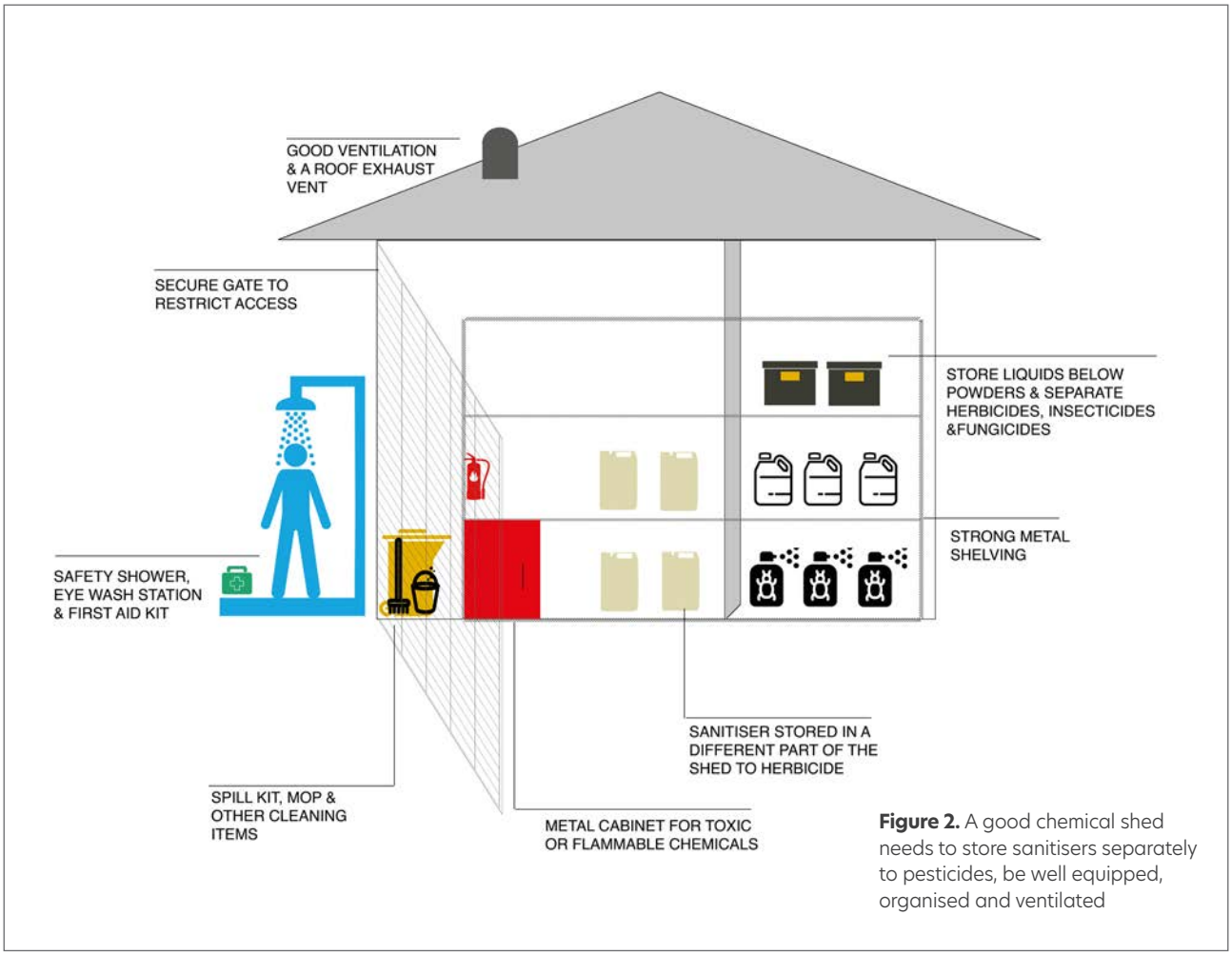

Figure 2. A good chemical shed needs to store sanitisers separately to pesticides, be well equipped, organised and ventilated

packaging that is starting to rust or leak. It is also useful to know what is in there and how much, so that more can be ordered as needed.

A good mixing area

Storing the chemicals safely is one thing, preparing them for use is another. A specific area should be set up for mixing chemicals, whether inside the shed, or next to it. Designing this properly will make everyday tasks faster and easier, such as mixing solution to replenish foot baths, or preparing spray bottles with sanitiser.

The area used for mixing chemicals needs to be covered, well ventilated but also not too breezy; pouring chemicals in a blustery wind is a recipe for disaster.

The mixing bench needs to have an impervious surface, such as metal or glass, rather than a wooden surface that can absorb spilled chemicals. It needs to be well separated from the packing area and away from drains or waterways.

The mixing area should be equipped with;

- Clearly labelled measuring containers for each product used regularly
- A calibrated balance with protective cling wrap or foil, that can be easily changed
- Good lighting
- Personal protective equipment (PPE) that includes goggles, rubber gloves and a washable apron, as well as a respirator if volatile and hazardous chemicals are being prepared
- Cleaning wipes in case of spillage

It is clearly essential that staff involved in mixing chemicals (and applying) are properly trained. Providing clear, written instructions on dilution rates and mixing is the best way to ensure chemicals are used properly.

For example, mixing up a sprayer with 200ppm bleach could state:

1. Put on gloves and safety glasses
2. Fill backpack unit with water to the 10L mark
3. Carefully measure out 32ml of bleach (12.5% sodium hypochlorite) from a drum using the yellow funnel and small measuring jug labelled "bleach only"
4. Add bleach to backpack unit
5. Fill backpack unit with water to the 20L mark
6. Secure cap

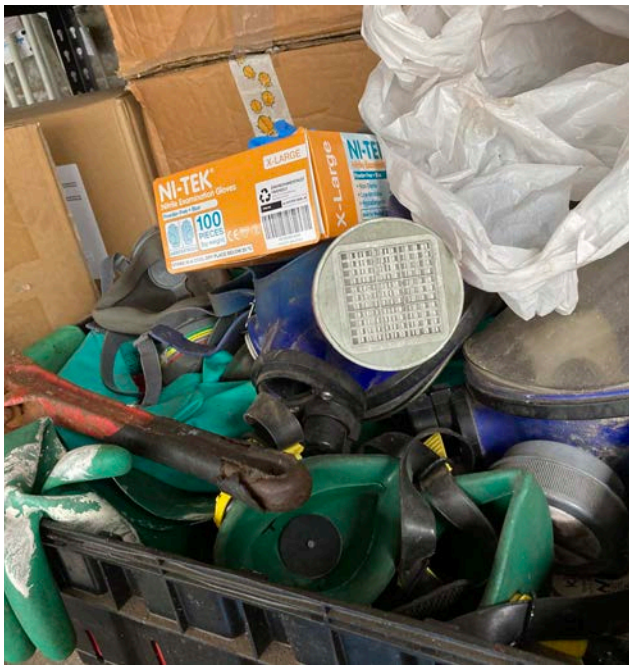

Figure 3. PPE should be kept in good condition and stored in a specific area so it is ready to use.

This can be combined with a full work instruction sheet, as in the example shown in the breakout box for foot bath maintenance.

Staff need to understand what to do if a spill occurs or they have accidental contact with a concentrated chemical. It is essential they don't eat, drink or smoke while mixing sanitisers or pesticides. They should also try to mix only what is needed, as unused chemical needs to be disposed of safely – it can't just be tipped down the drain.

In some locations, empty drums of regularly used products such as bleach can be recycled directly. However, most containers need to be triple washed before collection under the DrumMUSTER programme. DrumMUSTER will not accept containers that still have residues on either the inside or outside, including the thread and cap.

The best time to rinse the empty container is when preparing the same chemical, as the rinse water used can be added to the spray tank during mixing.

Example - Foot mat maintenance

Top up disinfection mats daily and fully replace solution weekly.

Each Monday morning - Collect disinfection mats (total three) and take to the bunded wash down bay at the rear of the facility. Brush down mats to remove adhering soil then wash thoroughly using the hose provided, rinsing until the water runs clear. Allow mats to drain for 30 minutes then return them to their locations in front of entry doors.

Put on gloves, safety glasses and protective boots.

Mix a solution of SAN-I-MUSH according to the label directions (60ml/5L) e.g. Measure out 72ml (using the measuring cup labelled "SAN-I-MUSH only"), add to 6L water inside the watering can (labelled "SAN-I-MUSH only"), then mix well using the plastic stirring stick. Use the solution to fill one disinfection mat. Repeat with the two remaining mats.

Each other morning - Mix a solution of SAN-I-MUSH as previously, adding 6L water to the watering can (labelled "SAN-I-MUSH only") then adding 72ml of SAN-I-MUSH and mixing well using the plastic stirring stick.

Add sufficient solution to each disinfection mat so that it is fully hydrated: Note that each mat can hold up to 6L of disinfectant solution. Leftover solution can be left in the watering can and used as needed.

In summary

Good hygiene is the number one defence against mushroom diseases, as well as ensuring food safety. While physical measures such as cookout are important, thorough cleaning followed by sanitation is essential to keep crops healthy and clean.

However, detergents and sanitisers need to be treated with respect. It is easy to become complacent, but these are powerful chemicals, especially in their concentrated form. It is important they are stored correctly. This ensures that they don't present a danger to staff or equipment as well as preserved in active condition.

Sanitisers and detergents need to be kept separated from pesticides, such as those used to control flies or weed moulds. Providing proper equipment and facilities to store and mix chemicals, as well as clear instructions to staff, will ensure they are mixed and applied correctly.

A well-kept chemical shed can therefore help keep staff safe and auditors happy.

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