Sanitisation, disinfection and sterilisation in veterinary practice

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Scarcely a day goes by nowadays without some headline in the press about MRSA (Methicillin resistant Staphylococcus aureus) and hospital hygiene. This has had an impact on the veterinary profession because MRSA has been isolated from dogs on occasions. It has further been suggested that companion animals may constitute a reservoir of infection for humans.

Veterinary hygiene has been a neglected subject in recent years but with increasing emphasis on biosecurity on the farm and practice accreditation, it is important that veterinary surgeons are familiar with the general principles of sanitisation and disinfection and their implementation.

Sanitisation is the establishment of conditions favourable to health, especially with respect to infectious diseases. It includes the disposal of infective materials - e.g. carcases, excreta, etc.; general cleaning to make the application of disinfectants effective; isolation of infected animals and improvement of hygiene and ventilation.

Disinfection is the removal and destruction, or inactivation, of micro-organisms by way of physical or chemical means. Disinfectants are often the subject of legislation and orders relating to specific diseases and approved products must have passed rigorous testing on the basis of European standards and protocols (Centre de European Normalisation: CEN).

Sterilisation implies the complete destruction of micro-organisms. Many different types of antimicrobial agents are available, serving a variety of purposes, but not all are used in the field of veterinary disinfection. In veterinary practice, chemical agents provide the most widespread means of disinfection, though physical methods are also used in the surgery.

Factors influencing the activity of disinfectants

(a) Concentration of the agent

A knowledge of the effect of concentration on antimicrobial activity is essential in the evaluation of disinfectants and the actual usage in practice. Some compounds are less influenced by dilution, whereas others may require a marked increase in time to achieve comparable results.

TABLE 1. Characteristics of an ideal disinfectant

- rapidly toxic to a wide range of micro-organisms at room temperature - vegetative bacteria, bacterial and fungal spores, acid-fast bacteria, rickettsia, chlamydophila, viruses and coccidia.
- unaffected by environmental factors - organic matter, soaps or detergents, pH, temperature and relative humidity
- non-toxic for animals and man
- non-corrosive
- capacity to penetrate, preferably with a detergent action
- stable both when concentrated and diluted
- water soluble and unaffected by hard water
- either colourless or non-staining
- odourless
- homogeneous both when concentrated and diluted readily available, economical and easy to use

(b) Number and location of micro-organisms

It is easier for a disinfectant to be effective when the number of micro-organisms is low. Thus, adequate cleaning is an important prerequisite to the disinfection process, and cleaning implies the removal of dust- often difficult in farm buildings in which some bacteria can survive for long periods. It is also important to remember that ineffective cleaning may make the situation worse by spreading micro-organisms to other areas and prolong their survival. The presence of an aqueous environment is usually considered as being essential for chemical disinfection. Dried films of organic matter such as blood, excreta, etc., may prevent the penetration of a disinfectant.

(c) Temperature

The activity of a disinfectant is usually increased when the temperature at which it is acting is increased.

(d) Environment pH

pH can influence the activity of microbial agents in a number of ways. Some compounds, e.g. phenols, hypochlorites and iodine, may show decreased activity as pH increases, whereas quaternary ammonium compounds, acridines and glutaraldehyde may show an increased activity.

(e) Organic matter

Organic matter is one of the most important environmental factors influencing the activity of disinfectants, though some compounds (e.g. hypochlorites) are more affected than others (e.g. phenolics).

(f) Water hardness

The activity of QACs and iodophores may be reduced on dilution with hard water.

(g) Type of organism

Different micro-organisms pose different problems in relation to their sensitivity to disinfectants, e.g. few disinfectants are sporicides and problems have been encountered when disinfecting transmissible spongiform encephalopathy contaminated material.

Functional facilities and procedures

Buildings and equipment should be adapted according to the procedures being carried out and the floors, walls, etc., should be of impervious material that allow complete sanitisation. In the surgery separate rooms should be provided for "clean" and "dirty" procedures.

Clean protective clothing should be provided for staff and worn at all times. Fans should be extracting and connected to a filter system.

Both Standard Operating Procedures (SOPs) and Control of Substances Hazardous to Health (CoSHH) requirements should be in place and the monitoring of hygiene procedures and staff training on a regular basis is recommended.

Hazard-Analysis Critical Control Point (HACCP) principles are widely used in the food industry and abattoirs and are worthwhile considering especially during animal production and in veterinary hospitals. Having such procedures in place may be advantageous in cases of litigation.

The choice of a particular substance is dependent on the surrounding circumstances and should be based on a careful risk assessment of the biological agent and the material to be disinfected. Some factors such as toxicity to animals and personnel, efficacy of the product and corrosive activity on fabric and equipment are important considerations, as are the cost and shelf life of the product and its stability.

In the cases of notifiable diseases, reference to the appropriate legislation regarding the choice of disinfection is necessary. It should also be remembered that bacteria may develop resistance to some classes of disinfectants, and it is advisable to change disinfectants at intervals (QAC resistance in some MRSA was reported in 1983!).

Disinfection may be achieved by physical and chemical means, though the former is more limited in veterinary practice. Boiling or the use of pressurised steam in the autoclave may be used in the veterinary surgery, though it should be remembered that boiling will not kill bacterial spores. Ultra-violet light may be used in some areas, but it does not penetrate glass and prolonged exposure may result in damage to the eye and skin. The chemical compounds that may be used are shown in **Table 2.**

Conclusions

Disinfection/sanitisation is an important part of veterinary practice, whether it is on the farm or in the veterinary surgery. It is time-consuming to achieve good results and it should be remembered that though a surface may look clean, unless the procedures are done thoroughly and correctly, such surfaces may still harbour pathogens.

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TABLE 2. Chemical compounds that may be used

Classes	Activity spectrum	Comments	Incompatibility
Phenols (e.g. Phenol, Cresol)	B T (F) (cV)	Stable component Relatively good activity in the presence of organic material; Strong odour (coal-tar derivate); Toxic to skin, eyes and respiratory tract; Very toxic to cats and reptiles. Does not stain surfaces or leave residual odour; Commonly used for stable sanitisation & foot baths	Do not use in the presence of strong oxidising agents; Can modify rubber and synthetic materials
Aldehydes (e.g. Formaldehyde Glutaraldehyde)	B, T, F, S, cV, uV	Reducing agent; Readily volatile Relatively unstable Carcinogenic; Irritates eyes and airways; Deactivates DNA and RNA proteins; Effective in any temperature and hardness of water Effective even in the presence of organic material	Poor protein load tolerance Impurities on surfaces may lead to unsuccessful disinfection; Do not mix with other cleaning products or disinfectants
Chlorines (Sodium hypochloride)	B, (T), (F), (S), cV, uV	Corrosive; Sensitive to organic Substances; Relatively unstable Much more active in warm as opposed to cold water; Irritant to skin Relatively inexpensive	Toxic gases form if mixed with acids Irritating fumes; In high concentrations caustic to tissues and equipment; Can produce carcinogenic by-products
Iodophors	B, T, F, S, cV, uV	Ineffective if contaminated with blood and organic substances; May cause hypersensitivity; Often used on equipment surfaces and in water and on wounds; Very low toxicity; Stains materials and porous surfaces; Long shelf life	Incompatible with mercury compounds, metals and quaternary ammonium compounds
Quaternary ammonium compounds (Benzalkonium chloride)	B, (V), (cV)	Sensitive to organic substances; Many quaternaries also function as detergents, Inactive towards certain Gram-negative bacteria	Quaternary ammonium compounds precipitate in the presence of anionic derivatives (e.g. soap, detergent) This minimises their effectiveness.
Alkali (Sodium hydroxide)	B, T, F, cV, uV	Neutralises an acid to form a salt	Ammonia forms when in contact with ammonium compounds
Chlorhexidine	(B)	Non toxic if applied to the skin or mucous membranes (used in solutions for wound and antiseptic); Non corrosive	Synergistic effects with alcohol; Affected by organic compounds
Alcohol (Ethanol)	B T, F, cV	Only effective before evaporation; Sensitive to organic substances; Low cost; Effective against many pathogens if contact time long enough; Ethanol most effective as 70% solution	Synergistic effects with iodine, chlorhexidine and quaternary ammonium compounds; Long contact time; Not all alcohols have disinfecting properties; Fire hazard from fumes May dissolve synthetic surfaces
Amines (e.g. Quaternary amines)	B, T, F, cV, uV	Synergistic mechanism of quaternary amines and alcohols causes irreversible cell damage; Used as a general cleaner, ultrasonic cleaning solution, and sometimes for instrument immersion	Not compatible with aldehydes (no such products should be used before or after treatment) No tuberculocidal activity
Peroxide (e.g. Hydrogen peroxide, Peroxygen compounds)	B, T, F, cV, uV	Less corrosive than iodine and chlorine compounds	Toxic gases form when in contact with chlorine and bi-sulfites; Dilute always by adding acid to water; Exothermic reactions with lyes Breaks down very quickly when contaminated with impurities especially heavy metals

B=bactericidal, T=tuberculocidal, S=sporicidal, cV=coated viruses, uV=uncoated viruses