Sanitisation, disinfection and sterilisation in veterinary practice

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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.

(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.

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, chlamyphila, 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.
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 boiling will not kill bacterial spores. Effective in any temperature and hardness of water Effective even in the presence of organic material

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.

TABLE 2. Chemical compounds that may be used

<table>
<thead>
<tr>
<th>Classes</th>
<th>Activity spectrum</th>
<th>Comments</th>
<th>Incompatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenols (e.g. Phenol, Cresol)</td>
<td>B, T, F, i(V)</td>
<td>Stable component in the presence of organic material; Strong odour</td>
<td>Do not use in the presence of strong oxidising agents; Can modify rubber and synthetic materials</td>
</tr>
<tr>
<td>Aldehydes (e.g. Formaldehyde, Glutaraldehyde)</td>
<td>B, T, F, S, cV, uV</td>
<td>Reducing agent; Readily soluble</td>
<td>Poor protein load tolerance Impairments on surfaces may lead to unsuccessful disinfection. Do not mix with other cleaning products or disinfectants</td>
</tr>
<tr>
<td>Chlorines (Sodium hypochloride)</td>
<td>B, (T), (F), (S), cV, uV</td>
<td>Corrosive; Sensitive to organic substances</td>
<td>Toxic gases form if mixed with acids; Irritating fumes; Can produce carcinogenic by-products</td>
</tr>
<tr>
<td>Iodophors</td>
<td>B, T, F, S, cV, uV</td>
<td>Ineffective if contaminated with blood and organic substances</td>
<td>Incompatible with mercury compounds, metals and quaternary ammonium compounds</td>
</tr>
<tr>
<td>Quaternary ammonium compounds (Benzalkonium chloride)</td>
<td>B, (V), i(V)</td>
<td>Sensitive to organic substances; Many quaternaries also function as detergents, inactive towards Gram-negative bacteria</td>
<td>Quaternary ammonium compounds precipitate in the presence of amionic derivatives (e.g. soap, detergent) This minimises their effectiveness</td>
</tr>
<tr>
<td>Alkali (Sodium hydroxide)</td>
<td>B, T, F, cV, uV</td>
<td>Neutralises an acid to form Ammonia forms</td>
<td>Ammonia forms when in contact with ammonium compounds</td>
</tr>
<tr>
<td>Chlorhexidine</td>
<td>B</td>
<td>Not toxic if applied to the skin or mucous membranes</td>
<td>Synergistic effects with alcohol; Affected by organic compounds</td>
</tr>
<tr>
<td>Alcohol (Ethanol)</td>
<td>B, T, F, cV</td>
<td>Only effective before evaporation; Sensitive to organic substances; Low cost; Effective against many pathogens if contact time long enough; Ethanol most effective at 70% solution</td>
<td>Synergistic effects with isode, chlorhexidine and quaternary ammonium compounds; Long contact time; Not all alcohols have distressing properties; Fire hazard from fumes May dissolve synthetic surfaces</td>
</tr>
<tr>
<td>Amines (e.g. Quaternary amines)</td>
<td>B, T, F, cV, uV</td>
<td>Synergistic mechanism of quaternary amines and alcohols causes irreversible cell damage; Used as a general cleaner, ultrasonic cleaning solution, and sometimes for instrument immersion</td>
<td>Not compatible with aldehydes (so such products should be used before or after treatment) No tuberculosis activity</td>
</tr>
<tr>
<td>Peroxide (e.g. Hydrogen peroxide, Peroxogen compounds)</td>
<td>B, T, F, cV, uV</td>
<td>Less corrosive than iodine and chlorine compounds</td>
<td>Toxic gases form when in contact with chlorine and bi-</td>
</tr>
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</table>