

CLEANING AND DISINFECTION



BASICS

OVERVIEW

- Cleaning and disinfection are two distinctly different processes, both essential for animal health and high quality production
- This chapter will focus on the importance of establishing an effective, consistent cleaning protocol and the correct application of disinfectant agents to maximize the inhibition of pathogenic organisms within the production facility.

SIGNALMENT

Species--All ruminant species

AGENTS OF DISEASE

- Viruses (enveloped and non-enveloped viruses)
 - Examples:
 - Enveloped viruses: BVD, IBR, PI3
 - Non-enveloped viruses: Bluetongue, Papillomatosis, FMD
- Bacteria – (e.g., *Salmonella* spp, *E. coli*, *Mycoplasma* spp., *Staphylococcus* spp, *Streptococcus* spp.,)
- Protozoa – (e.g., *Cryptosporidium parvum*)
- Fungi -- (e.g., Cryptococcosis, Histoplasmosis)
- Many of these disease agents can be transmitted by fomites, vectors, animal droppings, etc.
 - hands, needles, multi-dose syringes, ear taggers, tattooers, boots, coveralls, nose-tongs, halters, sleeves, feed buckets, feed-hauling equipment, rodents, birds (droppings)
- To reduce the possibility of disease transmission:
 - Clean and disinfect equipment between animals and farms
 - Clean table/truck/tires between farms
 - Clean boots/coveralls between farms
 - Wash hands effectively regardless of whether or not gloves have been used
 - Effective hand-washing per CDC guidelines:
 - Wet hands with clean running water
 - Use soap (any kind)
 - Scrub palm, dorsum and all interdigital spaces
 - Rinse with running water
 - Dry hands with clean towel (turn off water with towel)
 - The entire process should take 40-60 seconds

- Effective cleaning includes the removal of all gross debris and organic matter. Most disinfectants are inactivated in the presence of gross debris.
- Clean in a methodical manner so as to not re-contaminate the surface
 - Example: back to front, top to bottom, inner to outer (tires)
 - The manner chosen is not as important as consistency
 - Training of farm/veterinary personnel is imperative
 - Written protocols are helpful

THE USE OF DISINFECTANTS

- Use the right product concentration for the right contact time.
- Most products are inactivated with too much manure or blood.
- The solutions may need rejuvenation to be effective.
- Disinfectants vary in their ability to kill different kinds of disease agents.
- Pay attention to storage requirements; read labels carefully
- Ensure appropriate Personal Protective Equipment (PPE) are available and in good working order per manufacturer specifications.
- Obtain and store all Safety Data Sheets (SDS) in an easily retrievable format
 - Ensure all SDS are available in both English and the language most readily spoken by employees of the production operation.

Types of Disinfectants

Alcohols	Aldehydes
Acids/alkalines	Halogens: iodine/chlorine
Quaternary ammonium	Chlorhexidine (an antiseptic)
Phenolics	Peroxides

Acids and Alkalines

- Alters the pH and enzyme activities of microbes.
- Can be very caustic.
- Examples include: muriatic acid, acetic acid, and sodium hydroxide (NaOH).
- Acetic acid at 4-5% (vinegar is 4%) can be effective against FMD virus.
- Sodium hydroxide (lye) at 2% can be effective against FMD virus. Add 2.7 oz lye to 1-gallon water.

Ammonia

- A single ammonium compound
- A 5% solution has some activity against *Cryptosporidium parvum*.

Alcohols

- Kill bacteria and enveloped viruses at many different concentrations.
- No action against spores or non-enveloped viruses.
- Require time to work.
- Limited activity in presence of organic matter.
- Damage to rubber and plastics, rapid evaporation and are flammable.
- Irritation to skin with prolonged contact

Aldehydes

- Wide germicidal spectrum.
- Slight to moderate residual activity.

- Effective in presence of organic matter.
- Irritating formaldehyde fumes, must be mixed properly, possible carcinogen.
- Examples: formaldehyde, glutaraldehyde.

Chlorhexidine

- Bactericidal, virucidal, fungicidal, not effective against spore-forming bacteria.
- Ineffective against some important species.
- Maintains effectiveness in presence of organic material.
- Inactivated by hard or alkaline water.
- Some residual activity but must remain in contact for 5 min.
- Some examples: Nolvasan®, Chlorhex®, Chlorasan® solution.

Halogens

Iodine and Iodophors

- Iodophors are combinations of elemental iodine and a substance that makes the iodine soluble in water.
- Iodophors are effective against bacteria, fungi, and many viruses.
- Not very sporicidal.
- Act to denature proteins.
- Least toxic
- Inactivated in presence of organic material. Must have color to be potentially active.
- Requires prolonged contact. Poor residual activity. Can stain clothing and porous surfaces. Examples include: Betadine®, Povidone®, Weladol®, One Step®

Chlorines (e.g. chlorine bleach)

- Can eliminate both enveloped and non-enveloped viruses, fungi, and bacteria. Not effective against spores.
- Good, fast-acting disinfectants on clean surfaces, but quickly inactivated by dirt and manure. Inexpensive.
- More active in warm water than in cold water.
- Available chlorine is taken up by organic material. Therefore, often valuable to disinfect at least twice with this compound. No residual activity.
- Irritating to skin and corrosive to metal. Fumes are irritating.
- Examples: Clorox®, Chloramine-T®, and Halazone®.
- Sodium hypochlorite (NaOCl) or household bleach (stock concentration 5.25 percent available chlorine) is effective against most viruses at a concentration of 0.1 percent. Add 30 cc (ml) (or about 1/8-1/2 cup) of household bleach into a gallon of water or 1 gallon of bleach plus 50 gallons of water. A 3% solution is recommended for FMD virus (2 gallons of chlorine bleach to 3 gallons water).

Oxidizing Agents

- Hydrogen peroxide and other oxidizing agents like peracetic acid and propionic acids or acid peroxygen systems.
- Active against bacteria, bacterial spores, viruses, and fungi at quite low concentrations.
- These agents work better at higher temperatures
- Retain more activity in the presence of organic material than iodine or chlorine-containing disinfectants.
- Good activity against anaerobes. Not effective against spores.
- Ineffective in presence of organic matter

- Examples include: hydrogen peroxide; Virkon S® is a combination of peroxides and an organic acid with a pH 2.6.
- Virkon S® at 1% is labeled as being effective against FMD virus and is effective against *Mycobacterium avium paratuberculosis* – Johne's disease. Solution is stable for about 7 days.

Phenolics

- Phenols are coal-tar derivatives and turn milky in water. Phenols are effective antibacterial agents, and effective against enveloped viruses.
- Work better at higher temperatures
- Retain more activity in the presence of organic material than iodine or chlorine-containing disinfectants.
- Not effective against enveloped viruses and spores.
- Not compatible with detergents, limited residual activity and can cause tissue irritation.
- Examples include: Environ®, One-Stroke®, Lysol®, Pine-Sol®, Cresi-400®, Discan®, and Tek-Trol®

Quaternary Ammonium Compounds

- These agents are bactericidal, virucidal (enveloped viruses) not sporicidal, limited fungicidal.
- Generally odorless, colorless, non-irritating, and deodorizing.
- Have some detergent action, and are good disinfectants.
- Some inactivated in the presence of some soaps or soap residues and hard water salts.
- Antibacterial activity reduced in presence of organic material.
- Has some residual activity; non-corrosive.
- Examples include: Roccal®, Germex®, Zephiran®.

Natural Disinfecting Agents

Sunlight, heat, cold, drying (desiccation) and agitation can also serve to reduce pathogen loads in the environment.

PRECAUTIONS

Milk and meat withdrawal times must be observed for animals or animal products exposed to disinfecting agents.

ZOONOTIC POTENTIAL

- Many disease-causing agents are zoonotic therefore caution must be exercised during the diagnostic and treatment phases. Additionally care must be taken in the disposal of potentially infected tissues or fluids as well as with the cleaning process itself (e.g., aerosolization, contact with breaks in the skin, eyes, etc.)
- Personnel training in the potential for zoonotic disease transmission should be a part of best management practice for all livestock operations.

BIOSECURITY

Cleaning and disinfection protocols are essential elements to biosecurity.



MISCELLANEOUS

SEE ALSO

Biosecurity: Beef Cow/Calf (www.fiveminutevet.com/ruminant)

Biosecurity: Cervidae (www.fiveminutevet.com/ruminant)

Biosecurity: Dairy (www.fiveminutevet.com/ruminant)

Biosecurity: Goats (www.fiveminutevet.com/ruminant)

Biosecurity: Research Herds (www.fiveminutevet.com/ruminant)

Biosecurity: Sheep (www.fiveminutevet.com/ruminant)

ABBREVIATIONS

BVD: bovine viral diarrhea

IBR= infectious bovine rhinotracheitis

PI3= parainfluenza type 3

NaOH = Sodium hydroxide

FMD= foot and mouth disease

NaOCL= Sodium hypochlorite

PPE=Personal Protective Equipment

SDS=Safety Data Sheet

SUGGESTED READING

Centers for Disease Control and Prevention. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. MMWR 2002; 51(No. RR-16)

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