

On-Farm Selection and Use of Disinfectants
Mel Pence DVM, MS, PAS, Diplomate ABVP (beef cattle)
University of Georgia, College of Veterinary Medicine

There are numerous products available for use as disinfectants on the farm. Many of the products are quite effective if used properly. The selection of the appropriate product will depend on the type of bacteria or virus you are trying to kill or reduce the numbers, the amount of organic material present, safety of the product, and cost. **All disinfectants have a reduced activity in the presents of organic material like manure. To be effective manure must be removed.** The tried and true method of scoop shovel to get the big pieces then scrub with soap and water, rinse and let dry is the most effective. Only after that will disinfection be effective. Once the area is dried apply the disinfectant and let it stand. Most disinfectants need to be in contact with the bacteria or virus for some period of time to work, so do not rinse off the disinfectant just let it dry. For general farm, trailer, and equipment use the chlorhexidine compounds like Nolvasan, Chlorhex, Chlorasan, and Virosan are a good compromise between effectiveness, safety and cost. **To clean a dirt floor pen or lot the best procedure is to first remove all of the manure possible then apply lime to the surface.** Lime changes the ph of the soil and makes it difficult for many bacteria to survive. This will not eliminate the bacteria or viruses but will reduce the numbers. The following information is from an article by Dr. Dee Griffin at Clay Center, NE. Some definitions:

Antiseptic - chemicals used to inhibit or prevent the growth of microbes on living tissue

Disinfectant - chemicals used to inhibit or prevent the growth of microbes on inanimate objects

Sanitize - reduce the number of microbes to a safe level

Sterilize - eliminate all microbes (inactivates or kills)

Bactericide - kills bacteria

Fungicide - kills fungi

Viricide - kills virus (enveloped/lipophilic are typically easier to kill than non-enveloped viruses)

Sporicide - kill spores (fungi and bacteria)

Bacteriostat - inhibits the growth of bacteria

Detergent - contains free ions (leaves film on surface)

Anionic Detergent - (soaps) have free negative ions that produce curd when combined with Ca & Mg in hard water

Cationic Detergent - QA contains positively charged ions which remain suspended in solution

Selection:

Usually disinfectants are "cidal" in that they kill the susceptible potential pathogenic agents like bacteria and viruses. The selection of a disinfectant should be based on the job you expect the disinfectant to do not necessarily on a sales pitch, or on what we have always used. Ideally select a disinfectant that is broad spectrum (eliminate bacteria, viruses, protozoa, fungi, & spores) and is non-irritating, non-toxic, non-corrosive and inexpensive. Selection decisions should include effectiveness against the potential pathogenic agent, safety to people/animals, impact on equipment and the environment., and expense.

Disinfectant effectiveness upon many factors. These include:

1. Type of contaminating microorganism .. each disinfectant has unique anti-microbial (bacteria and viruses) attributes
2. Degree of contamination .. this affects the time required for disinfection and the amount of chemical required
3. Amount of protein-containing material present .. protein based materials absorb and inactivate some chemical disinfectants
4. Type of chemical .. it is important to understand the mode of action in order to select the appropriate disinfectant
5. Concentration and quantity of chemical .. it is important to choose the proper concentration and quantity of chemical that are best used for the disinfection of each situation.
6. Contact time .. sufficient time which is proportional to the degree of contamination must be allowed for action of the disinfectant to work
7. Application temperature, pH and interactions with other compounds must be considered

Types of Disinfectants Considered

Chlorine - Iodophors – Chlorhexidine – Alcohols – Peroxides - Phenols - Quaternary ammonia - Aldehydes

Hypochlorites (chlorine):

Household bleach (5.25% NaClO), a common source, is cheap and readily available. It is typically diluted using 1:128 to 1:32 with water (1/8 to 1/2 cup per gallon of water). Chlorine disinfectants are corrosive to metals and cause deterioration of fabrics. Chlorine in high concentrations is irritating to the mucus membranes, eyes, and skin. **Organic material such as feces inactivate chlorine disinfectants therefore surfaces must be clean before using a chlorine disinfectant.** In order to obtain maximum results with chlorine disinfectants they must remain in contact with surfaces for several minutes. The pH of the water used for dilution should be between 6 to 8 to be effective. The effectiveness decreases when application temperatures are below 65 degrees. Decreasing the temperature to 50 degrees cuts the effectiveness in half. Chlorination of drinking water for cattle should not exceed 6 to 10ppm.

- Summary:
- 1) Provide wide germicidal activity and are relative non-toxic
 - 2) Limited activity when in the presence of organic matter
 - 3) Poor residual activity and corrosive
 - 4) Fair effectiveness as sporicidal agents
 - 5) Effective at low concentrations for disinfecting clean, small objects
 - 6) Low cost but requires frequent applications

Iodine and iodophor disinfectants:

Iodine and iodophors are simply chemical compounds. These compounds can be included in a time release formulation and with soaps (surgical scrubs). Simple iodine tinctures (iodine + R-OH) do not contain a cleaning compound. Iodine and iodophors are bactericidal, sporicidal, virucidal and fungicidal. **Iodine like chlorine is inactivated in the presence of organic material** and to thoroughly disinfect they must be applied multiple times. Iodine tinctures can be very irritating to tissues, stain fabric and corrosive. "Tamed" iodines such as surgical scrubs and surgical disinfectants are generally not irritating to tissues. Tamed iodines include: Betadyne, Povidone, Wescodyne, Virac, and Prepodyne. Others include: One Step & Iosan.

- Summary:
- 1) Provide wide germicidal activity and are relative non-toxic
 - 2) Limited activity when in the presence of organic matter
 - 3) Poor residual activity, corrosive and stain fabric and equipment
 - 4) Fair effectiveness as sporicidal agents but better than chlorine
 - 5) Effective at low concentrations for disinfecting clean, small objects
 - 6) Low cost but requires frequent applications

Chlorhexidine:

Chlorhexidine is one the more widely used disinfectants. Chlorhexidine is relatively non-irritation to tissues. Chlorhexidine, while considered bactericidal, virucidal, & fungicidal, is less effective against these agents than many other disinfectants. Chlorhexidine maintains effectiveness in the presence of some organic material but cleaning before application is recommended. To be effective chlorhexidine must remain in contact with the surface for not less than five minutes. **Hard or alkaline water will cause precipitation of the active ingredients necessary for disinfection.** Chlorhexidine disinfectants include: Nolvasan, Chlorhex, Chlorasan, Virosan, Hibistat, Phisohex

- Summary: 1) Wide germicidal activity but ineffective against some important species) & non-toxic
- 2) Some activity in the presence of organic matter
 - 3) Some residual activity but must be in contact for at least five minutes
 - 4) Fair effectiveness as sporicidal agents
 - 5) Effective at low concentrations for disinfecting clean, small objects
 - 6) Low cost but requires frequent applications

Oxidizing Agents:

Peroxides such as hydrogen peroxide are often used to clean wounds. Blended and/or stabilized peroxides can be used for disinfection of equipment surfaces. Stabilized peroxides may be blended with iodophors or quaternary ammonia. Some products are effective against a much broader range of pathogens including both enveloped and non-enveloped viruses, vegetative bacteria, fungi and bacterial spores. Examples include: Hyperox, VirkonS,

- Summary:
- 1) Moderate to wide germicidal activity, moderately corrosive and limited toxicity
 - 2) Rendered ineffective in the presence of organic matter
 - 3) Poor to limited residual activity
 - 4) Not effective against bacterial or fungal spores

- 5) More valuable as a cleansing and deodorizing agent and are only moderate cost.

Phenolic disinfectants:

Commonly found in mouth washes, scrub soaps and surface disinfectants, and are the main disinfectant found in household disinfectants. Phenols are effective against bacteria (especially gram positive bacteria) and enveloped viruses. Phenols are not effective against non-enveloped viruses and spores. Enveloped viruses include: BRS, BVD, Coronavirus, IBR, Leukemia, PI3, Pox, Rabies and Stomatitis virus. Non-enveloped viruses include: Bluetongue, Papilloma, Parvo, Rota virus. Common spore forming bacteria of cattle include all the clostridia's (such as tetanus) and bacillus (such as anthrax).

Phenols maintain their activity in the presence of organic material therefore are more useful in foot baths and areas which organic material can not be completely removed. Phenolic disinfectants (including cresols and pine oil) are generally safe but prolonged exposure to the skin may cause irritation. Phenolic disinfectants include: O-Syl, Matar, Septicol, Hexachlorophene, Environ, One-Stroke, Lysovet, Tek-Trol, Lysol, Pantek, Discan, Pine-sol, and Staphene.

- Summary:
- 1) Wide germicidal range and relatively non-corrosive and limited toxicity
 - 2) Very effective in the presence of organic matter
 - 3) Poor to limited residual activity
 - 4) Not sporicidal
 - 5) Typically effective as a deodorizer and are of low to moderate cost.

Quaternary Ammonium Compounds:

Quaternary ammonium (QA) disinfectant contain NH4. **QA compounds bind to organic material including soaps so the area to be disinfected should be clean and rinsed of soap.** Extremely hard water also deactivates QA disinfectants QA compounds are generally low in toxicity but prolonged contact can be irritating. QA disinfectants include: Roccal, Quats, Lysoquat, Multi-Quat, TKO, Utmost and Zephiran.

- Summary:
- 1) Wide germicidal range, non-corrosive and low toxicity
 - 2) Reduced efficiency and residual activity in the presence of organic matter
 - 3) Not sporicidal, effective against vegetative bacteria, fungi and viruses
 - 4) Limited effectiveness in soaps, detergents and hard water salts
 - 5) Good disinfectant for use on cleaned surfaces and low cost

Aldehydes:

Aldehydes have a wide germicidal spectrum. They have a moderated residual activity and are effective in the presents of moderate organic material. Glutaraldehyde disinfectants include: Lysofume and Wavicide-I / Wavicide-06. Formaldehydes are very potent disinfectants, but can be highly toxic to people and animals. Use them only as a last resort and then under trained supervision in a well ventilated setting.

- Summary:
- 1) Wide germicidal activity, sporicidal and fungicidal, but moderately toxic
 - 2) Slight to moderate efficiency in presence of organic matter
 - 3) Slight residual activity
 - 4) Most of these products are moderately expensive.

Disinfectant Selection Table

Compound	Chlorine 0.01-5%	Iodine Iodophor 0.5-5%	Chlorhexidine 0.05-0.5%	Alcohol 70-95%	Oxidizing 0.2-3%	Phenol 0.2-3%	Quaternary Ammonium 0.1-2%	Aldehyd 1-2%
Examples	Clorox	Tincture / Provodine	Novalsan		VikronS	Lysol	Roccal-D	Wavicide
Bactericidal	Good	Good	Very Good	Good	Good	Good	Good	Very Good
Viricidal	Very Good	Good	Very Good	Good	Good	Fair	Fair	Very Good
Envelope Viruses	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Non-Envelope Viruses	Yes	Yes	No	No	Yes	No	No	Yes
Bacterial Spores	Fair	Fair	Poor	Fair	Fair-Good	Poor	Poor	Good

Fungicidal	Good	Good	Fair to Good	Fair	Fair	Good	Fair	Good
Effective in Organic Matter	Poor	Fair	Fair	Fair	Poor	Good	Fair	Good
Inactivated by soap	No	No & Yes	No	No	No	No	Yes	No
Effective in Hard water	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Contact Time (minutes)	5-30	10-30	5-10	10-30	10-30	10-30	10-30	10-600
Residual activity	Poor	Poor	Good	Fair	Poor	Poor	Fair	Fair