CIRCULAR V-319 Revised APRIL1981

DISINFECTION*

for Healthier Livestock and Poultry

*THE USE OF COMPOUNDS THAT KILL ALL TYPES OF ORGANISMS

DR. I. A. SCHIPPER
Veterinarian
Agricultural Experiment Station

DR. KURT WOHLGEMUTH
Veterinarian
Cooperative Extension Service

Disinfection and Disinfectants

Lack of sanitation is an invitation to disease. Livestock and poultry men can save many dollars worth of "cures" and treatments through the application of a good sanitation program. The intelligent application of disinfectants is but one phase of good sanitation.

What is Disinfection

Disinfectant and germicide are terms used synonymously. When correctly used they refer to compounds that kill all types of organisms. Antiseptics are compounds that hinder the growth of organisms, but usually do not kill the organisms. Antibiotics and sulfonamides are not disinfectants or antiseptics and should not be used as such.

How Do Disinfectants Work

In general, the action of disinfectants depends on drastic alteration of the infectious organisms's environment. This may be accomplished by removing the organisms' protection (blood, manure) or removing the organism from the animal or its environment by scrubbing with hot soapy water. The organism may be exposed to direct sunlight (drying) or have its chemical functions (enzyme activity) so altered that death results. Disinfectants must be applied over the entire area, with every effort made to get the material into cracks and crevices of walls, ceilings and floors, if they are to be effective.

What is a Good Disinfectant

A good disinfectant should (1) have the power to kill disease-producing organisms, (2) remain stable in the presence of organic matter (manure, hair, soil), (3) dissolve readily in water and remain in solution, (4) be non-toxic to the animal or human, (5) rapidly penetrate organic matter, (6) remove dirt and grease, and (7) be economical to use.

The number of available disinfectants is large because the ideal universally applicable disinfectant does not exist.

You Must Follow the Rules

The primary source of disease organisms is diseased animals. To avoid having the herd or flock exposed to these organisms, these sick animals must be removed and isolated and the premises thoroughly disinfected. Not all diseased herds or animals have obvious symptoms of disease, and they still may expel disease-producing organisms for extensive periods. A good disinfection program aids in

COOPERATIVE EXTENSION SERVICE
North Dakota State University Fargo, North Dakota 58105

eliminating the disease-producing organisms that nearly constantly exist in the environment of livestock and poultry. To have a successful disinfection program, the following rules are a must.

Thoroughly clean the area to be disinfected before disinfection. This is the time and place to become an active member of the 4-S Club--Shovel, Sweep, Scrape, and Scrub. If a disinfectant is to be effective, it must contact the organisms you want to destroy. To be sure the disinfectant can get to these disease-producing organisms, organic materials such as manure, blood, cobwebs, dirt, debris, and other materials that may serve as a protective barrier to the disease organisms must be removed. Organic materials partially or entirely neutralize disinfectants and lower their effectiveness. Disease-producing organisms have been known to live for years in a carcass buried in manure, under grain sacks, or in moist areas or crevices in lumber that has been covered with manure and other body excretions. A poorly prepared area results in a waste of effort and disinfectant.

Since favorable conditions seldom exist for instantaneous action of a disinfectant, it is always well to allow ample time for complete action. Disinfectants are most effective when applied warm or hot. Cold decreases their activity. Odor or color is no indication of disinfection value of a compound. An odorless, colorless material may be a most effective disinfectant.

Water is inexpensive and can be used advantageously to clean surfaces before disinfection. If soaps or detergents are used with the water, it is best to rinse the surface thoroughly before applying a disinfectant, as some soaps may neutralize disinfectants. Hard water interferes with disinfectants because of the calcium, magnesium or iron content. This is particularly true in the case of phenol and quarternary ammonium compounds. Make every effort to obtain soft water or water with a minimum hardness for disinfection purposes.

Always follow the instructions on the container. Some disinfectants may lose their ability to kill germs if they are used in too strong or too diluted solutions. The manufacturer's recommendations are based on extensive tests and are reliable. Also, check the container label for antidotes in case the disinfectant is mistakenly or accidentally swallowed. Most disinfectants are poisonous to animals and humans. Keep them out of reach of children. Always keep the container labels.

How are Disinfectants Evaluated

To evaluate a disinfectant's ability to destroy disease organisms, a comparison must be made with phenol, which has an established ability to kill germs. The disinfectant's strength is designated as the "phenol coefficient". In general, it indicates how many times a disinfectant can be diluted and still maintain disinfecting ability comparable to phenol. Disinfectants with a low phenol coefficient value are of little benefit, while those with a high coefficient number may not always indicate a superior disinfection ability, as the values are established under controlled laboratory conditions. These conditions usually are drastically different from the conditions found in livestock environment. Though the phenol coefficient is not a universal test for determining the effectiveness of all disinfectants, it still remains the most well recognized test. Whenever you purchase a disinfectant look for the phenol coefficient on the label.

Mechanical Disinfection

Mechanical disinfection is basically the removal of organic materials that serve as a protection to the disease organisms. This can be accomplished by what may be designated as the four "S's" of sanitation--scraping, sweeping, and scalding.

Wetting the surface to be worked upon will prevent the spread of microorganisms by dust. Conversely, the use of water under pressure may serve to spread the organisms by droplets.

Heat

Materials or surfaces containing pathogenic organisms may be disinfected by exposure to the sun. All organisms require moisture, and sunlight eliminates moisture and also kills the organisms through its ultraviolet rays. These rays are partially eliminated by window glass and obstructed by organic materials.

Burning, scalding hot water, steam and pasteurization are all forms of heat used for disinfection. Burning is an ideal method of destroying diseased animals, contaminated bedding and discharges of diseased animals. It is one of the recommended methods of destroying animals or birds that have died from infection and/or contagious diseases such as anthrax. Scalding hot water or steam under pressure are effective only if contact is made for at least 30 minutes, but are not effective against spores of anthrax or tetanus (lock jaw). The addition of soap or detergents aids in removing organic materials from wood, concrete and other building materials to which diseased animals or birds have had contact. Pasteurization of milk and other dairy products is an effective method of destroying brucellosis organisms and tuberculosis organisms by the application of heat. Flowing steam is of little value as a disinfectant, but is useful in removing dirt and organic materials for later disinfection.

Cold

Low temperatures are of no value as disinfectants. Cold actually extends the life of many organisms and freezing is utilized to preserve organisms for

laboratory use in investigational purposes. Thus, cold temperatures may serve to extend the life of the organism in the livestock environment.

Chemical Disinfectant

Many chemical disinfectants are available for livestock and poultry husbandrymen. Each has a specific recommended method of application to achieve maximum effectiveness. When incorrectly applied, some of these compounds are of little value, and also may become toxic to animals. In addition to those groups to be discussed in the accompanying chart, there are many commercial "trade name" preparations that are highly effective disinfectants if employed as directed by the manufacturer. Your veterinarian can help you in recommending disinfectants that are suitable for your specific purpose.

Coal, Tar Derivitives

Phenol (carbolic acid)

Phenol disinfectants will penetrate the skin and cause toxic reactions. These compounds generally are considered too costly to be used as a general disinfectant and they are highly poisonous. Phenol has excellent germicidal activity and is used as a basic disinfectant on which to compare others. When used, it should be used in a 5% solution. Phenol is bacteriostatic (slows bacterial growth) at 0.2 %, bacteriocidal (kills bacteria) at 1 % and fungicidal (kills fungi) at 1.3%.

Cresol (cresylic acid, tricresol)

Cresol is less toxic and costly than phenol and is effective against most organisms and some viruses. It is ineffective against bacterial spores. Cresol is usually used at a 2 to 4% solution (1 cup to 2 gallons of water makes a 4 % solution). It has a characteristic odor that is readily absorbed in milk, eggs or meat. It has a good penetrating ability and is one of the most universal disinfectants. Always use the same precautions when using cresol that you would with phenol. It is one of the better disinfectants for general disinfection of animal and poultry housing and equipment. Cresol is three times more active than phenol and is less toxic. It is effective against the acid fast (TB) organism.

Saponated Cresol (Lysol)

Saponated cresol is a combination of linseed or other oils and cresol that does not mix well in hard water, but is less costly than phenol. It is usually used in a 1 to 2 % solution and has a characteristic odor. It is an effective disinfectant for skin, instruments and livestock and poultry equipment. Use the same precautions as for phenol. Saponated cresol is useful as a disinfectant for surgical instruments and skin disinfection before surgery, such as castration. Lysol is useful as a disinfectant of excrement. It is effective against most of the common livestock viruses at 2.5%.

Sodium Ortho phenylphenate

This coal tar derivitive is effective against TB organisms in a hot 1 per cent solution. It has practically no value when used cold, but has no objectionable odor.

Hexachlorophene

This compound often is incorporated in soaps (G-II) and is used primarily as a pre-operative skin disinfectant.It has little application to disinfection in the livestock and poultry industry.

ACIDS

Many acids will destroy disease organisms, but they have never become popular because they are costly and highly toxic to animals when used in concentrations that would be considered germicidal.

Boric Acid

Boric acid is a very weak disinfectant, but not irritating to sensitive tissues. It has such low germicidal power that it is very seldom used as a disinfectant.

ALKALIES

Compounds that produce a highly alkaline condition are utilized universally as effective disinfectants.

Lye (soda lye, sodium hydroxide)

Lye is usually used as 2 or 5 per cent solution. Its effectiveness may be increased if it is added to whitewash. A 2 per cent solution will destroy bacterial cells in the vegetative stage (growing) while the 5 per cent solution is effective against the spore stage (survival or protective stage). The organisms causing foot and mouth disease, pullorum disease, fowl cholera and the eggs of the swine round worm are destroyed by a 2 per cent solution of lye.

A 5 per cent solution will destroy the spores of anthrax, but is reportedly not effective against the TB organism. To prepare a 2 per cent solution, add 1 can to 5 gallons of water, or 1 can to 2 gallons of water for a 5 per cent solution.

Always keep in mind that lye is an **extremely caustic disinfectant**, and will cause severe burns to the skin. When handling lye solution, it is imperative that you protect yourself or anyone working with you

with rubber gloves, garments, and eye goggles. Walls or floors covered with lye should be thoroughly dry before livestock come in contact with them. Lye is useful as a disinfectant in farrowing pens, or building walls.

Lime (quick lime, calcium oxide)

Lime plus water results in a water slaked lime or milk of lime. Water slaked lime diluted to an applicable consistency with water can be used as a whitewash on walls and ceilings of the housing area. The addition of 4 per cent cresol or 1 to 2 per cent lye results in an inexpensive valuable disinfectant and aids in closing the cracks and crevices that harbor disease organisms such as the fungi that cause ringworm, and the virus for warts. The addition of insecticides is helpful in controlling flies.

Lime, in the powdered form (unslaked), is useful as a disinfectant on barn floors, disease contaminated yards, or to cover dead animals before burying. Avoid causing a dust with powdered lime, as upon inhalation, it will cause irritation to the respiratory tract. It may also be applied to floors, yards or areas about watering or feeding facilities to aid in controlling foot rot.

Lime is an inexpensive general disinfectant that will not act on anthrax or tetanus (lockjaw) spore.

Chlorinated Lime (chloride of lime, bleaching powder)

This compound is effective in controlling disease organisms in organic substances, ground, or as a cover for dead animals that are to be buried. This compound greatly irritates the respiratory tract, and loses its chlorine when exposed to the air. It also may be used as a floor disinfectant.

Sal Soda and Soda Ash

Sal soda and soda ash are alkalies that may be used in place of lye. These are most effective when used as a hot solution.

SURFACTANTS (surface acting agents)

Soaps have little germicidal activity, as their primary action is the removal of dirt and body secretions and disease organisms by emulsification. Some soaps have compounds, such as hexachlorophene, added that increase their germicidal usefulness, but the primary action is always mechanical removal of the organism. They will neutralize cationic surfactants, thus should be thoroughly rinsed from the skin surface before the application of the cationic surfactants.

(Quaternary Ammonium Compounds) Cationic surfactants

Benzalkonium chloride (Cetyl pyridimun)

There are numerous disinfectants whose basic compound is one of the "Quats". They are sold under many trade names such as Zepharin, Roccal, Caepryn, Triton K-12 and numerous others. These compounds are of low toxicity and are effective against most bacteria and many viruses. They are effective disinfectants for skin, dairy utensils, udder washes, and on instruments that are intended for surgery. They have a low toxicity and are effective over a wide range of application at 1,000 ppm. They are active in the presence of organic substances and are neutralized by soaps. They may be used in drinking water for poultry at 100 parts per million (ppm) and to eliminate algae in ponds at ½ to 1 ppm. These compounds are comparatively inexpenive disinfectants.

HALOGENS

Iodine (tincture)

A tincture of iodine is an alcoholic solution of iodine of various concentrations usually diluted 4 to 7%. It is primarily a skin disinfectant and is corrosive to metals. It is too expensive to use as a general disinfectant. It is probably the best skin disinfectant available. Tincture of iodine is effective on bacterial spores.

Iodophore (tamed iodine)

Primary use of these compounds has been dairy utensils. The iodine is slowly released and germicidal activity is neutralized by organic materials. The germicidal activity is questionable. It is not as effective as a 1% tincture of iodine as a skin disinfectant and is a sanitizing agent only.

Chlorines (sodium hypochlorate, chlormine-T)

These compounds are used at approximately 200 ppm for dairy equipment and as deodorants. They are corrosive to metals and neutralized by organic materials. They can be irritating to tissue upon prolonged use or in too high concentration. Chlorines are highly effective against viruses at 1% and is germicidal to acid fast organisms.

Mercurials

The action of these disinfectants is primary to stop the growth of disease organisms.

Mercuric Bichloride (corrosive sublimate)

Essentially this is of no value as a disinfectant.

Merbromin (mercurochrome)

Mercurochrome is primarily a skin disinfectant and is destroyed by organic material.

Thimerosal (Merthiolate) and **Nitromersol** (Metaphen)

These two mercural compounds are primarily used as skin disinfectants and are neutralized by organic materials.

MISCELLANEOUS

Formaldehyde

Formaldehyde will kill anthrax spores, TB organisms and animal viruses in a 1 to 2% solution. It is a powerful disinfectant, not hindered by organic materials and is non-corrosive to paint, metal or fabrics. It has a disagreeable odor, destroys living tissue, and can be extremely poisonous if swallowed.

Formaldehyde often is used to fumigate buildings following a disease outbreak. To be effective, the building must be air tight, and kept at 70°F and humid for at least 8 hours. Potassium permanganate (1½ lbs) plus formaldehyde (3 pints) for each 100 cubic feet to be fumigated is placed in a container. The mixture becomes extremely warm and inhalation could be harmful. Extreme care should be exercised in fumigation.

A 1 to 2% solution may be used as a foot bath for the control of foot rot in animals. Formaldehyde is highly effective at 2% against most livestock viruses.

Alcohols (Ethyl-ethanol, Isopropyl, Methanol)

Alcohols should be used at a 50 to 70 per cent solution to be effective. They are too costly for general disinfection. They are ineffective against bacterial spores and are used primarily as skin disinfectants and for emergency purposes on instruments.

Chlorhexidine (Nolvasan, Hipitane)

These preparations are relatively nontoxic and active against most bacteria, but not bacterial spores. Organic matter has little effect on these compounds. They are used at about a 2 per cent solution and have been proposed as general disinfectants as well as for skin and instruments.

Hydrogen Pyroxide

This compound is primarily a cleansing agent with very little germicidal activity.

Wood Tar (Pine Tar)

Very little germicidal activity is provided by this preparation. It is effective in repelling insects from wound areas.

Cooperative Extension Service, North Dakota State University of Agriculture and Applied Science, and U. S. Department of Agriculture cooperating. Myron D. Johnsrud, Director, Fargo, North Dakota. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. We offer our programs and facilities to all persons regardless of race, color, sex, religion, age, national origin, or handicap; and are an equal opportunity employer.