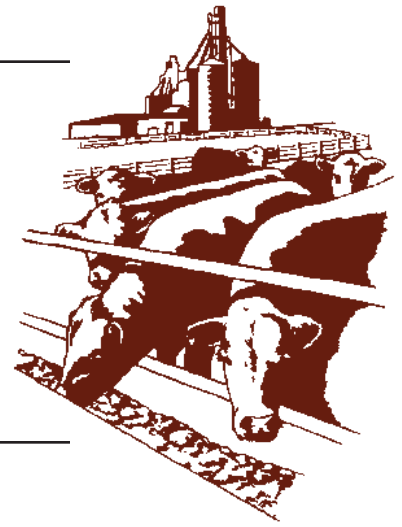


Beef Cattle Handbook



BCH-3010

Product of Extension Beef Cattle Resource Committee
Adapted from the Cattle Producer's Library

Disinfectants and Disinfection: A Guide to Reducing Disease Buildup

Jack Gaskin, Veterinary Virologist, University of Florida
G. W. Meyerholz, Extension Veterinarian, University of Florida

Disinfection is important in controlling the accumulation and spread of disease-causing microorganisms. This is especially true in modern livestock and poultry buildings where continuous use and high concentrations of animals may result in a condition referred to as "disease build up." As disease-producing bacteria, fungi, and parasite eggs accumulate in the environment, disease problems can be transmitted to each successive group of animals raised. Cattle-raising facilities, swine buildings, and poultry houses are especially vulnerable. Thorough cleaning and disinfection often provide the only successful solution to breaking the disease cycle and controlling the problem.

Principles of Disinfection

Because organic matter (dirt and manure for the most part) inactivates certain disinfectants and protects infective microorganisms from germicidal activity, good cleaning is a necessary prerequisite to proper disinfection. Simple scrubbing or a high velocity stream of water can do an excellent job of removing organic matter. Use of detergent solutions will hasten dirt and manure removal, increasing the wetting speed, and breaking organic matter into small particles that easily wash away. Portable steam generators—"steam jennies"—are useful for cleaning dirty surfaces, but do not kill organisms effectively. Removing accumulated grime permits disinfectants to more easily penetrate and kill infective organisms.

The chemical disinfectants that are commercially available have different characteristics. Many factors must be weighed in choosing a proper disinfectant for a particular job. The following discussion is intended as a

guide to selecting currently used disinfectants.

Disinfectants

Alkalies

Alkalies have been used as germicidal agents since antiquity. A pH greater than 9 will inhibit most bacteria and is destructive to many viruses.

Lye (soda lye) contains approximately 94 percent sodium hydroxide, a very effective disinfectant. For disinfectant purposes, lye should be applied as a 2 percent solution in hot or boiling water (one pound of lye to 5.5 gallons of water). Concentrated lye is a caustic poison and must be handled with care. Solutions of lye are injurious to painted or varnished surfaces and to textiles if allowed to remain in contact with them for very long. Lye does not injure bare wood, enamelware, earthenware, or any of the common metals except aluminum.

Lime (calcium oxide, quicklime) is one of the least expensive disinfectants and is reasonably good for use around livestock. Powdered lime may be scattered about yards or lots or swept over concrete floors for general disinfection. Since it tends to dry the skin and hoofs of animals, sometimes causing cracks that invite foot rot, avoid using excessive amounts of lime on concrete floors.

Surfactants

Surfactants (surface-active agents) are chemical compounds that lower the surface tension of aqueous solutions and thus promote wetting.

Soaps, in general, are mild disinfectants. They are

antibacterial against certain gram-positive organisms such as the common skin-inhabiting species, but are much less effective against the gram-negative microorganisms associated with fecal contamination. The primary value of soaps as disinfectants is in facilitating the mechanical removal of contaminated organic matter.

Quaternary ammonium compounds are surfactants commonly used as general antibacterial disinfectants of dairy, meat-packing, and food-handling equipment. They do not possess substantial viricidal, fungicidal, or sporicidal action and are used chiefly as sanitizing rinses for eating, drinking, and dairy utensils after mechanical cleaning. These compounds are not suitable for disinfection of premises since they are readily inactivated by organic matter. They are also neutralized by soaps, and therefore surfaces to be disinfected with them should be thoroughly rinsed.

Halogens

Halogens, such as chlorine and iodine, and halogen compounds have potent antibacterial effects. In the presence of organic matter, iodine is more active than chlorine.

The activity of iodine solutions is directly related to the amount of free iodine present. Tincture of iodine is a 2 percent solution of elementary iodine in alcohol, and is a very effective antiseptic. Strong tincture of iodine (7 percent) has a greater antibacterial action but is more irritating to tissue. Iodophors are combinations of iodine and solubilizing compounds, usually non-ionic detergents. They are non-staining, non-irritating, and largely free from the risk of producing hypersensitivity. Iodophors, sometimes referred to as "tamed iodines," are now commonly used for disinfection of dairy utensils and equipment and for teat dipping after milking. Iodophors prepared for use on equipment contain phosphoric acid and should not be used on skin.

Chlorine acts rapidly against bacteria, spores, fungi, and viruses. Its activity, however, is substantially reduced by the presence of organic matter. So preliminary cleaning is essential before chlorine disinfectant is used. Solutions of sodium hypochlorite, similar to those used in laundry bleaches, are commonly used to disinfect dairy utensils. These solutions decompose when exposed to light so they must be protected. A 2 percent solution of calcium hypochlorite (bleaching powder, chloride of lime) is a cheap, but effective disinfectant for buildings and utensils. Its action, however, is readily dissipated by organic matter, and careful cleaning should precede its use. Powdered chlorinated lime may be dusted directly on contaminated livestock quarters as a powerful deodorant as well as a good disinfectant. It should be stored in air-tight containers because it deteriorates upon exposure to air. Chloramines are organic chlorine compounds that release chlorine slowly and exert a prolonged bacterial effect. They are less toxic and irritating than the hypochlorites.

Coal and Wood Tar Derivatives

Phenol (carbolic acid) is reasonably effective in destroy-

ing most common types of bacteria but is too expensive and toxic for general use. Concentrations in excess of 2 percent phenol are dangerous for all species of animals, particularly cats, because of absorption through the skin.

Cresol is relatively inexpensive and efficient as a disinfectant. It is not readily soluble in water and hot water should be used for preparing solutions. Saponated cresol preparations such as "Lysol" are mixtures of cresol with soap to form more readily soluble solutions for easier application. Cresylic compounds, in general, are not suitable for use in dairy barns because their strong and persistent odor may contaminate milk. USDA recommends using 4 ounces of an acceptable cresol or saponated cresol compound per gallon of water for disinfecting animal quarters, carriers, and premises. Pressure spraying is the easiest and most efficient method of application.

Sodium orthophenylphenate is a coal tar derivative that has been recognized as an official disinfectant by USDA, primarily because of its effectiveness against tuberculosis organisms. It is readily soluble in water, has potent germicidal activity and is active in the presence of detergents and moderate amounts of organic material. Because it is irritating to the eyes and mucous membranes, simple precautions must be observed during its use, but it has no objectionable odor and is therefore suitable for use in dairy barns.

Miscellaneous Disinfectants

Hydrogen peroxide solution releases free oxygen rapidly upon contact with mucous membranes or denuded surfaces that provide the enzyme catalase. When hydrogen peroxide is applied to a wound containing exudate, its effervescence in the recesses of the wound is beneficial in the mechanical removal of pus and organic debris. In infected tissue, hydrogen peroxide is probably of more value as a cleaning agent than as a germicide.

Common alcohols are good solvents, antiseptics, and disinfectants. Ethyl alcohol (ethanol, grain alcohol) is commonly used as a dilution of 70 percent by weight or 78 percent by volume for cleaning and disinfecting the skin, syringes, instruments, etc. This concentration has greater germicidal activity than either more concentrated or more dilute solutions. Isopropyl alcohol has antibacterial properties similar to ethyl alcohol and is generally used in the same concentration. Isopropyl alcohol, being non-intoxicating, is exempt from the special tax that must be paid on ethyl alcohol, and for disinfecting purposes is cheaper and just as effective.

Chlorhexidine ("Nolvasan") is a synthetic compound that has been found useful in disinfecting contaminated equipment and premises, sanitizing udder cloths and milking equipment, and as a topical germicide for treating wounds and dipping teats. It is active against a variety of microorganisms, is not appreciably inactivated by small quantities of organic matter, and is relatively non-toxic. Chlorhexidine is commercially available as a 2 percent solution and in other forms.

Formaldehyde solution can be purchased as an

aqueous solution containing about 40 percent formaldehyde gas, commonly known by the name Formalin. A concentration of 40 percent formaldehyde gas is an excellent and reliable disinfectant and is lethal to anthrax spores within 15 minutes. Fumigation with formaldehyde has been popular in large poultry houses and swine units. Proper disinfection depends on a long period of exposure at proper concentrations and humidity. Because the gas tends to condense at low temperatures, fumigation with formaldehyde is unreliable below 65°F. Buildings should be thoroughly cleaned before fumigation and must be aired for 12 to 24 hours before reuse.

There are two methods of fumigating with formaldehyde gas. The first employs wide bottom buckets placed approximately every 10 feet through the length of the building. In each receptacle, 175 grams (10 level tablespoons) of potassium permanganate is placed, then 12 ounces (1 1/2 cups) of a 40 percent solution of formaldehyde (formalin) is poured over it. Under proper conditions this mixture will generate enough formaldehyde gas to disinfect 1,000 cubic feet of space. The second method employs a white powder, paraformaldehyde, and commercially available electric heating units that release the gas from the powder. With either method, the floor should be moistened about 15 minutes before fumigation, and the building must be kept tightly closed for at least 8 hours.

Summary

Each of the disinfectants has advantages and disadvantages. The proper choice of a disinfectant for a particular job is an important decision and involves consideration of many factors. Thorough cleaning, including the use of detergents, is an essential step that must precede the proper application of germicidal agents. Frequent manure removal, routine cleanliness, and proper disinfection are management procedures that can provide great dividends in healthy and productive livestock. These simple measures reduce the hazards of disease buildup that significantly increase death losses, reduce growth rates or feeding efficiency, and decrease profits.

Adapted from CATTLE PRODUCER'S LIBRARY CL615

Authors:

Jack Gaskin, Veterinary Virologist, University of Florida
G. W. Meyerholz, Extension Veterinarian, University of Florida

This publication was prepared in cooperation with the Extension Beef Cattle Resource Committee and its member states and produced in an electronic format by the University of Wisconsin-Extension, Cooperative Extension. Issued in furtherance of Cooperative Extension work, ACTS of May 8 and June 30, 1914.