

Disinfecting the Indoor Environment: Facts About Chlorine Bleach, Quats and Other Disinfecting and Sanitizing Agents

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Disinfectants and the Environmental Protection Agency (EPA)

In the United States, disinfectants and disinfectant cleaners must be reviewed and registered by the Environmental Protection Agency (EPA) before they can be offered for sale. EPA assigns a registration number for each product and that number must be clearly displayed on every container of the product. Companies submitting disinfectants for registration are required to include current efficacy data to prove that their product kills ALL of the microorganisms listed on the product label. For instance, if the product label claims to kill *staphylococcus aureus*, then test data must be submitted to EPA to prove that the product when diluted according to label directions kills the *staphylococcus aureus* bacteria.

Efficacy Tests Measure the Effectiveness of Disinfectants

The tests used to measure the effectiveness of disinfectants on various pathogenic (disease causing) organisms are called, efficacy tests. The EPA must pre-approve all “efficacy test methods” used to measure the effectiveness of disinfectants against specific microorganisms. The most common efficacy test prescribed by EPA is the Association of Official Analytical Chemist (AOAC) Use Dilution Confirmation Test. Currently, for a disinfectant cleaner to be registered by EPA as hospital strength, it must be effective at its recommended dilution in killing targeted pathogens in the presence of 400 ppm hard water and 5% organic serum. It must kill 100% of the targeted test organisms.

Ask Your Supplier to Provide Current Efficacy Data

It is a good idea for you to require the manufacturer and/or distributor of a disinfectant or disinfectant-cleaner to provide efficacy data to your organization before you select it for use in your facilities. The data should include a listing of the microorganisms it effectively kills. Before selecting a disinfectant product it is important to review the product label to confirm that it: 1) contains a valid EPA Registration Number, 2) effectively kills the pathogenic microorganisms you are concerned with eliminating and 3) clearly identifies both the proper application and safety procedures to be followed when using the product.

What are the Differences Between Disinfectants and Disinfectant Cleaners?

Disinfectants require the removal of soils from a surface before they are effective. Disinfectant cleaners combine the cleaner and disinfectant into a “one-step” process. A disinfectant-cleaner is diluted and then used to remove soils and kill germs all in one application. One step disinfectant-cleaners save labor time and money. Simply stated, disinfectants “disinfect” and disinfectant-cleaners “disinfect and clean.” If you are uncertain if your product is a disinfectant or disinfectant-cleaner, read the product label carefully. If the label does not mention “cleans and disinfects,” then it is probably a disinfectant or sanitizer and not a one-step disinfectant-cleaner.

1. **Chlorine Bleach Solutions**

Excellent Disinfectants, But Poor Cleaners

Household and institutional chlorine bleaches contain 5.25% active sodium hypochlorite when they are manufactured. The remaining 94.75% is primarily water. Chlorinated compounds such as sodium hypochlorite when diluted in water form hypochlorous acid. This acid is extremely effective against many types of microorganisms including bacteria, fungi and viruses. For instance, the product label for Purex household bleach claims it is effective against staphylococcus and streptococcus bacteria, Influenza A and B viruses and athletes foot fungus. However, the label also says a surface must be pre-cleaned before using the chlorine bleach solution.

Disadvantages of Using Chlorine Bleach As a Disinfectant

Many institutions do not commonly use chlorine bleach products because they:

1. Lack detergency – Contain no wetting agents to allow the disinfecting agent to penetrate soils, so surfaces MUST be pre-cleaned before the chlorine bleach will effectively kill germs.
2. Very caustic to human tissues – Can burn skin and eyes
3. React with other chemicals to create toxic byproducts and gases – Incompatible with products that contain ammonia, hydrochloric acid, phosphoric acid and acetic acid (vinegar).
4. Fumes can be irritating – Occupants of buildings frequently complain about bleach and bleach related odors migrating into their work areas.
5. Can emit a carcinogenic gas if it comes in contact with formaldehyde, or is hyper-chlorinated by hot water.
6. Extremely corrosive to metals – Chlorine bleach can attack and corrode metal surfaces as well as permanently discolor countertops.
7. Discolor fibers and colored surfaces – Carpets, entrance matting and clothing are just a few of the fibers that can be damaged when contacted by chlorine bleach solutions.
8. Damage floor finishes – Chlorine bleach can attack the floor finish coatings on the floor requiring them to be removed and replaced. This is an expensive process.
9. Rapidly inactivated by organic debris (blood, tissue, saliva, microbes)
10. Diluted solutions quickly lose their effectiveness. Chlorine bleach is unstable and can lose its oxidizing and disinfecting strength rapidly compared to “quat” based disinfectant-cleaners and/or sanitizers.
11. Are expensive to use – The recommended dilution ratio for proper disinfecting of surfaces is 1:10 (13 ounces of chlorine bleach per gallon of water) while “quat” based disinfectant-cleaners are effective when diluted up to 1:256 (1/2 ounce per gallon of water).

2. **Phenolics Based Solutions**

Phenols or phenolic disinfectant-cleaners are not as corrosive as chlorine bleach. But they are aggressive enough to attack and damage floor finishes and sensitive flooring. Phenolic disinfectants are still the preferred product in a few health care facilities. They are used in areas where gross contamination of blood and body fluids subsist. Phenolics are effective against pathogenic bacteria like *tubercle bacillus* that cause tuberculosis.

Disadvantages of Phenolic Disinfectants

Many institutions do not commonly use phenolic products because they:

1. Can be toxic to skin and eyes. Depigmentation can occur with long periods of exposure or use.
2. Commonly causes sinus and respiratory tract irritation or problems.
3. Corrosive to certain rubber and plastic surfaces.
4. Flammable
5. Can leave a film on a cleaned surface, creating a buildup that will eventually need removal.
6. Solutions need to be discarded and remixed daily.
7. Discolor fibers and colored surfaces – Carpets, entrance matting and clothing are just a few of the fibers that can be damaged when contacted by chlorine bleach solutions.
8. Damage floor finishes – Chlorine bleach can attack the floor finish coatings on the floor requiring them to be removed and replaced. This is an expensive process.
9. Expensive compared to comparable “quat” disinfectants.

3. **Iodophors**

Iodines and iodophor compounds can be very effective disinfectants with a broad range of killing power.

Disadvantages of Iodophors

1. Have relatively slow killing times. Dilutions and contact times are critical for efficacy.+
2. May dry out and crack skin, possibly burn tissue with prolonged exposure. Toxic if ingested.
3. Corrosive to metal and rubber materials.
4. Solutions can stain plastics, fabrics and other materials.
5. Inactivated by hard water and must be discarded and remixed daily.
6. Reports of anaphylactic shock developing in some staff acquiring extreme sensitivity to iodophors.
7. Expensive compared to “quat” disinfectants and sanitizers.

4. **Quaternary Ammonium Chlorides (Quats)**

Number One Choice of Hospitals, Medical Care Facilities and Food Service. Provide Safe and Effective Sanitizing and One-Step Cleaning-Disinfecting

Quaternary Ammonium Chlorides or “quats” as they are commonly known are based upon the active ingredient benzalkonium chloride. These quaternary salt compounds can be formulated with a variety of ingredients to provide a safe and effective neutral pH, disinfectant-cleaner without damaging floor finishes or sensitive floor surfaces. They can be effectively formulated into hospital strength and general disinfectants, disinfectant-cleaners and food contact surface sanitizers. Many public health officials are accepting and recommending “quat” sanitizers as replacements for chlorine bleach sanitizers. In addition, quats are relatively economical and extremely effective odor control agents when used according to label directions.

Quats are effective in destroying a broad spectrum of harmful microorganisms. They are effective in killing many pathogenic microorganisms while cleaning the surfaces upon which they reside – all in one simple step. A few of the microorganisms killed by quat disinfectants and sanitizers include:

1. Gram negative and gram positive bacteria like *salmonella typhi*, *staphylococcus aureus*, *streptococcus epidermidis*, *pseudomonas aeruginosa*, and *E-coli*.
2. Viruses like HIV-1, Hepatitis B and C, Herpes simplex 1 and 2, Influenza and Parvovirus
Antibiotic resistant strains of bacteria including methicillin resistant staphylococcus aureus (MRSA), VRE and many other antibiotic resistant strains.
3. Fungi like trichophyton interdigitale (athlete’s foot) and the fungus that causes ringworm.

Ten Questions to Answer Before Selecting a Disinfectant-Cleaner

1. Does the product have an EPA Registration Number?
2. What is the active ingredients? (Quats, Phenolics, Chlorine Bleach, Iodine or Pine Oil?)
3. Is it safe for daily use by housekeepers and custodians?
4. Will it damage the surfaces cleaned with it?
5. What germs does it kill?
6. What is the dilution ratio of the product?
7. Is it a “one-step” disinfectant-cleaner, disinfectant, food contact sanitizer?
8. Is it effective in hard water?
9. Is it effective in the presence of organic soil?
10. What is the end-use cost of the product?

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