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Calcium Hypochlorite

- Bactericide
- Algaecide
- Bleach
- Sanitizer
- Water Treating Agent for:
  Swimming Pools
  Industrial Applications
  Potable Water Applications
- Water Sanitization and Sewage Treatment Uses
- Institutional, Commercial and Home Uses
- A Multipurpose Chemical for Disinfection and Sanitization in:
  Agriculture
  Aquaculture
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- Preparing Calcium Hypochlorite Solutions

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Introduction

Calcium Hypochlorite is Effective

PPG calcium hypochlorite is a dry, white, free-flowing, granular material. In solution with water, it is used as a general disinfectant to destroy bacteria, algae, fungi, and other microorganisms through the process of chlorination. Chlorination is recognized and widely accepted as the standard method of disinfecting drinking water and as a sanitizer in a variety of food processing, commercial, institutional, and domestic applications.

Calcium Hypochlorite is Efficient

PPG calcium hypochlorite is efficient, easy to use and handle. Solutions can be prepared quickly for on the spot use from the economical drums and convenient pails and jugs provided by PPG. PPG markets granular calcium hypochlorite under the names Pittclor® and Induclor™ and tableted calcium hypochlorite as PPG 3-inch tablets, Pittabs® and Induclor Tablets. All are high quality calcium hypochlorite products containing a minimum of 65% available chlorine.

Any of these products may be used for the applications described in this brochure provided directions are followed and this brochure is in the possession of the user at the time of application.

Calcium Hypochlorite is Economical

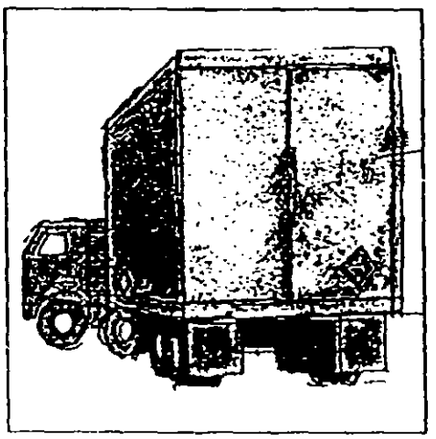
PPG calcium hypochlorite does the job without waste and without the need for elaborate equipment. Stored in clean, dry sealed containers, in a cool dry place it remains chemically stable and retains a high available chlorine content for a long period. And, leading distributors sell PPG calcium hypochlorite in quantities and at prices which make it economical for both small and large users.

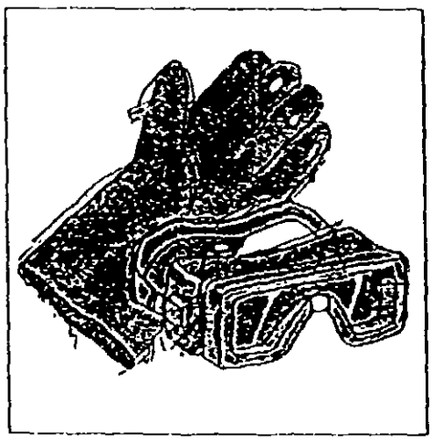
For additional product information, refer to PPG's calcium hypochlorite MSDSs, available upon request.

Note: Calcium Hypochlorite refers to the following products:
Pittclor® EPA Reg. No. 748-217
Induclor EPA Reg. No. 748-239
Pittabs® EPA Reg. No. 748-138
Induclor EPA Reg. No. 748-217
Induclor Tablets EPA Reg. No. 748-138
PPG Calcium Hypochlorite Tablets, EPA Reg. No. 748-[illegible]

PPG 70 CAL HYPO. GRANULES
EPA Reg. No. 748-296

Calcium Hypochlorite Applications





Precautions and Safety Measures

Calcium hypochlorite is a stable chemical when properly stored and handled. However it is highly corrosive and a strong oxidizing agent. Calcium hypochlorite is not flammable, but in the presence of contaminants or other chemicals, it can cause fire or explosion.

Everyone who handles calcium hypochlorite must be completely familiar with proper handling, storage and use procedures as well as first aid emergency procedures in case of accident.

NOTE: The U.S. Department of Transportation regulates transportation of calcium hypochlorite as "hazardous material". As serious penalties can be imposed for violation of DOT regulations, everyone who transports these products should be informed of these regulations and follow them.

Handling and Storage

Before using calcium hypochlorite, read all label directions on the container. All handling and storage directions on the container must be followed to ensure accident-free use of the chemical.

Do not slide or drop calcium hypochlorite containers. Store the chemical in its original container in a cool dry place. Be sure the calcium hypochlorite container is tightly closed when not in use. Keep calcium hypochlorite away from heat sources, sparks, open flames and lighted tobacco products.

In case of fire, drench with water. Since calcium hypochlorite supplies oxygen, attempts to smother the fire with a wet blanket, carbon dioxide or dry chemical extinguisher are ineffective.

Do not get in eyes, on skin or on clothing. Calcium hypochlorite may produce severe chemical burns. Wear eye protection, gloves and protective clothing when using this product. Do not breathe dust or fumes.

Be sure to wash your hands after handling calcium hypochlorite.

Use only a clean, dry scoop made of metal or plastic each time calcium hypochlorite is taken from the container. Add calcium hypochlorite only to water. A fire or explosion may result if calcium hypochlorite is mixed with other chemicals, contaminated with acids, or brought into contact with any other easily combustible materials such as oil, kerosene, gasoline, paint products and any other organic materials

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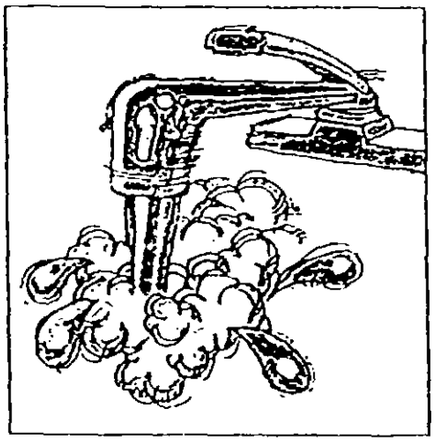
Calcium Hypochlorite Applications



In Case of Spill or Leak

Use extreme caution. Contamination may cause fire or violent reaction. If fire or reaction occurs in area of spill, douse with plenty of water. Otherwise, sweep up spilled material, using a clean, dry shovel and broom, and dissolve spilled material in water. Use the solution immediately as directed.

Do not reuse empty calcium hypochlorite containers. They should be rinsed with water then disposed of.

Environmental Hazards: This pesticide is toxic to fish and aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or public waters unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

First Aid

Eye or Skin Contact: Flush with plenty of water for at least 15 minutes while removing clothing if it is contaminated. For eye contact, or if skin irritation occurs, get immediate medical attention.

Inhalation: Remove person(s) affected to fresh air. If signs of irritation or discomfort occur, take the person to a hospital or physician immediately.

If Swallowed: drink large quantities of water. Do not induce vomiting. If vomiting occurs, administer additional water. Take the person immediately to a hospital or physician. If the person is unconscious, or in convulsions, do not attempt to induce vomiting or give anything by mouth. Get medical attention immediately.

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Water Sanitization and Sewage Treatment

Water Systems, General

Chlorination is the recognized and accepted method of treating water supplies throughout the world. Whether chlorination is achieved by a *continuous feeding of gaseous chlorine* into water or by the regular addition of granular calcium hypochlorite, the chlorinating, sanitizing action is the same. When added to water, both gaseous chlorine and granular calcium hypochlorite form hypochlorous acid. Hypochlorous acid thoroughly destroys microorganisms by penetrating their cell walls and attacking the exposed internal structure.

The concentration of hypochlorous acid in water—expressed as "percent available chlorine"— determines its germicidal strength.

"Chlorine demand" is the amount of chlorine required to destroy bacteria and other organic matter presently existing in water. The available chlorine remaining after "chlorine demand" is satisfied is referred to as "Free Residual Chlorine". Free residual chlorine provides protection against new contamination. The amount of free residual chlorine present in a quantity of water is usually expressed in "parts per million (ppm)" of free, available chlorine.

Regular and accurate testing of water supplies to determine the amount of free residual chlorine is extremely important. It should be carried out on a continuing, systematic basis as this is the only way to accurately determine the free residual chlorine and, therefore, the purity and acceptability of the water.

Although calcium hypochlorite serves municipalities and commercial users in many ways, its most important function is in water sanitization. In large cities with proportionately large water consumption requirements, chlorination is most often achieved through a continuous feed gaseous chlorine system. In smaller communities where water consumption requirements do not justify the need for gaseous chlorine equipment, granular calcium hypochlorite is most often used:

To treat surface water supplies

Such as reservoirs, to destroy bacteria and algae, and to correct algae problems associated with water works equipment and filters.

To sanitize wells

Calcium hypochlorite may be used to sanitize wells initially and provide continuous treatment.

To sanitize new mains and equipment

All new water mains as well as new processing and distribution equipment for drinking water should be thoroughly sanitized with intensive treatments of calcium hypochlorite before use.

As emergency water supply treatment

Calcium hypochlorite is always ready to supply quick, effective chlorination of new or supplementary water supplies when fire, flood, drought or other emergencies disrupt or contaminate regular sources.

To treat sewage effluent

The use of calcium hypochlorite in conjunction with other environmentally sound practices to maintain clean rivers and streams has grown with our ecological awareness. Today, it is widely used to reduce Biological Oxygen Demand, control odors, treat effluent and aid in sewage coagulation.

All water intended for human consumption should be chlorinated. Although calcium hypochlorite can be used at any stage in the water purification process, turbid water should be clarified first.

Large water systems using continuously fed gaseous chlorine, as well as smaller systems which use granular calcium hypochlorite as their primary treatment, often also stock calcium hypochlorite for special purposes, such as destroying sudden algae growth, treatment of mains, conditioning of filters and for emergency chlorination.

It is important to remember that any water supply, large or small, can be contaminated by seepage or carelessness and treatment must take place immediately upon its discovery.

Bacteria control

Contamination of reservoirs is an ever-present possibility. Most frequently, it is caused by careless persons or seepage from ground contamination. In order to keep reservoir water bacteriologically acceptable, it is necessary to test regularly and chlorinate sufficiently to maintain a residual of 0.2 ppm free available chlorine. This is equivalent to 1.2 ounces of calcium hypochlorite per 30,000 gallons of water **after** chlorine demand has been satisfied.

Where contamination is caused by overflowing streams, establish hypochlorinating stations upstream of the reservoir. Chlorinate the inlet water until the entire reservoir attains a 0.2 ppm available chlorine residual as determined by a chlorine test kit. Where contamination is from surface drainage, apply sufficient calcium hypochlorite directly to the reservoir to attain a 0.2 ppm available chlorine residual in all parts of the reservoir.

Daily testing should be accomplished **away** from the water inlet. If samples must be taken near the inlet, allow them to stand at least 20 minutes before testing. Also, remember that chlorine demand will be higher during periods of heavy rainfall and extreme dryness or heat.

Continuous feeding of calcium hypochlorite at the input source is usually the most effective means of maintaining an adequate chlorine residual.

When applying granular calcium hypochlorite to surface water, take care to reach all parts of the reservoir with equal amounts of the product so that distribution is complete and equal throughout.

Algae control

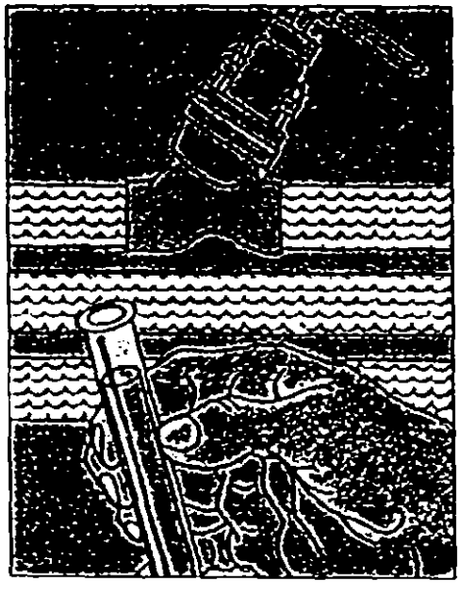
Rapid algae growth in reservoirs is an indication of increased chlorine demand. When algae becomes a problem, special action is necessary. There are several methods of treatment. One of these is to hypochlorinate streams feeding the reservoir. Suitable feeding points should be selected on each stream at least 50 yards upstream from the point of entry into the reservoir.

Continuous chlorination is usually effective in destroying algae where a sufficient amount of sanitizer is fed to produce a chlorine residual of 0.2 to 0.5 ppm free available chlorine. Where continuous feeding is not possible, scheduled, intermittent feeding should be practiced. In doing so, broadcast calcium hypochlorite over the surface of the reservoir evenly, taking special care to treat shallows and edges. As it descends, the product dissolves, distributing a chlorinating action to all depths.

Introduce a sufficient amount of calcium hypochlorite to provide a residual of from 0.2 to 1.5 ppm for up to 24 hours.

New and Newly Cleaned Reservoirs

New or recently cleaned reservoirs must be completely disinfected with calcium hypochlorite before use. Spray all parts and surfaces with a 0.5% (5000 ppm) solution (1 ounce calcium hypochlorite to 1 gallon of water). When the reservoir is filled, chlorinate as described above. NOTE: **As a safety precaution, do not store calcium hypochlorite solution. When mixed, use immediately.**

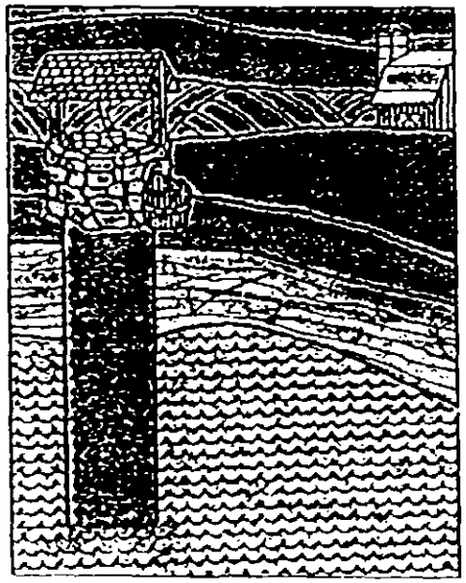


Water Mains

Newly installed water mains or those which have been repaired must be disinfected before being put into service as they are contaminated by construction conditions. Completely flush the section to be sanitized. Allow a water flow of 2.5 feet or more per second to continue under pressure while introducing a 1% available chlorine solution with a hypochlorinator. Continue injecting this solution until a 50 ppm free available chlorine reading is obtained at the distant end of the new section after a 24-hour retention period. Afterward, flush the heavily chlorinated water free of the system. (Refer to page 29 for preparation of the 1% solution.)

Forty-eight hours after the initial treatment, test the water supply again for bacteria and chemicals. If results are unsatisfactory, maintain a 0.4 ppm free chlorine residual in the main until test samples are acceptable for two successive days.

NOTE: Keep out trench water and other contaminates from new mains by capping the pipe ends before lowering them into place.



Wells

Municipal authorities often help the residents of rural areas, particularly dairy farmers, safeguard their water supplies as any disease originating there could easily spread throughout the community.

Since the contamination of well water, even from deep wells, is always possible, it too should be chlorinated. The most effective method of doing so is to feed calcium hypochlorite into the intake line of the pump. This also helps keep the filter free of slime. Automatic hypochlorinating equipment for this purpose is readily available and easy to use.

If it is not possible to locate a feed at the intake line, feed calcium hypochlorite anywhere in the pump discharge line. Feed sufficient calcium hypochlorite to produce a free chlorine residual of at least 0.2 ppm and no more than 0.6 ppm after a 20-minute contact period.

Regular testing is necessary and a record of test readings should be kept.

New wells must be treated.

Public wells

Before using, flush the casing with a 50 ppm available chlorine solution (1 ounce of calcium hypochlorite for each 100 gallons of water) The solution should be pumped or fed by gravity into the well and thoroughly mixed and agitated. The well should stand overnight or for twelve hours under chlorination. It may then be pumped until bacterial examination of a representative raw water sample will indicate whether further treatment is necessary.

After the initial treatment, begin feeding a 1% available chlorine solution of this product with a hypochlorinator, as directed above, until a free available chlorine residual of at least 0.2 ppm and no more than 0.6 ppm is attained throughout the distribution system. Check the water frequently with a chlorine test kit. Bacteriological sampling must be conducted at a frequency no less than that prescribed by the National Interim Primary Drinking Water Regulations. Contact your local Health Department for further details.

Private Wells

Dug Wells—Upon completion of the casing (lining), wash the interior of the casing (lining) with a 100 ppm available chlorine solution using a stiff brush. This solution can be made by thoroughly mixing 1 ounce of this product into 50 gallons of water. After covering the well, pour the sanitizing solution into the well through both the pipe-sleeve opening and the pipeline. Also, wash the exterior of the pump cylinder with the sanitizing solution. Start the pump and pump water until a strong odor of chlorine in the water is noted. At this point, stop the pump and allow it to stand at least 24 hours. After 24 hours, flush well until all traces of chlorine have been removed from the water. Contac your local Health Department fo: further details.

Drilled, Driven, and Bored Wells—Run the pump until the water is as free from turbity as possible. Pour a 100 ppm available chlorine sanitizing solution into the well. This solution can be made by thoroughly mixing 1 ounce of this product into 50 gallons of water. Add 5 to 10 gallons of clean, chlorinated water to the well to force the sanitizer into the rock formation. Wash the exterior of the pump cylinder with the sanitizer. Drop the pipeline into the well, start the pump and pump water until a strong odor of chlorine in the water is noted. At this point, stop the pump and wait at least 24 hours. After 24 hours, flush well until all traces of chlorine have been removed from the water. Deep wells with high water levels may necessitate the use of special methods for introduction of the sanitizer into the well. Consult your local Health Department for further details.

After the initial treatment, feed calcium hypochlorite into the intake line of the well pump. This also helps keep any filters free of slime. Automatic hypochlorinating equipment for this purpose is readily available and easy to use.

If it is not possible to locate a feed at the intake line, feed calcium hypochlorite anywhere in the well pump discharge line. Feed sufficient calcium hypochlorite to produce a free chlorine residual of at least 0.2 ppm and no more than 0.6 ppm after a 20-minute contact period.

Regular testing is necessary and a record of test readings should be kept.

Flowing Artesian Wells—Artesian wells generally do not require disinfection. If analyses indicate persistent contamination, the well should be disinfected. Consult your local Health Department for further details.

After the initial treatment, follow the practice of maintaining a free chlorine residual of 0.2 ppm to 0.6 ppm in the water outlets after a minimum 20-minute contact period as directed previously.

Bacteria control

Contamination of tanks is an ever-present possibility. In order to keep potable tank water bacteriologically acceptable, it is necessary to test regularly and chlorinate sufficiently to maintain a residual of 0.2 ppm free available chlorine. This is equivalent to 0.2 ounces of calcium hypochlorite per 5,000 gallons of water **after** chlorine demand has been satisfied.

Where contamination is caused by water supply sources, establish hypochlorinating stations upstream of the tank. Chlorinate the inlet water until the entire tank attains a 0.2 ppm available chlorine residual as determined by a chlorine test kit.

Daily testing should be accomplished away from the water inlet. If samples must be taken near the inlet, allow them to stand at least 20 minutes before testing. Also, remember that chlorine demand may be higher during periods of heavy rainfall and extreme dryness or heat.

Continuous feeding of calcium hypochlorite at the input source is usually the most effective means of maintaining an adequate chlorine residual.

When applying granular calcium hypochlorite to the water surface in the tank, take care to reach all parts of the tank with equal amounts of the product so that distribution is complete and equal throughout

Treatment Plants

Granular calcium hypochlorite may be used as a sanitizer in water treatment plants when the system is too small to require gas chlorination equipment or to supplement well or reservoir chlorination.

Treatment plants also rely on granular calcium hypochlorite to add in algae control. As algae may be the source of many objectionable odors, cause mud balls and slime in filters, pipes and pumps, as well as reduce pipeline capacity, its control through chlorination is an important factor.

The presence of algae is often indicated by a slimy, gelatinous film on the inside of pumps, lines and mixers, etc. It may be eliminated by adding a sufficient quantity of calcium hypochlorite to the forebay or pump well to obtain a 5.0 to 10.0 ppm residual chlorine reading after 20 minutes contact time.

The dosage necessary to provide this reading will vary with conditions, i.e.—hot weather will increase the need for treatment. It should be controlled by actual test.

New tanks, basins, etc.

Remove all physical soil from the surfaces. Introduce 4 ounces of calcium hypochlorite for each 5 cubic feet of working capacity (500 ppm available chlorine). Fill to working capacity and allow the solution to stand for at least 4 hours. Drain and flush with potable water and return to service

New filter sand

Apply 16 ounces of calcium hypochlorite for each 150 to 200 cubic feet of sand. The action of the product dissolving as the water passes through the bed will aid in sanitizing the new sand.

Existing equipment

Remove the equipment from service and thoroughly clean all physical soil from surfaces. Sanitize by introducing 4 ounces of this product for each 5 cubic feet of capacity (approximately 500 ppm available chlorine). Fill to working capacity and let the solution stand at least 4 hours. Drain and place in service. If the previous treatment is not practical, surfaces may be sprayed with a solution containing 1 ounce of this product for each 5 gallons of water (approximately 1000 ppm available chlorine). After drying, flush with water and return to service.

Cooling tower and heat exchange surface

A clogged or fouled system should be mechanically cleaned to remove all physical soil prior to beginning treatment. Initially, treat by adding enough calcium hypochlorite to provide 10 ppm available chlorine (2 ounces per 1000 gallons) as a shock dosage and circulate it thoroughly through the system

Then, for continuous preventive control of algae and slime growth, regularly add enough calcium hypochlorite to the recirculation system to maintain a 1.0 ppm free chlorine residual

Other water conditions factors, such as pH, should be controlled as recommended by the equipment manufacturer

Emergency Disinfection

Emergency Uses

Acts of nature or the failure of man-made equipment may jeopardize a community's water supply at any time. Flood waters may contaminate reservoirs and wells; drought may dry up water supplies; fire or power failures may interrupt the operation of pumping or purification facilities; mains may break; and unknown sources can pollute water. All of these emergencies demand prompt action by responsible authorities. Many communities keep standby supplies of calcium hypochlorite ready to meet such problems. It can be stored in closed containers for reasonably long periods without appreciable loss of its effectiveness. When needed, calcium hypochlorite solutions can be quickly prepared to meet many requirements and may be applied to water with feeders or added manually.

During emergencies, calcium hypochlorite may be used to chlorinate water supplies which have been contaminated, or to purify new sources of water quickly and dependably.

Wells

Thoroughly flush the contaminated casing with a 500 ppm available chlorine solution. (Mix 1 ounce of the product with 10 gallons of water.) Backwash the well to increase yield and reduce turbidity, adding sufficient chlorinating solution to the backwash to produce a 10 ppm available chlorine residual, as determined by a chlorine test kit. After the turbidity has been reduced and the casing has been treated, add sufficient chlorinating solution to produce a 50 ppm available chlorine residual. Agitate the well water for several hours, and take a representative water sample. Re-treat the well if water samples are biologically unacceptable.

Basins, tanks, flumes, etc.

Thoroughly clean all equipment, then apply 4 ounces of calcium hypochlorite per 5 cubic feet of water to obtain 500 ppm available chlorine, as determined by a suitable test kit. After 24 hours, drain, flush, and return to service. If the previous method is not suitable, spray or flush the equipment with a solution containing 1 ounce of this product for each 5 gallons of water (1000 ppm available chlorine). Allow to stand 2 to 4 hours, flush and return to service.

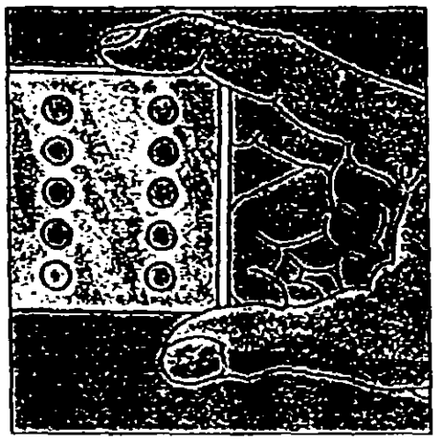
Filters

When sand filters need replacement, apply 16 ounces of calcium hypochlorite for each 150 to 200 cubic feet of sand. Where the filter is severely contaminated, additional calcium hypochlorite should be distributed over the surface at the rate of 16 ounces per 20 square feet. Water should stand at a depth of 1 foot above the surface of the filter bed for 4 to 24 hours. Where filter beds can be backwashed of mud and silt, apply 16 ounces of calcium hypochlorite per each 50 square feet, allowing the water to stand at a depth of 1 foot above the filter sand. After 30 minutes, drain the water to the level of the filter. After 4 to 6 hours, drain and proceed with normal backwashing

Distribution System

Flush the repaired or replaced section with water. Establish a hypochlorinating station and apply sufficient product until a concentrated available chlorine residual of at least 10 ppm remains after an 8 hour retention time. Use a chlorine test kit.

Emergency Disinfection



Cross connections or emergency connections

Hypochlorinators or gravity feed equipment should be set up near the intake of the untreated water supply. Apply sufficient product to give a chlorine residual of at least 0.1 to 0.2 ppm at the point where the untreated supply enters the regular distribution system. Use a chlorine test kit.

Supplementary water supplies

Gravity or mechanical hypochlorite feeders should be set up on a supplementary line to dose the water to a minimum chlorine residual of 0.2 ppm after a 20-minute contact time. Use a chlorine test kit.

Water shipped in by tanks, tank cars, trucks, etc.

Thoroughly clean all containers and equipment. Spray with a 500 ppm available chlorine solution and rinse with potable water after letting stand 5 minutes. This solution is made by mixing 1 ounce of calcium hypochlorite for each 5 gallons of water. During the filling of the containers, dose with sufficient amounts of this product to provide at least a 0.2 ppm chlorine residual. Use a chlorine test kit.

Individual Water Supplies

Where boiling of water for 1 minute is not practical, water can be made potable by using calcium hypochlorite. **Prior** to addition of the sanitizer, remove all suspended material by filtration or by allowing it to settle to the bottom. Decant the **clarified**, contaminated water to a clean container and add 1 grain of calcium hypochlorite to 1 gallon of water. One grain is approximately the size of the letter "O" in this sentence. Allow the treated water to stand for 30 minutes. Properly treated water **should** have a slight chlorine odor. If not, repeat dosage and allow the water to stand an additional 15 minutes. The treated water can then be made palatable by pouring it between clean containers several times.

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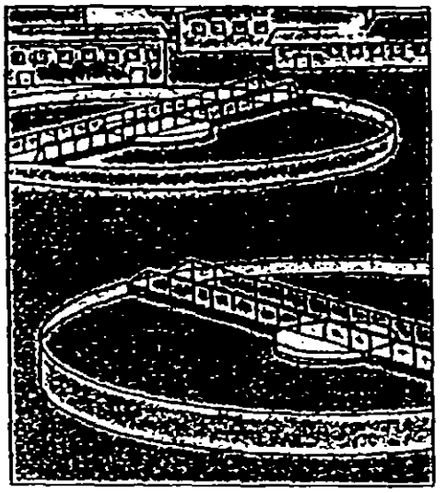
Sewage Treatment



B.O.D. reduction

B.O.D., or Biochemical Oxygen Demand, is the quantity of oxygen required to oxidize the polluting substance to a biochemically inert material. As little as 1 part per million of chlorine may bring about a reduction of 2 to 3 ppm in B.O.D. Calcium hypochlorite for this purpose may be added at virtually any point in the system.

To achieve maximum results in terms of desirable aerobic action and retardation of anaerobic decomposition, hypochlorination should be complete. The treatment will still be of value, however, even if the amount of calcium hypochlorite applied is less than the total amount which could be utilized.

Odor control

The most offensive odor encountered in sewage treatment is due to hydrogen sulfide. It is caused by the sulphate-splitting bacteria normally present in sewage.

Hydrogen sulfide can be very effectively controlled by calcium hypochlorite hypochlorination of the fresh sewage, which destroys the sulfide-producing bacteria. If the treatment of fresh sewage is not practical, calcium hypochlorite may be added at any point where the odors become objectionable. The amount required will, however, be increased, as the available chlorine in calcium hypochlorite will react not only with hydrogen sulfide, but also with other bacteria and organic material.

For a sulfide reduction of 1 ppm, from 8 to 10 ppm of available chlorine probably will be required.

Disinfection of sewage and wastewater effluent

Although every effort is usually made to locate treatment plants where effluent will not be the cause of problems, safe practice dictates that it should be treated to destroy harmful bacteria. Calcium hypochlorite has proven to be an effective and dependable means of destroying harmful bacteria in effluent. The amount required depends on the type of sewage to be treated. Raw sewage may require as much as 30 ppm available chlorine, while secondary treated sewage may need as little as 3 ppm.

The disinfection of sewage effluent must be evaluated by determining the total number of coliform bacteria and/or fecal coliform bacteria, as determined by the Most Probable Number (MPN) procedure, of the chlorinated effluent. This must be reduced to or below the maximum permitted by the controlling regulatory jurisdiction.

On the average, satisfactory disinfection of secondary wastewater effluent can be obtained when the chlorine residual is 0.5 ppm after 15 minutes contact. Although chlorine residual is the critical factor in disinfection, the importance of correlating chlorine residual with bacterial kill must be emphasized. The MPN of the effluent, which is directly related to the water quality standards requirements, should be the final and primary standard and the chlorine residual should be considered an operating standard valid only to the extent verified by the coliform quality of the effluent.

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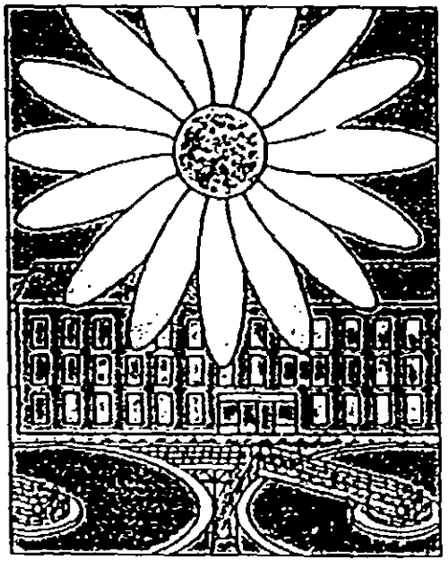
Sewage Treatment



The following are critical factors affecting wastewater disinfection:

1. **Mixing:** It is imperative that the product and the wastewater be instantaneously and completely flash mixed to assure reaction with every chemically active soluble and particulate component of the wastewater
2. **Contacting:** Upon flash mixing, the flow through the system must be maintained.
3. **Dosage/Residual Control:** Successful disinfection is extremely dependent upon response to fluctuating chlorine demand to maintain a predetermined, desirable chlorine level. Secondary effluent should contain 0.2 to 1.0 ppm chlorine residual after a 15-to-20 minute contact time. A reasonable average of residual chlorine is 0.5 ppm after 15 minutes contact time

Effluent slime control

Apply a 100 to 1000 ppm available chlorine solution at a location which will allow complete mixing. Prepare this solution by mixing 2 to 20 ounces of calcium hypochlorite with 100 gallons of water. Once control is evident, apply a 15 ppm available chlorine solution Prepare this solution by mixing 0.3 ounce of the product with 100 gallons of water

Filter beds—slime control

Remove the filter from service, drain it to a depth of 1 foot above the filter sand, and add 16 ounces of calcium hypochlorite per 20-square feet evenly over the surface. Wait 30 minutes before draining water to a level that is even with the top of the filter. Wait for 4 to 6 hours before completely draining and backwashing the filter.

Aid in coagulation

The value of calcium hypochlorite's available chlorine as an aid in coagulation is due primarily to its oxidizing power—a property which is of particular value in sewage treatment because there is almost no oxygen in sewage.

Hypochlorination with calcium hypochlorite is particularly helpful when iron salts are used as the primary coagulant. Ferric iron, in the absence of oxygen, tends to revert to ferrous iron, which is of little value as a precipitant Calcium hypochlorite supplies sufficient oxygen to retard or prevent this change. It should be used just before the primary coagulant in a proportion of 3 to 5 ppm

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Swimming Pools

Pool water chlorination

Calcium hypochlorite provides a simple, effective method of treatment for chlorinating swimming pool water. Its use is especially suited to indoor pools. For best results, it is introduced in controlled quantities into the recirculated water. Automatic feed equipment for this purpose is readily available.

Pool accessory equipment

The possibility for the spread of infectious diseases is heightened wherever bathers gather. To provide proper and effective preventive care, calcium hypochlorite should be used to inexpensively destroy harmful bacteria on swimming pool premises and equipment, including shower rooms, floors and walkways, restroom facilities, diving boards, ladders, etc.

NOTE: As this product is toxic to fish and other aquatic life, treated water should not be discharged where it will drain into streams, rivers, lakes, or public waters.

Service

The technical service staff of PPG Industries is available for consultation on handling, storage, and the use of calcium hypochlorite and on swimming pool care in general.

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Agricultural Uses

Farm Buildings and Enclosures

Regularly clear all livestock, poultry and other animals, as well as their feed from premises, enclosures, vehicles, etc. Clean all litter and manure from floors, walls and surfaces of facilities occupied or traversed by animals or poultry. Empty all troughs and other feeding and watering devices. Thoroughly clean all surfaces with soap or detergent and rinse with water. Disinfect by saturating all surfaces with a solution of at least 1000 ppm available chlorine (see Preparing Calcium Hypochlorite Solutions, p. 29) for a period of 10 minutes. Also, immerse all halters, ropes, cages and other equipment used in handling and restraining animals or poultry, the cleaned forks, shovels and scrapers used for removing litter and manure in this solution. Ventilate the buildings, vehicles and closed spaces. Do not release livestock or poultry or reemploy equipment until chlorine has been dissipated. Disinfected feed racks, automatic feeders, fountains and waterers must be rinsed with potable water before reuse.

Poultry Plants

Calcium hypochlorite solutions will control odors and bacterial growth in poultry feeding and dressing plants. Poultry feeding areas, dropping boards, feeding troughs and watering fountains should receive regular treatment with solutions containing 5000 ppm available chlorine.

Spray or flush dropping boards and feeding troughs thoroughly with the solution.

Watering fountains should be rinsed with the solution. In float control fountains, treat poultry drinking water with 1 oz. of calcium hypochlorite by using a gravity feeder. In refillable fountains, treat poultry drinking water by adding 1 oz. of calcium hypochlorite for every 1000 to 5000 gallons of poultry drinking water.

Clean poultry dressing areas regularly before treatment. Immediately after, disinfect by spraying the walls, tables, floors and ceilings with a solution containing 5000 ppm available chlorine for a period of 10 minutes.

Clean equipment and utensils should be sanitized with a 200 ppm available chlorine solution for a period of 2 minutes.

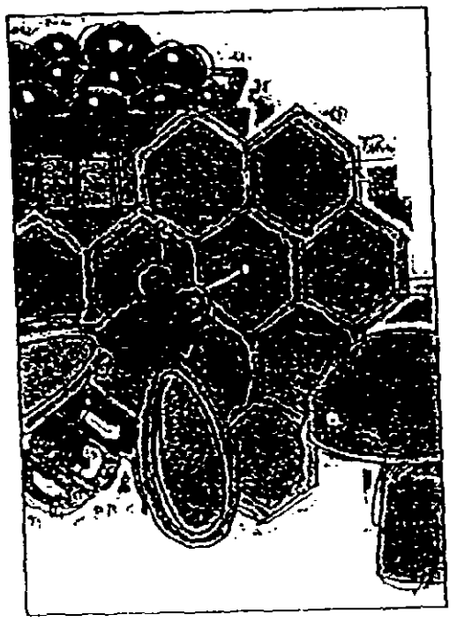
Harvested Potatoes

To help control and reduce the spread of organisms which cause soft rot, sanitize potatoes after cleaning and prior to storage by spraying with a solution containing 500 ppm available chlorine at a dosage of 1 gallon of sanitizing solution per ton of potatoes. Spray the solution over the potatoes as they enter storage on a conveyor line. Provide tumbling action during this treatment.

Harvested Sweet Potatoes

To control and reduce the spread of soft rot-causing organisms in water and on sweet potatoes (*Ipomoea batatas*), spray potatoes with a 150 to 500 ppm solution for 2 to 5 minutes.

If a dip is used, monitor the solution hourly and add enough calcium hypochlorite to the solution to maintain the 150 to 500 ppm level. Or, change the solution hourly (or as frequently as necessary) to prevent the available chlorine level from dropping too low.



Mushrooms

To control bacterial blotch (Pseudomonas toloasii), apply a 100 to 200 ppm solution prior to watering mushroom production surfaces. The first application should begin when pins form, and thereafter between breaks on a need basis depending on the occurrence of bacterial blotch. Calcium hypochlorite may be applied directly to pins to control small infection foci. Apply 1.5 to 2.0 oz. per square foot of growing space.

Bee Cells and Boards

(Not Applicable in California)

Immerse leafcutting bee cells and bee boards in a solution containing 1 ppm available chlorine for 3 minutes to disinfect. Allow cells to drain for 2 minutes and dry for 4 to 5 hours, or until no chlorine odor can be detected. This solution is made by thoroughly mixing 1/4 tsp. of calcium hypochlorite in 200 gallons of water. Bee domiciles are disinfected by spraying with a 0.1 ppm solution until all surfaces are thoroughly covered. Allow the domicile to dry until chlorine odor has dissipated before placing in use.

Harvested Fruits

Calcium hypochlorite solutions containing 25 ppm available chlorine can reduce harmful bacteria and improve the keeping properties of fruit. First, clean all fruit in wash tank. Then, prepare a 25 ppm available chlorine solution in a second wash tank. Soak the fruit for two minutes in the solution, then rinse with potable water.

Harvested Vegetables

First, remove surface soils and debris from vegetables in a wash tank. After draining, disinfect by submerging vegetables in a second wash tank for two minutes while circulating a 25 ppm available chlorine solution. After this washing, spray rinse with fresh calcium hypochlorite solution, rinse with potable water and then package.

Seeds

Bacterial spot (Xanthomonas vesticatoris) on pimentos seeds may be controlled by initially removing moist seeds from ripe fruits to control surface fungi and bacteria on tomato seeds. Initially wash seeds, then immediately soak seeds in 39,000 ppm solution for 15 minutes with continuous agitation. After treatment, rinse seeds in potable water for 15 minutes. Dry seeds to normal moisture. Make this solution by mixing 8 oz. of this product with 1 gallon of water.

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Aquacultural Uses

Fish Ponds

Remove all fish from ponds prior to treatment. Thereafter, thoroughly mix 20 oz. of calcium hypochlorite for each 10,000 gallons of pond water. Repeat the treatment if the available chlorine level is below 1 ppm after 5 minutes. Return fish to the pond after the available chlorine level reaches zero.

Fish Pond Equipment

Clean all physical soil from equipment prior to treatment. Soak equipment in a solution of 200 ppm available chlorine. Porous equipment should soak for one hour.

Maine Lobster Ponds

Remove lobster, seaweed, etc. from ponds prior to treatment. Drain the pond and thoroughly mix 75 pounds of calcium hypochlorite to each 10,000 gallons of pond water. Apply evenly so that all barrows, gates, rocks and dam are treated with the product. Permit high tide to fill the pond and then close gates. Allow water to stand 2 to 3 days until the available chlorine level reaches zero. Open the gates and allow 2 tidal cycles to flush the pond before returning lobsters to the pond.

Conditioning Live Oysters

(Not Applicable In California)

Mix 1 oz. of this product completely with each 10,000 gallons of water at 50 to 70 degrees F. Expose the oysters to this solution for at least 15 minutes, monitoring the available chlorine level to be sure it does not fall below 0.05 ppm. Repeat the entire process if the available chlorine level drops below 0.05 ppm or the temperature falls below 50 degrees F.

Control of Scavenger Fish in Hatchery Ponds

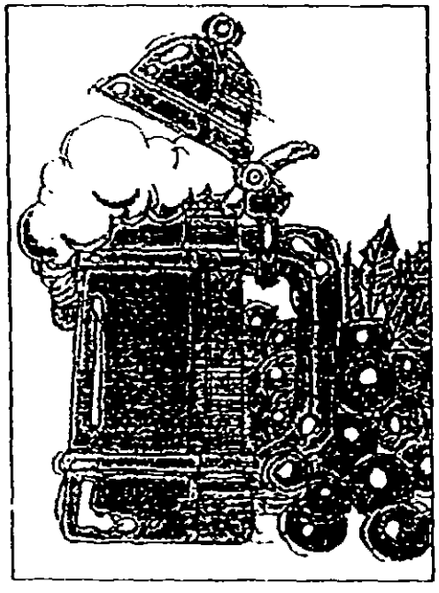
Prepare a 200 ppm solution. Pour into drained pond potholes and repeat if necessary. Do not replace desirable fish into refilled ponds until chlorine residual has dropped to 0 ppm, as determined by a test kit.

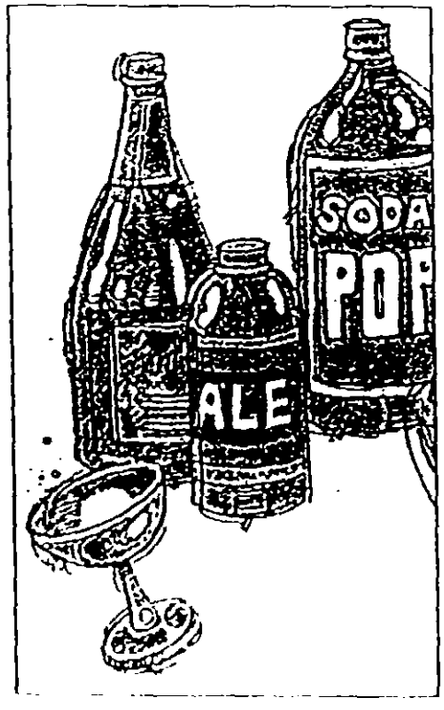
Boat Hulls

(Not Applicable In California)

To control slime on boat hulls, sling a plastic tarp under the boat, retaining enough water to cover the fouled bottom area. Do not allow additional water to enter enclosed area. This envelope should contain approximately 500 gallons of water for a 14 foot boat. Add 3.5 oz. of calcium hypochlorite to the enclosed water to obtain a 35 ppm available chlorine concentration. Leave immersed for 8 to 12 hours. Repeat if necessary. Do not discharge the solution until the free chlorine level has dropped to 0 ppm, as determined by a test kit.

Beverage Plants





Breweries

Calcium hypochlorite solutions enable breweries to prevent bacterial growth and assure the purity and fresh taste of their products on a continuing basis.

As a general sanitizer, calcium hypochlorite is doubly effective because of its dissolving action on beer stone, proteins, slime, yeast and other matter commonly found in brewery lines, tanks, hoses, etc.

To prepare a stock cleaning and sanitizing solution, add 5 pounds of calcium hypochlorite to 3 gallons of warm water in a 20-gallon container. Introduce 3 pounds of soda ash and stir until dissolved. Dilute this mixture with cold water to make 15 gallons of solution, then add 5 pounds of PPG Pels® caustic soda beads. Stir to dissolve and allow to stand. When diluted 1-to-10 with water, this solution is an excellent cleaner/sanitizer for piping and equipment, steel, tile and concrete vats.

Fermenting Tubs—Cyprus:

Clean and rinse the tub thoroughly to remove all traces of oil, then fill with a 200 ppm available chlorine solution to sanitize. Allow to stand 10-12 hours.

Washing Equipment:

Sanitize the washing equipment by first thoroughly cleaning, then flushing all surfaces with calcium hypochlorite solution containing 200 ppm available chlorine.

Malting Areas:

Floors and walls around malt tanks should be thoroughly washed once a week to prevent mold formation and odor. After cleansing, flush both floors and walls with a solution containing 0.25% available chlorine.

Aging Cellars:

Spray the concrete walls of aging cellars regularly with a calcium hypochlorite solution of 0.5% available chlorine to destroy existing mold and mildew and prevent odor.

Pasteurizers:

Slime and odors that develop in pocket-type pasteurizers can be controlled with regular use of a 1% available chlorine solution fed into the pasteurizer water supply by a hypochlorinator. A feed rate which provides a dosage of 0.5 to 1.0 ppm available chlorine at the overflow is required for optimum results. After draining and cleaning pasteurizers, the hypochlorinator should be used to provide fresh refill water with the proper chlorine residual.

Grain Steep Tanks:

Calcium hypochlorite is a highly effective sanitizer in controlling mold growth in humid malt house conditions. Steep tanks should be cleaned first, then sprayed with a 1.5 to 2.0% available chlorine solution. Allow to stand 30 minutes.

The walls of concrete germination compartments should also be cleaned and treated as above.

The perforated metal floors of germination compartments should be sprayed with high pressure water for thorough cleaning and then covered at a rate of 0.15 oz. of dry calcium hypochlorite per square foot of wet floor. (A clean, dry, uncontaminated broadcaster or spreading device may be used effectively.) Allow the coating to stand for 30 minutes, rinse thoroughly with potable water before putting equipment in service.

Beverage Plants

Water Supplies:

Calcium hypochlorite solutions containing 1% available chlorine will properly sanitize plant water used to produce beer.

The calcium hypochlorite solution should be introduced into the water supply by a hypochlorinator. An available chlorine residual of 0.2 to 0.6 ppm must be maintained throughout the system at all times. Be sure to dechlorinate the water before it is used to process beer.

Carbonated Beverage Plants

Water Supplies:

Available plant water supplies used to produce carbonated beverages may be properly sanitized by introducing a solution of 1% available chlorine. The solution should be introduced by a hypochlorinator and adjusted to supply an available chlorine residual of 0.2 to 0.6 ppm at all times.

Be sure to dechlorinate the water before it is used to process beverages.

Manufacturing equipment:

The use of calcium hypochlorite is a reliable and economical way to sanitize equipment and control the quality and taste of carbonated beverages.

Before bottling operations start up, feed a 200 ppm available chlorine solution through all pumps, lines and filters to eliminate bacteria. Clean surfaces before treatment. After each bottling operation, thoroughly spray syrup tanks with a 200 ppm available chlorine solution, and let stand for 30 minutes.

Cider Plants

Even when stored under cold conditions, sweet cider is particularly susceptible to fungus growth, which causes spoilage. As a preventive, sanitize each cask for a period of two minutes with a 200 ppm available chlorine solution, for a period of two minutes before use. Clean thoroughly first, then rinse each cask with the solution.

Wineries

Plant Sanitization:

Calcium hypochlorite will sanitize and prevent contamination in wineries to insure product quality. Following each run, clean the entire plant area and its equipment. Immediately before the next run, sanitize with calcium hypochlorite as follows:

Rinse nonporous wall surfaces, floors and equipment with a calcium hypochlorite solution containing 500 ppm available chlorine. Let stand 10 minutes.

Porous surfaces (wood, concrete, etc.) should be scrubbed or sprayed with a 1000 ppm available chlorine solution. Let stand 10 minutes.

Storage vessels, fermenting vats, casks, presses and grape crushers should be cleaned of physical soil thoroughly before treatment. Rinse or spray with a calcium hypochlorite solution containing 200 ppm available chlorine. Let stand 10 minutes.

Sanitize bottles and corks by immersing them for 5 minutes in a tank containing 200 ppm available chlorine.

Mold Control:

Mold growth should be treated on discovery with calcium hypochlorite to prevent further spreading.

Spray the affected surfaces with a calcium hypochlorite solution providing 0.5% available chlorine. Heavy growth may require scrubbing and/or repeated applications.

Storage and Filling Tanks:

Disinfect storage and filling tanks with calcium hypochlorite to maintain a high level of product quality.

After a run and before refilling tanks, they should be thoroughly disinfected with calcium hypochlorite.

For wooden or nonporous tanks, first preclean then fill with calcium hypochlorite solutions containing 600 ppm available chlorine. Solutions should stand for at least 10 minutes. Then, rinse tanks with potable water for a period of 2 minutes immediately before refilling.

Unused tanks and vats should be kept sanitized with calcium hypochlorite. Fill each with water and dry calcium hypochlorite to obtain a residual of approximately 15 ppm available chlorine. Test every week and repeat treatment if residual falls below 2 ppm.

Press Cloths:

Press cloths contaminated with bacteria or organic matter must be treated with calcium hypochlorite solutions to neutralize microorganisms and prevent spreading.

After use, wash cloths thoroughly, then soak as follows: For every 100 pounds dry weight of the cloth, add 2 oz. dry calcium hypochlorite to 60 gallons of water. Soak for 15 minutes.

Grape Juice Plants

Sanitize equipment and problem areas of grape juice plants using the same treatment procedures recommended for wineries.

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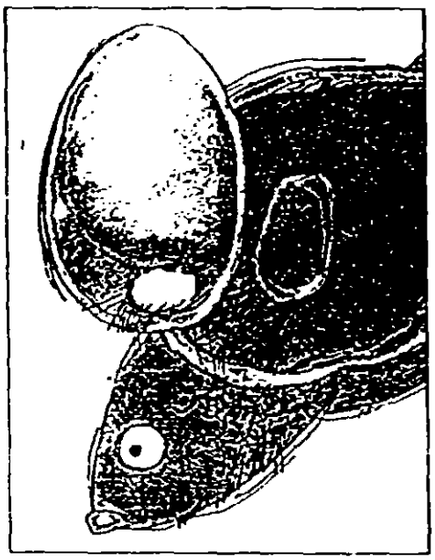
Food Processing Plants



Egg Breaking Operations

Calcium hypochlorite solutions will control bacteria on contaminated eggs and sanitize equipment and areas used in egg breaking operations.

Food Egg Product Sanitization:

Thoroughly clean all eggs. Prepare a 200 ppm available chlorine solution using warm water. (Temperature should not exceed 130 degrees F.) Spray the warm sanitizer over eggs so that they are thoroughly wetted. Allow the eggs to dry before casing or breaking. Do not apply a potable water rinse. The solutions should not be reused to sanitize eggs.

Cups, breaking knives, trays and any other equipment that comes in contact with "off" eggs should be thoroughly cleaned and sanitized. Clean all equipment with washing powder and rinse with clear water. Immediately prior to placing back in use, spray with a calcium hypochlorite solution containing 50 to 200 ppm available chlorine.

Sanitize egg freezers and dryers, tanks, pipelines, pumps, etc. using a spray method treatment. This method is generally used to sanitize large, nonporous surfaces already free of physical soil.

Prepare a calcium hypochlorite solution containing 200 ppm available chlorine. If possible, use pressure spraying or fogging equipment designed for use with hypochlorite solutions (plastic, rubber coated or stainless steel.) When using other types of spraying equipment, be sure to empty and rinse thoroughly with fresh water immediately after use.

Thoroughly spray or fog all surfaces eggs will touch. Allow excess solution to drain off, then place in service.

Food Egg Product Disinfection:

In egg breaking rooms, all equipment and surfaces should be deodorized and disinfected with solutions of calcium hypochlorite. After cleaning, and just prior to using, spray, wipe or rinse tables, stools, walls and floors with a calcium hypochlorite solution containing 1000 ppm available chlorine. Let stand 10 minutes.

Fish Processing Plants

Calcium hypochlorite solutions will control the growth of bacteria and microorganisms which occur in fish processing plants.

Scrub all surfaces thoroughly with hot water and washing powder to remove all physical soil before treatment.

Hard or Nonporous Surfaces

Calcium hypochlorite solutions containing 600 ppm available chlorine will disinfect hardwood, metal or synthetic surfaces (new boxes or tabletops; conveyor belts or machines). Flood surfaces with calcium hypochlorite solution for 2 to 5 minutes. Let stand for 10 minutes. Rinse with 200 ppm available chlorine solution for a period of 2 minutes.

Food Processing Plants

Soft or Porous Surfaces:

Calcium hypochlorite solutions containing 600 ppm available chlorine will sanitize soft or porous surfaces (worn tables, old boxes, concrete floors and walls). Flood surfaces with calcium hypochlorite solution for 2 to 5 minutes. Let stand 2 minutes. Rinse with 200 ppm available chlorine solution for a period of 2 minutes.

Pecan Cracking and Bleaching

Calcium hypochlorite solutions can be used both to control bacteria in pecans and also to bleach the shells in preparation for dyeing. Calcium hypochlorite solutions containing 1000 ppm available chlorine reduce bacteria in pecans without affecting the taste. Prior to cracking and shelling, soak the pecans in the solutions for at least 10 minutes. Remove and let the pecans age for 24 hours to allow for softening of the meat. Following this, the pecans will crack more uniformly and the entire nut may be removed more easily.

Solutions containing 5000 ppm available chlorine effectively bleach pecan shells. Before bleaching, wash the pecans in a rotary cleaner. Rinse, drain and soak the pecans in a 2% sulfuric acid bath at 27 degrees to 32 degrees C (80 to 90 degrees F) for one minute. Afterward, place them in the calcium hypochlorite solution for 4 to 8 minutes. When the pecans are bleached white, drain and wash in a 1% sulfuric acid bath at 27 to 32 degrees C. After drying, they are ready to be dyed.

Canneries

Hot, freshly-packed cans are often cooled by immersion in cold water. This creates a partial vacuum in the container which may allow the cooling water to enter through seams or pin holes. If bacteria are present in the water, contents may become contaminated and spoil.

Calcium hypochlorite solutions providing 1% available chlorine should be fed into cooling tanks or channels by an elevated tank to provide a concentration of 2 ppm available chlorine. The flow may be controlled with a non-corroding valve or a pinch-stop on a rubber hose.

Feed points should be located to provide uniform distribution of solution throughout the entire system. Long and narrow tanks may require the solution to be fed at two points to insure proper distribution.

Test the cooling water for available chlorine. If a residual of 2 ppm is present throughout the system, the water is properly sanitized.

Test for available chlorine every hour until dosage requirements are established. Thereafter, check every 2 or 3 hours to ascertain that an available chlorine residual of 2 ppm is maintained throughout the cooling system.

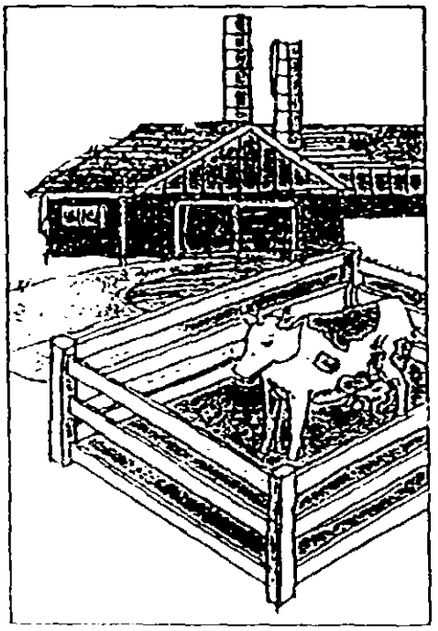
Water Supplies:

One percent chlorine solutions will effectively purify the water supply in canneries. Feed the solution into the water supply by a hypochlorinator on the intake side of the pump. An available chlorine residual of 0.2 to 0.3 ppm must be maintained throughout the water distribution system to assure adequate purification. Regular testing should be initiated to assure proper chlorine residuals are present at all times.

Wastes:

Solutions containing 1000 ppm available chlorine control odors from decaying food waste disposed in dumps or collecting points. Accumulations of waste should be sprayed or soaked with calcium hypochlorite solution daily to eliminate odors.

Calcium hypochlorite solutions applied by continuous treatment to maintain a residual of 15 to 25 ppm will control odors in food waste being removed by water suspension.



Meat Processing Plants

An effective general sanitizer or disinfectant, calcium hypochlorite solutions also provide odor control in meat processing plants.

Killing Rooms:

Disinfect the entire killing room with calcium hypochlorite solution to prevent the contamination of meat and the development of offensive odors.

Scrub all walls and floors completely. Spray thoroughly with a solution containing 5000 ppm available chlorine.

Drains and traps through which blood passes should be flushed thoroughly with water and flushed with solution containing 5000 ppm available chlorine. Allow this solution to stand overnight, then flush

Inedible Rooms:

Solutions containing 1000 ppm available chlorine will properly disinfect inedible rooms, prevent odors and improve the handling qualities of hides and other marketable items.

Thoroughly clean inedible rooms on a regular basis. After cleaning, spray the tank house, the press rooms and the hide rooms generously with the calcium hypochlorite solution.

Edible Rooms:

Calcium hypochlorite solutions containing 1000 ppm available chlorine will disinfect and control bacteria in refrigerating, curing, and processing areas to prevent taste and color problems in products.

Thoroughly clean all edible rooms on a regular basis. After cleaning, room surfaces and equipment should be sprayed well with 1000 ppm solution for 10 minutes. Rinse with 200 ppm available chlorine solution for a period of 2 minutes.

Equipment and Utensils:

To prevent contamination, sanitize all equipment and utensils that came in contact with meat with a solution containing 200 ppm available chlorine Clean equipment and utensils thoroughly, removing all fat and grease. Spray or rinse with solution. Let stand 2 minutes.

Locker Rooms, Elevator Pits and Toilets:

Disinfect and deodorize locker rooms, elevator pits and toilets with a calcium hypochlorite solution containing 5000 ppm available chlorine

Locker rooms, shower rooms, toilets, urinals and drains should be cleaned, then sprayed or flushed with the solution on a regular basis. After treatment, let stand 10 minutes, then rinse exposed surfaces with potable water to prevent corrosion

Add 1 level tablespoon of calcium hypochlorite to the residual water of toilet bowls and walls

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Dairy Industries

Creameries, Ice Cream Factories, Cheese Factories, and Milk Plants:

Calcium hypochlorite solutions provide an effective, economical method of sanitizing processing equipment and problem areas in creameries, ice cream factories, cheese factories and milk plants.

To prevent contamination of the product, apply calcium hypochlorite solutions to every surface the product will touch.

Pressure Sanitizing Equipment:

Pressure is commonly used to sanitize closed systems, such as fluid milk cooling and handling equipment. The pressure method is also appropriate for sanitizing weigh tanks, coolers, short-time pasteurizers, pumps, homogenizers, fillers, sanitary piping and fittings, and bottle and can fillers.

Immediately after use, clean all equipment thoroughly, then place back in operating position.

Prepare a sufficient amount of a calcium hypochlorite solution containing 200 ppm available chlorine to fill the equipment. (Allow a 10% excess for waste.)

Pump the calcium hypochlorite solution through the system until it is filled and air is excluded. Close final drain valves and hold the system under pressure for 2 minutes to insure proper contact with all surfaces. Drain the solution.

Spray Sanitizing Equipment:

A spray (or fog) method is generally used to sanitize large, nonporous surfaces which have been freed of physical soil and thoroughly cleaned. It is appropriate for batch pasteurizers, holding tanks, weigh tanks, tank trucks and cars, vats, tile walls, ceilings and floors.

Prepare a solution containing 200 ppm available chlorine. Use pressure spraying or fogging equipment designed to resist hypochlorite solutions (rubber-coated, plastic or stainless steel). When using other types of spraying equipment, empty and rinse thoroughly with fresh water immediately following treatment.

Heavily spray or fog all surfaces the product will contact. All surfaces, corners and turns should be thoroughly coated. Allow excess solution to drain off, then place in service.

Water Supplies:

Calcium hypochlorite solutions containing 1% available chlorine will disinfect water supplies used in the production of dairy products. The solution should be prepared using the following procedure.

Mix 3.75 pounds of calcium hypochlorite into a 30-gallon plastic container 1/3 full of warm water. Add 3 pounds of light soda ash, stir thoroughly and dilute to 30 gallons. Add this solution to the water supply and let stand 20 minutes. The water supply has been sanitized when a 0.2 ppm of available chlorine is present.

General Sanitizing:

Sanitize plant floors, walls and ceilings, and control odors in refrigerated areas and on drain platforms with a 1000 ppm calcium hypochlorite solution.

Flush or swab surfaces generously with solution. Allow to stand 2 minutes.

Controlling Mold and Mildew:

Destroy mold and nonresidual mildew that often grows in cheese aging rooms, storage rooms and other areas with a calcium hypochlorite solution of 5000 ppm available chlorine.

Brush or spray all precleaned walls, floors, ceilings and shelves with the solution. Then, rinse all metal surfaces immediately to prevent corrosion.

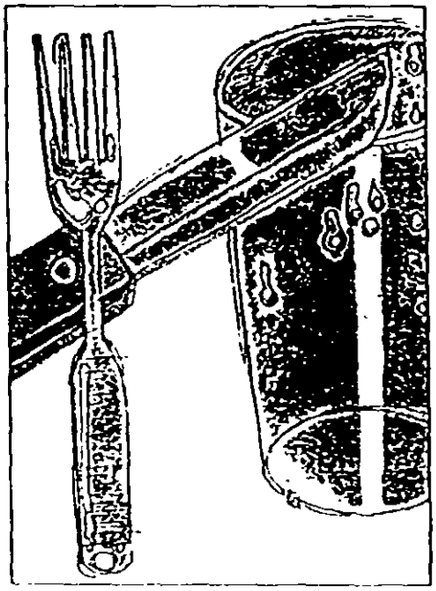
Wastes:

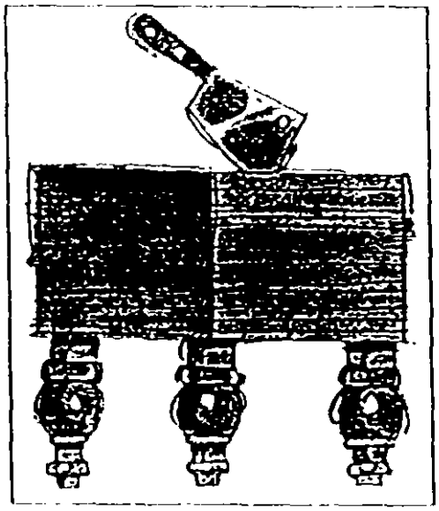
Calcium hypochlorite solutions containing 15 to 25 ppm available chlorine provide odor control of dairy plant waste.

An overflow-type retention basin, flume or outfall of sufficient length is necessary to provide required contact time and mixing. For continuous treatment, calcium hypochlorite is introduced by a hypochlorinator capable of feeding the solution in proportion to waste flow. The hypochlorinator should be located near the point where waste leaves the plant building, followed by baffles for agitation.

Batch waste should be impounded and treated with calcium hypochlorite solution, which provides a residual of 15 to 25 ppm available chlorine.

Institutional, Commercial, and Home Uses





Sanitizing Nonporous Food Contact Surfaces

Rinse Method:

A calcium hypochlorite solution of 100 ppm available chlorine may be used in the sanitizing solution if a chlorine test kit is available. Solutions containing an initial concentration of 100 ppm available chlorine must be tested and adjusted periodically to insure that the available chlorine does not fall below 50 ppm. If a test kit is not available, prepare a sanitizing solution to provide approximately 200 ppm available chlorine by weight

Thoroughly scrub all surfaces with an approved cleaner, followed by a potable water rinse before sanitization Prior to use, rinse surfaces thoroughly with the sanitizing solution, maintaining contact with the sanitizer for at least 2 minutes If solution contains less than 50 ppm available chlorine, as determined by a suitable test kit, either discard or add sufficient dry calcium hypochlorite to re-establish a 200 ppm residual. Do not rinse equipment with water after treatment and do not soak equipment overnight. Sanitizers used in automated systems may be used for general cleaning but may not be reused for sanitizing purposes

Immersion Method:

A calcium hypochlorite solution of 100 ppm available chlorine may be used in the sanitizing solution if a chlorine test kit is available. Solutions containing an initial concentration of 100 ppm available chlorine must be tested and adjusted periodically to insure that the available chlorine does not fall below 50 ppm. If no test kit is available, prepare a sanitizing solution to provide approximately 200 ppm available chlorine by weight

Thoroughly scrub all surfaces with an approved cleaner, followed by a potable water rinse before sanitization. Prior to use, immerse equipment in the sanitizing solution for at least 2 minutes and allow the sanitizer to drain. If solution contains less than 50 ppm available chlorine, as determined by a suitable test kit, either discard or add sufficient dry calcium hypochlorite to re-establish a 200 ppm residual. Do not rinse equipment with water after treatment.

Sanitizers used in automated systems may be used for general cleaning but may not be reused for sanitizing purposes

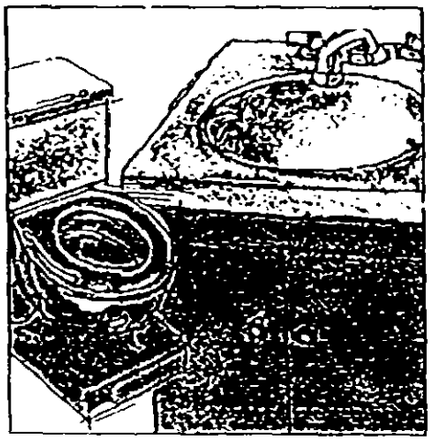
Flow/Pressure Method:

Disassemble equipment and thoroughly clean after use Assemble equipment in operating position prior to use Prepare a volume of a 200 ppm available chlorine sanitizing solution equal to 110% of volume capacity of the equipment. Pump solution through the system until a full flow is obtained in all extremities and the system is completely filled with the sanitizer. Close drain valves and hold under pressure for at least 2 minutes to insure contact with all internal surfaces Remove some solution from drain valve and test with a chlorine test kit If effluent contains less than 50 ppm available chlorine, repeat the process

Clean-in-Place Method:

Thoroughly clean the equipment after use Prepare a volume of a 200 ppm available chlorine sanitizing solution equal to 110% of volume capacity of the equipment Pump the solution through the system until full flow is obtained at all extremities and the system is completely empty of air and filled with the sanitizer Close drain

Institutional, Commercial, and Home Uses



valves and hold under pressure for at least 10 minutes to insure contact with all internal surfaces. Remove some solution from drain valve and test with a chlorine test kit. If effluent contains less than 50 ppm available chlorine, repeat the process.

Spray/Fog Method:

Preclean all surfaces after use. Use a 200 ppm available chlorine solution to control bacteria, mold or fungi and a 600 ppm solution to control bacteriophage. Prepare a 200 ppm sanitizing solution of sufficient size by thoroughly mixing the product in a ratio of 1 oz product with 20 gallons of water. Prepare a 600 ppm solution by thoroughly mixing the product in a ratio of 3 oz product with 20 gallons of water. Use spray or fogging equipment which can resist hypochlorite solutions. Always empty and rinse spray/fog equipment with potable water after use. Thoroughly spray or fog all surfaces until wet, allowing excess sanitizer to drain. Vacate area for at least 2 hours. Prior to using equipment, rinse all surfaces treated with a 600 ppm solution with a 200 ppm solution.

Sanitizing Porous Food Contact Surfaces

Rinse Method:

Prepare a solution of approximately 600 ppm available chlorine by weight. Preclean surfaces in the normal manner and immediately rinse all surfaces thoroughly with the sanitizing solution, maintaining contact with the sanitizer for at least two minutes. Prior to using the equipment, rinse all surfaces with 200 ppm available chlorine solution. Do not rinse and do not soak equipment overnight.

Immersion Method:

Prepare a sanitizing solution of approximately 600 ppm available chlorine by weight. Clean the equipment in a normal manner. Prior to using, immerse equipment in a 200 ppm sanitizing solution for at least two minutes and allow the sanitizer to drain. Do not rinse and do not soak equipment overnight.

Spray/Fog Method:

Preclean all surfaces after use. Prepare a 600 ppm available chlorine sanitizing solution. Use spray or fogging equipment which resists hypochlorite solutions. Thoroughly spray or fog all surfaces until wet, allowing excess sanitizer to drain. Vacate the area for at least 2 hours. Prior to using the equipment, rinse all surfaces with a 200 ppm available chlorine solution.

Sanitizing Nonporous Non-Food Contact Surfaces

Rinse Method:

Clean equipment surfaces in the normal manner. Immediately rinse all surfaces thoroughly with a 200 ppm available chlorine solution, maintaining contact for at least 2 minutes. Do not rinse after treatment and do not soak equipment overnight

Immersion Method:

Clean the equipment in normal manner. Immediately immerse in a 200 ppm available chlorine solution for at least 2 minutes and allow the sanitizer to drain. Do not rinse after treatment

Spray/Fog Method:

Preclean all surfaces after use. Prepare a 200 ppm available chlorine solution Use spray or fogging equipment which can resist hypochlorite solutions Immediately spray or fog all surfaces thoroughly, then allow excess solution to drain. Vacate area for at least 2 hours.

Sanitizing Porous Non-Food Contact Surfaces

Rinse Method:

Prepare a sanitizing solution of approximately 600 ppm available chlorine by weight. Clean the surfaces in a normal manner. Prior to use, rinse all surfaces thoroughly with the sanitizing solution, maintaining contact with the sanitizer for at least 2 minutes. Do not rinse equipment after treatment. Do not soak equipment overnight

Immersion Method:

Prepare a sanitizing solution of approximately 600 ppm available chlorine by weight Clean the equipment in a normal manner. Prior to use, immerse the equipment in the sanitizing solution for at least 2 minutes and allow the sanitizer to drain Do not rinse equipment after treatment

Spray/Fog Method:

After cleaning, sanitize non-food contact surfaces with a solution containing 600 ppm available chlorine Use spray or fogging equipment which can resist hypochlorite solutions. Prior to using the equipment, thoroughly spray or fog all surfaces until wet, allowing the excess sanitizer solution to drain Vacate area for at least 2 hours

Disinfecting Nonporous Non-Food Contact Surfaces

Rinse Method:

Prepare a disinfecting solution of approximately 600 ppm available chlorine by weight. Clean equipment surfaces in a normal manner. Immediately prior to use, rinse all surfaces thoroughly with the disinfecting solution, maintaining contact with the solution for at least 10 minutes. Do not rinse after treatment. Do not soak equipment overnight.

Immersion Method:

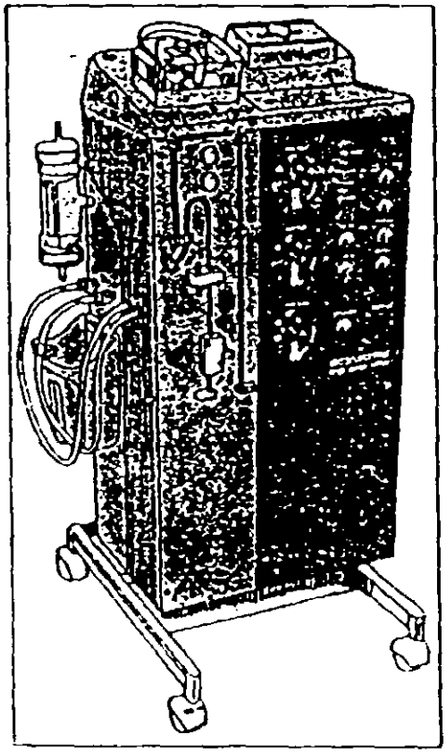
Prepare a disinfecting solution of approximately 600 ppm available chlorine by weight. Clean the equipment in a normal manner Immediately, prior to use, immerse the equipment in the disinfecting solution for at least 10 minutes and allow the sanitizer solution to drain Do not rinse the equipment after treatment

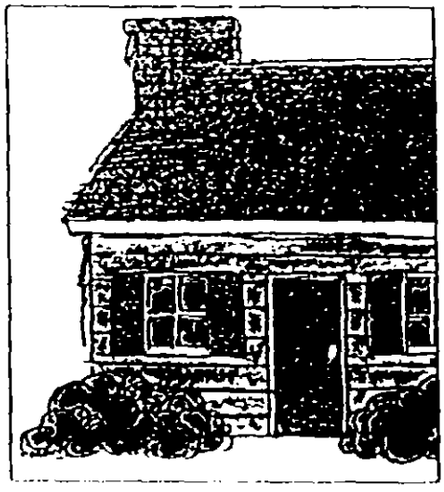
General Sanitization

Calcium hypochlorite solutions of 1000 ppm available chlorine will sanitize floors, walls and ceilings, and control odors in refrigerated areas and on drain platforms

Clean surfaces before treatment. Flush or swab surfaces thoroughly with the solution Let stand 2 minutes, hose or rinse all metal surfaces with potable water

Institutional, Commercial, and Home Uses





Controlling Mold or Mildew

Calcium hypochlorite solutions containing 5000 ppm available chlorine will destroy mold and nonresidual mildew that grow in storage rooms and other areas.

Brush or spray all precleaned walls, floors, ceilings and shelves with the solution. Rinse all metal surfaces immediately to prevent corrosion.

Bathrooms

Calcium hypochlorite solutions containing 5000 ppm available chlorine will sanitize and deodorize toilets, shower rooms, urinals, drains and other bathroom facilities.

Toilets, shower rooms, urinals and drains should be cleaned and sprayed or flushed with the calcium hypochlorite solution on a regular basis. After treatment, let stand 10 minutes and rinse exposed metal surfaces with potable water to prevent corrosion.

For toilet bowls, add 1 tablespoon of dry calcium hypochlorite to the residual water and swab.

Sanitizing Dialysis Machines

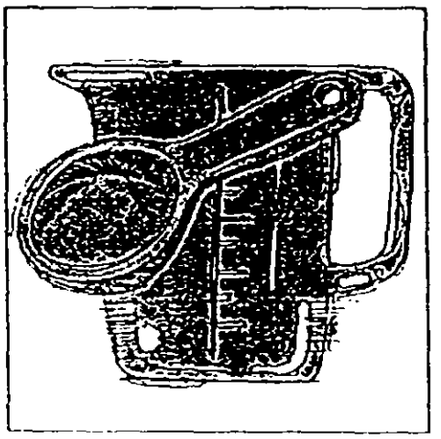
Flush dialysis equipment thoroughly with water prior to sanitizing. Thoroughly dissolve 7 oz. of this product in 60 gallons of water to obtain at least a 600 ppm available chlorine solution. Use this solution in the hemodialysate system immediately allowing a minimum contact time of 15 minutes at 20 degrees C. Thereafter, drain the system of the sanitizing solution and thoroughly rinse with potable water. Discard and **do not** reuse the spent sanitizer. Rinsate must be monitored with a suitable test kit to insure that no available chlorine remains in the system.

Calcium hypochlorite solutions are recommended for decontaminating single and multipatient hemodialysate systems. Calcium hypochlorite has been shown to be an effective disinfectant (virucide, fungicide, bactericide, pseudomonicide) when tested by AOAC and EPA test methods. Calcium hypochlorite may not totally eliminate all vegetative microorganisms in hemodialysate delivery systems due to their construction and/or assembly, but can be relied upon to reduce the number of microorganisms to acceptable levels when used as directed. This product should be used in a disinfectant program which includes bacteriological monitoring of the hemodialysate delivery system. Calcium hypochlorite is **not** recommended for use in hemodialysate or reverse osmosis (RO) membranes.

Consult the guidelines for hemodialysate systems which are available from the Hepatitis Laboratories, CDC, Phoenix, AZ 85021.

Asphalt or Wood Roofs and Sidings

To control fungus and mildew, first remove all physical soil by brushing and hosing with clean water. Then apply a 5000 ppm available chlorine solution. Mix 1 oz. of this product per gallon of water and brush or spray roof or siding. After 30 minutes standing time, rinse by hosing with clean water.



Each of the applications described in this brochure requires a specific concentration of solution measured in parts per million (ppm) or percent available chlorine. To prepare the proper strength solution, follow these simple directions:

1. Use a clean, **non-metallic** container free of grease, oil, or residue
2. Add granular calcium hypochlorite to lukewarm water.
3. Stir for three to five minutes.
4. Use immediately.

NOTE: As a safety precaution, prepare only the amount of solution needed. Never store a calcium hypochlorite solution.

Calcium Hypochlorite Measurement Equivalents

Dry Weight	Household Measurement*
1/6 ounce	1 level teaspoon
1/2 ounce	1 level tablespoon
1 ounce	2 level tablespoons
8 ounces	16 level tablespoons (1 cup)

* These household measurement equivalents are only approximate values given for the user's convenience.

The following table indicates the amount of calcium hypochlorite needed to make various quantities of solution containing from 5 to 10,000 ppm available chlorine.

Available Chlorine (ppm)*	Weight of Calcium Hypochlorite Required to Make Solution							
	1 gallon		10 gallons		50 gallons		100 gallons	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
5	0	0.001	0	0.01	0	0.05	0	0.10
10	0	0.002	0	0.02	0	0.10	0	0.21
25	0	0.005	0	0.05	0	0.26	0	0.51
50	0	0.01	0	0.10	0	0.51	0	1.03
100	0	0.02	0	0.21	0	1.03	0	2.05
150	0	0.03	0	0.31	0	1.54	0	3.08
200	0	0.04	0	0.41	0	2.05	0	4.11
300	0	0.06	0	0.62	0	3.08	0	6.16
500	0	0.11	0	1.03	0	5.13	0	10.27
600	0	0.12	0	1.23	0	6.16	0	12.32
1,000	0	0.21	0	2.05	0	10.26	1	4.53
2,500 (.25%)	0	0.51	0	5.13	1	9.66	3	3.32
5,000 (.5%)	0	1.03	0	10.26	3	3.32	6	6.65
10,000 (1%)	0	2.05	1	4.53	6	6.65	12	13.29

* Parts per million available chlorine per million parts of water

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