

STANDARD OPERATING PROCEDURE

Safe and Correct Way to Use Bleach (Sodium Hypochlorite) as a Chemical Disinfectant in Biolaboratories

One of the most common and effective disinfectant used in a biolaboratory is sodium hypochlorite (NaOCl) in water or “bleach”. Bleach (chlorine bleach = household bleach) is a water-based solution of sodium hypochlorite with a typical concentration of 5.25% by weight (or 52,500 ppm) of the active sodium hypochlorite ingredient. The active ingredient in bleach, sodium hypochlorite, denatures proteins in micro-organisms and is therefore effective in killing bacteria, fungi, and viruses. Many brands and formulations of bleach are registered with the U.S. Environmental Protection Agency (EPA) as a disinfectant that is effective against bloodborne and other common human pathogens. Bleach works quickly and is widely available at a low cost. Diluted bleach is thus a good choice for the disinfection of surfaces (tabletops and other work areas) in biolaboratories. Certain liquid biohazardous wastes can also be disinfected by adding enough bleach to the biohazardous liquid before drain disposal.

As bleach irritates mucous membranes, skin, and airways, caution should be exercised in the use of it. The active ingredient, sodium hypochlorite, is a strong oxidizer. Oxidation reactions are corrosive, and solutions can burn skin and cause eye damage, especially when bleach is used in concentrated forms. Mixing bleach with some household cleaners can also be hazardous. For example, mixing an acid cleaner with sodium hypochlorite bleach generates chlorine gas. Mixing with ammonia solutions (including urine) produces chloramines. Both chlorine gas and chloramines are toxic. Mixtures of other cleaning agents and/or organic matter can result in a gaseous reaction that can cause acute lung injury. Improper use of bleach may also reduce its effectiveness in disinfection. Overuse of bleach or using a bleach solution that is too concentrated results in the production of toxic substances that pollute the environment and disturb ecological balance.

Procedures of Preparing/Using Diluted Bleach

1. Ensure good ventilation when diluting or using bleach.
2. Put on protective gear (gloves, lab coat or plastic apron, and goggles (recommended) when diluting or using bleach.
3. Cold water should be used for dilution as hot water decomposes the active ingredient, sodium hypochlorite, rendering it ineffective.
4. Common applications and mixtures of household bleach are listed below:
 - Work Surfaces and Equipment: Hard work surfaces and equipment may be disinfected with 1% solution of fresh household bleach (or approximately 500 ppm sodium hypochlorite). A 1% household bleach solution can be made by mixing 1 part household bleach with 99 parts water, or 10 ml of household bleach with water in a 1 L container. This solution can be sprayed on work surfaces, the entire surface wiped, and then allowed to air dry. Contact time for bleach is generally considered to be the time it takes the product to air dry. Metal surfaces that have been treated with bleach should be “rinsed” with sterile water or with e.g., 70% ethanol or propanol to avoid the corrosive effects.

- Biohazardous Spills: Biohazardous spills may be decontaminated using 10% concentration of household bleach (or approximately 5,000 ppm sodium hypochlorite). A 10% household bleach solution can be made by mixing 1 part household bleach with 9 parts water, or 100 ml of household bleach with water in a 1 L container. Remove visible biohazardous spill with disposable towels. Place contaminated towels in plastic bags marked with biohazard sign. Add 10% bleach solution over the spill spot and let stand approximately 30 minutes to ensure adequate germicidal action. Blot up bleach solution with disposable towels. Soak the area with additional 10% bleach, if needed, and let stand as indicated above. Soak up bleach with disposable towels. All contaminated towels and gloves should be gathered in biohazard waste disposal bags.
- Liquid Biohazardous Waste: Liquid biohazardous waste including blood, blood products, cultures and stocks of etiological agents and viruses, cell culture material, and products of recombinant or synthetic nucleic acid molecules technology may be disinfected by adding household bleach to the liquid to be decontaminated until a 10% concentration of household bleach is achieved (or approximately 5,000 ppm sodium hypochlorite). This mixture may be made by adding 1 part household bleach into 9 parts liquid biohazardous waste, or 100 ml of household bleach into biohazardous waste in a 1 L container. Let bleach-waste mixture stand for at least 30 minutes. This time might need to be longer depending on the extent of the organic matter that is present. After an appropriate contact time, the mixture can be poured into a sink drain connected to the campus sewage system. Be sure to follow the treated material with copious amounts of water. Do not pour bleach-waste mixture into a storm drain.



Disinfection of liquid biohazardous waste: A 10% concentration of household bleach in the liquid waste is created.

Precautions

- Sodium hypochlorite decomposes with time. To ensure its effectiveness, it is advised to purchase recently produced bleach and avoid over-stocking.
- For effective disinfection, diluted bleach should be used within 24 hours after preparation as decomposition increases with time if left unused. Heat and light speed up the decomposition of diluted bleach.
- Avoid using bleach on metals, wool, nylon, silk, dyed fabric, and painted surfaces.

- Do not autoclave bleach solutions!
- Avoid touching your eyes. If bleach gets into eyes, immediately rinse with water for at least 15 minutes and consult a doctor.
- Bleach should not be used together or mixed with other household detergents as this reduces its effectiveness in disinfection and causes chemical reactions. If necessary, use detergents first and rinse thoroughly with water before using bleach for disinfection.
- As undiluted bleach liberates a toxic gas when exposed to sunlight, it should be stored in a cool and shaded place.

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