

Understanding Common Dilution Rates of Sodium Hypochlorite Bleach Disinfectant Solutions

The professional attempting to disinfect hard surfaces with standard sodium hypochlorite bleach faces a confusing and seemingly contradictory array of percentages and dilution ratios. Diluted bleach is widely recommended as a general laboratory and hospital surface disinfectant; however, the protocol to prepare a 10% solution starting with 5.25% bleach to end up with 5,000 ppm available chlorine can leave technicians somewhat befuddled. It only adds to the confusion when the industry simultaneously refers to this bleach protocol as 10%, 10:1, 9:1, 1:10, 1:9, 5,000 ppm, 5.25%, 5 g/l, or sometimes simply *diluted bleach*.

The puzzle is solved by first considering parts-per-million instead of percentages or ratios. For an effective and affordable surface disinfectant in laboratory and healthcare settings, the CDC and other authorities recommend the use of household bleach diluted to approximately 5,000 parts-per-million (ppm) available chlorine [1,2]. Stock household bleach is 5.25% sodium hypochlorite equal to approximately 50,000 ppm available chlorine; therefore, it must be diluted to 10% with water (or expressed as a ratio, 9 parts water to 1 part bleach) to arrive at the recommended 5,000 ppm strength [3].

If you are wondering how the reference to a 10:1 bleach solution relates – it is based on the common misconception that 10% equates to the ratios 10:1 or 1:10.

Start with:	<u>% Sodium hypochlorite</u>	<u>Available Chlorine</u>
Regular <i>household</i> bleach	5.25% NaCl	50,000 ppm AvCl
Dilute 1 part bleach to 9 parts water for a:		
10%, 10:1, 1:10, 9:1, 1:9, or 5 g/l solution	0.525% NaCl	5,000 ppm AvCl

References with web links:

1. *Studies have shown that HIV is inactivated rapidly after being exposed to commonly used germicides at concentrations that are much lower than used in practice. In addition to commercially available chemical germicides, a solution of sodium hypochlorite (household bleach) prepared daily is an inexpensive and effective germicide. Concentrations ranging from approximately 500 ppm (1:100 dilution of household bleach) sodium hypochlorite to 5,000 ppm (1:10 dilution of household bleach) are effective depending on the amount of organic material (e.g., Blood, mucus) present on the surface to be cleaned and disinfected.* (U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Biosafety Branch, *Recommendations for Prevention of HIV Transmission in Health-care Settings*, MMWR 1987;36(2S): p10S)
<http://www.cdc.gov/od/ohs/biosfty/bleachiv.htm>

2. *Chlorine compounds are probably the most widely used disinfectants in the laboratory. You can easily prepare an inexpensive, broad-spectrum disinfectant by diluting common household bleach... In the case of large or concentrated spills of infectious agents, a higher level of chlorine is needed to be effective in destroying microorganisms. Use a 10:1 dilution (5,000 ppm of free chlorine) and flood the contaminated area with the solution. Alternatively, you can mix the disinfectant with the spilled material. This higher concentration is more suitable for porous surfaces that may harbor organisms in tiny cracks or pits. Make the solution fresh each day.* (Northwestern University *Laboratory Safety Manual*, Page 9, Section 7.5.1: Sterilization, Disinfection, and Decontamination).
www.research.northwestern.edu/ors/labsafe/index.htm

3. *Special Pathogens Branch recommends a 10% bleach solution be used to inactivate hantaviruses. A 10% solution corresponds to 1 and a half cups of household bleach per gallon of water, or 1 part bleach to nine parts water.* <http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/bleach.htm>