



# **CHAMPION® Expanding Encyclopedia Of Mortuary Practices**

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## **BLEACH IN EMBALMING ROOMS: OVERRATED AND OVERUSED.**

### **Part 1**

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*ABSTRACT: An overview of bleach use as a disinfectant in embalming rooms is surveyed. The shortcomings and misuses of bleach in embalming rooms is discussed. A discussion of bleach as a chemical disinfectant and its hazards is outlined. Bleach problems with formaldehyde embalming fluids and ammonia based cleansers is covered. Bleach and its use in CJD embalming cases is discussed. Suggestions for safer, more effective alternatives to bleach in embalming rooms are presented.*

**INTRODUCTION:** Bleach, as a disinfectant, is used in virtually all embalming rooms in the United States. Most embalmers, however, are unaware of the limitations and proper usage of bleach, particularly in embalming rooms. Bleach really became popular in the mid 1980's during the AIDS scare. The CDC (Center for Disease Control) document that advocated bleach use in AIDS disinfection (1987) launched the widespread overusage of bleach in embalming rooms. It was not uncommon at the time to hear of bleach being preinjected into bodies, bleach actually mixed with embalming fluid (a dangerous situation) or bodies being embalmed with bleach instead of embalming fluid. A close look at this document reveals that the CDC did not advocate bleach in lieu of other disinfectants, but merely a statement that bleach was effective if no other registered or approved disinfectants were available for use. The latest revision to the 1987 document (1995 revision) calls notice to the limitations of bleach in high organic debris, blood or body fluid situations (the typical scenario of embalming) and suggest careful selection of effective disinfectants -- whether bleach or otherwise.

Even in the situation with HIV, which is a very labile virus from a disinfection standpoint, bleach has several documented serious failures. Under reasonable blood burden, bleach at a 1:10 dilution is ineffective against HIV even at time frames of 5 minutes. Bleach is seriously limited in its oxidation potential when gross organic debris is present. Volume ratios of 9:1 - v/v are typical when blood spills are present -- a typical situation in embalming.

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Bleach is not very chemically compatible with formaldehyde and its derivatives. Several noxious gases are liberated in the reaction of bleach with formaldehyde, in addition to deactivating the disinfection potential of bleach. This fact alone makes the choice of bleach less than desirable in embalming situations. With these problems and limitations in mind, let us begin our discussion of bleach and its use in embalming rooms.

WHAT IS BLEACH? Bleach is essentially an aqueous solution of sodium hypochlorite in a dilution of 3-6% typically. Strictly, by definition, bleach should be 5.25% NaOCL in water. This is the dilution that is available to the public as Clorox or other brands of bleach in grocery stores, etc. Commercial or industrial bleach is available also and typically is 10-12% NaOCL aqueous solution. Concentrated powders of calcium hypochlorite (more stable than sodium hypochlorite) in the 60-70% range are also available for special uses and where concentrated bleaching or disinfecting power is required. Bleach, of course, is a hazardous chemical and must be treated as such when used in embalming rooms. A MSDS (material safety data sheet) must be on file in addition to a protocol for safe use and spill control that must be in your employee safety and training manual. Bleach is caustic and corrosive and evolves chlorine gas in addition to hydrogen chloride gas during use. Inhalation can cause burning and labored breathing of the airways, skin contact causes burns, pain and blisters. Accidental eye contact causes serious burns and ingestion causes burns, shock, vomiting and unconsciousness. Careful use of protective clothing and gear is essential along with irrigation of usage areas and good ventilation when in use. Bleach is recognized as a cardiovascular or blood toxicant, neurotoxicant and a skin/sense organ toxicant. Bleach is on 2 federal regulatory lists and is listed as more dangerous than most chemicals in 1 out of 3 environmental scoring systems. Its uses are mostly industrial bleaching but it is also used as a pesticide.

Bleach is chemically reactive with formaldehyde and generates several gases when mixed. Chlorine gas in addition to formic acid are formed during reaction -- both evolving considerable noxious fumes. Chlorine oxides are formed and BCME (bis-chloromethylether) which is a very neurotoxic gas is possible also. In fact, the typical lab synthesis of BCME involves formaldehyde reacting with a bleach type chlorine species. Phosgene (Cl<sub>2</sub>CO) is not produced, as has been occasionally reported elsewhere. Suffice it to say that formaldehyde and bleach are not recommended to be used together on a regular basis. Unfortunately, in modern embalming rooms the reverse is true -- large quantities of formaldehyde and bleach end up being used together on a daily basis.

Bleach is also incompatible with ammonia based cleaners that are popular and useful in embalming rooms. Mixing bleach and ammonia generates a vigorous reaction that evolves HCL(hydrochloric acid), NH<sub>3</sub> (ammonia gas), chloramines (a noxious gas), chlorine gas and hydrazine (NH<sub>2</sub>NH<sub>2</sub>). The chemical exposure from this mixture is overwhelming and very dangerous. Chloramines, in the lungs, liberate ammonia, hydrochloric acid and oxygen free radicals which induce severe deep lung damage. Numerous examples of near deadly exposures to this mixture has been reported with emergency tracheotomy being performed with massive edema from corrosive lung damage.

Bleach is highly corrosive, this is one of the major drawbacks in its use in disinfection. Corrosive action occurs on most surfaces, instruments, embalming equipment, rubber parts and plastic goods that are used extensively in funeral service and embalming. The continual use of bleach is inadvisable in embalming rooms due to this highly corrosive action on most of the equipment in embalming rooms.

**BLEACH DISINFECTION:** Despite the fact that bleach is aqueous sodium hypochlorite, the actual disinfecting species in bleach is hypochlorous acid (HOCL) not sodium hypochlorite (Figure 1). When one refers to the free available chlorine in a disinfectant, this denotes the sum of all chlorine species in solution and does not directly relate to the efficacy of a chlorine disinfectant (due to the pH differences that exist in varying solutions). The basic problem plaguing bleach as a disinfectant is due to the fact that the % of hypochlorous acid in solution is severely affected by the pH of the solution. Typical bleach has a very high pH of 9-11 (far too high for any significant HOCL (hypochlorous acid) to be present in solution. In fact, the quantity of HOCL is only 20% at a pH of 8 and degrades to less than 1% at a pH of 11. Consequently, a massive quantity of bleach must be used to deliver a sufficient quantity of active disinfecting chlorine species during a disinfection. In fact, my investigations

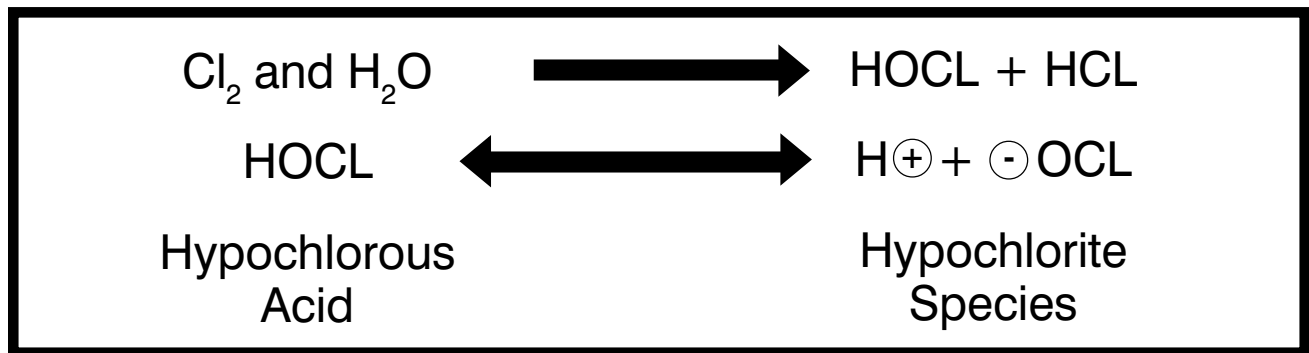


Figure 1

reveal that bleach purchased at retail consumer stores is usually degraded and yields only 3-4% hypochlorite in solution and the pH is usually in excess of 11, consequently chemical dilution of the product, itself, has already occurred. This is the reason for the caveat that bleach solutions should always be made fresh and tested for available chlorine as an indication of disinfecting capability. Only when the pH drops to around 6.5 does the quantity of hypochlorous acid in solution become substantial and disinfecting power increases drastically. This is the explanation for the successful use of bleach type sanitizers in the swimming pool industry. Swimming pool water is acid/base buffered to approximately pH 7 and this allows a good quantity of HOCL to be present for disinfection. This is also the reason for the popularity of chlorine releasing powders such as NaDCC (sodium dichloroisocyanurate) in the field of medical disinfection. These powders are capable of releasing a large quantity of active chlorine disinfecting species in a short time frame without the pH limitations of bleach and it's dilutions. Also, point-of-use chlorine generators (essentially buffered and metered release of calcium hypochlorite in aqueous delivery systems) are very effective and are popular in Europe and Africa for cleaning and disinfection of animal barns and outdoor toilet facilities. Chlorine can be a very effective disinfectant, but is clearly dependent on the pH and source of chlorine generation. Bleach solutions deliver the absolute minimum when compared to the chlorine alternatives and is a poor choice (considering the excellent alternatives available) for embalming rooms.

CONTINUED: Bleach in Embalming Rooms: Overrated and Overused.  
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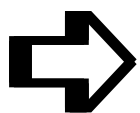
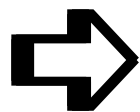
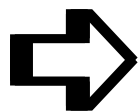
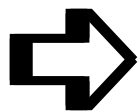
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