A50 The Effectiveness of Bleach for Eliminating Contaminating DNA on Laboratory Surfaces

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After attending this presentation, attendees of this presentation can expect to gain practical knowledge of the multiple factors that affect the ability of sodium hypochlorite, the active ingredient in commercial bleach, to eliminate amplifiable DNA contaminating laboratory surfaces. Issues to be addressed include bleach concentration, method of application, time of exposure, age of solution, and bleach brand manufacturer.

This presentation will impact the forensic science community by providing laboratories a comprehensive reference to evaluate the effectiveness of their current decontamination procedures with sodium hypochlorite and to improve decontamination methods, if needed.

Commercially available bleach is the most common means of removing DNA from laboratory surfaces, tools, and equipment in forensic biology laboratories. While there is an abundance of literature on the effects of bleach on microorganisms, the effectiveness of bleach on the elimination of DNA has not been systematically studied.

Most laboratories have protocols for the preparation and shelf-life of diluted bleach, although these protocols vary within the forensic community. Variables include the concentration of sodium hypochlorite in water (v/v), the manner of bleach application, the action of cleaning, and the time of exposure. Furthermore, forensic laboratories do not monitor the performance of their bleach solutions to determine whether an effective concentration is being utilized. All of these factors will affect the laboratory's ability to decontaminate surfaces.

Sodium hypochlorite in aqueous solution rapidly oxidizes to sodium hydroxide and free chlorine when it is exposed to light and air which eventually renders it ineffective for DNA decontamination. Many generic brands of bleach are not marked with their date of manufacture so it is impossible to tell the relative amount of sodium hypochlorite expected in unopened bottles of bleach. The fresher the bleach is, the higher the percent sodium hypochlorite present in the solution. Since individual laboratories retain their bleach solutions for different lengths of time, a working bleach solution may not be at an effective concentration for DNA decontamination when it is used. Likewise, a laboratory might assign arbitrary expirations dates to their bleach dilutions requiring them to be discarded while they are still effective. Many forensic biology laboratories require bleach dilutions be made daily. Without definitive knowledge of the life-span and the effective concentration of bleach solutions, a laboratory may not be consistently decontaminating laboratory work areas.

To address the effectiveness of bleach at removing DNA from surfaces, different concentrations of bleach, the method of bleach application, and time of exposure to bleach were studied. Scrubbing is a more effective method than submersion in bleach for DNA removal. To completely remove DNA from a surface, a sample requires more than 10 minutes of submersion in a 5% bleach solution or 3 minutes of submersion in 20% bleach. However, a 5% bleach solution can eliminate DNA from a surface immediately if scrubbing is used. When a lint-free towel is submerged in a dilution of 1% bleach and used to scrub a contaminated laboratory surface, 89% of contaminating DNA is removed from the work surface. Bleach dilutions of 5% and above will remove 100% of the contaminating DNA present. Interestingly, scrubbing with water alone removed 96% of DNA from a surface while scrubbing with 95% ethanol removed 40% of the DNA from a surface. While bleach is certainly more effective than water or ethanol in the removal of DNA, these findings suggest that the action of scrubbing plays the most important role in DNA removal. Also, ethanol should not be used alone as a decontamination strategy because it is not as effective at removing DNA even when combined with scrubbing.

The stability of 10, 15, and 20% bleach solutions exposed to and protected from light was monitored over a period of several days. Bleach dilutions protected from light were stable for at least five days while bleach dilutions exposed to light began to be less effective at DNA removal at five days. Final results of tests of the stability of bleach solutions protected from light will be presented.

Finally, the effectiveness of name brand Clorox ™ and two generic brands of bleach were compared. The generic brands of bleach performed as well or better than Clorox bleach. Only slight differences were observed between brands and that may be the result of differing sodium hypochlorite concentrations. Additional studies of the precise concentration of sodium hypochlorite in bleach will be presented.

STR, Sodium Hypochlorite, Contamination

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