



- (51) International Patent Classification:
A01N 31/00 (2006.01)
- (21) International Application Number:
PCT/US2010/001134
- (22) International Filing Date:
16 April 2010 (16.04.2010)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
12/387,120 28 April 2009 (28.04.2009) US
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— with international search report (Art. 21(3))

(54) Title: METHODS AND COMPOSITION FOR TREATING A MATERIAL

EFFECT OF 100% FB ON THE REDUCTION OF BLACK MOLD SPORES

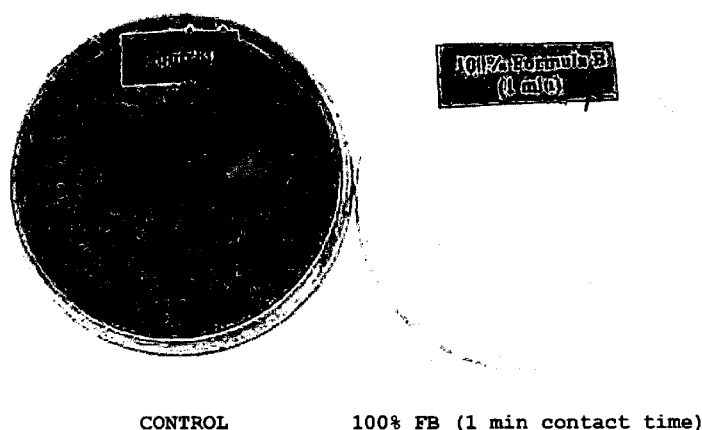


FIG. 1A

(57) Abstract: A composition and method are described for sanitizing or otherwise treating a material such as a non-living surface, living tissue, soil or atmosphere which may be contaminated by a toxin, chemical warfare agent, insect, prion, microorganism or other infectious agent. The composition generally includes an aqueous composition mixture that includes: (a) lower alkanol; (b) an alkalinating agent, and (c) a fatty acid salt and/or ester. The components are present in an effective amount to sanitize (or treat) a material (or modifying a chemical contained thereon) to which the composition is applied. Also described are methods of making the composition.

METHODS AND COMPOSITION FOR TREATING A MATERIAL

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of U.S. Patent Application No. 11/486,736, filed July 14, 2006 and is also a continuation-in-part of U.S. Patent Application No. 12/380,077, filed February 23, 2009, both of which are incorporated herein by reference in their entireties.

BACKGROUND OF THE INVENTION

(1) Field of the invention

[0002] This invention relates to compositions and methods for sanitizing or otherwise treating a material. The compositions improve the decontaminating effect of lower alkanols containing 1 to 6 carbon atoms (C_1-C_6). The compositions disinfect or otherwise sanitize materials such as living tissues (skin, hands, *etc.*) and inanimate objects (instruments, medical equipment, military and civilian facilities, furniture, papers and printed materials, *etc.*) of harmful contaminants including, but not limited to chemical warfare agents (VX, mustard, sarin, soman, and tabun), toxins, protozoa, insects (*e.g.*, disease vectors), and pathogenic infectious agents such as bacteria, fungi, viruses, fungal and bacterial spores, and conformationally altered prions (CJD, CWD, BSE, Scrapie).

(2) Description Of Prior Art

[0003] Germicides include both antiseptics and disinfectants. Antiseptics are germicides applied to living tissue and skin while disinfectants are antimicrobials applied only to inanimate objects. In general, antiseptics are only used on the skin and not for surface disinfection, and disinfectants are not used for skin antiseptics because they may cause injury to skin and other tissues (Rutala and Weber, 2004).

[0004] In the past, disinfecting hard surfaces did not require a major decision: You could use a standard powder detergent, bleach or an abrasive powder. End of discussion. Nowadays, hard-surface disinfectants fill entire store aisles and include many specialized products such as bathroom, toilet bowl, glass, ceramic, and kitchen disinfectants of varying kinds, powder and cream scourers, and wipes. One reason for the increase in the number of hard-surface disinfectants is the simple fact that today's hard surfaces include many more types of materials than in the past. For example, in the past, kitchens and bathrooms were primarily finished in wood and other natural

surfaces, the modern counterparts contain stainless steel, plastic, fiberglass, ceramics, marble, enamel and porcelain, to name just a few, creating new disinfecting challenges.

[0005] On the other hand, recently, there has been renewed emphasis placed on hand hygiene and skin wellness as a result of the Centers for Disease Control and Prevention (CDC)'s "Guideline for Hand Hygiene in Healthcare Settings." Hand hygiene is the single most important action that can help reduce the spread of infection in hospitals. The CDC's National Nosocomial Infections Surveillance system (NNIS), which collects data from some three hundred hospitals, estimates that in U.S. hospitals there are two million healthcare-associated infections each year accounting for nearly 90,000 deaths annually and \$4.5 billion in excess healthcare costs. Current literature documents unacceptably low levels of hand hygiene among healthcare workers (HCWs). There are a number of reasons that impact HCWs compliance to hand washing: (1) lack of easy accessibility to sinks; (2) hand washing causes dry, irritated hands; (3) HCWs are too busy to wash their hands with soap and water often enough; (4) lack of knowledge on when hand hygiene should take place, including casual contact, before and after gloving, *etc.*

[0006] Soaps are detergent-based products that contain esterified fatty acids and sodium or potassium hydroxide. Plain soaps have minimal, if any, antimicrobial activity. In several studies, hand washing with plain soap failed to remove pathogens from the hands of hospital personnel and, occasionally, plain soaps have become contaminated, which may lead to colonization of hands of personnel with gram-negative bacilli (Boyce and Pittet, 2002). Alcohol hand sanitizers have been introduced into healthcare facilities to help HCWs adhere to the recommended hand hygiene guidelines. The CDC legitimated alcohol-based sanitizers because it recognized that the efficacy of alcohol sanitizers was greater than soap and water in reducing the number of germs on hands. However, alcohols are not recommended for sterilizing medical and surgical materials principally because of their lack of sporicidal action and their inability to penetrate protein-rich materials (Rutala and Weber, 2004). The majority of alcohol-based hand antiseptics contain either isopropanol, ethanol, n-propanol, or a combination of two of these products. The majority of studies of alcohols have evaluated individual alcohols in varying concentrations. Other studies have focused on combinations of two alcohols or alcohol solutions containing limited amounts of hexachlorophene, quaternary ammonium compounds, povidone-iodine, triclosan, or chlorhexidine gluconate.

[0007] U.S. Pat. No. 4,200,655 to Farah, *et al.* discloses compositions containing benzyl alcohol as active ingredient intended for topical virucidal use both *in vivo* and *in vitro*, especially for use on the hands and especially for preventing transmission of rhinoviruses.

[0008] U.S. Pat. No. 4,446,153 to Yang discloses a skin sanitizing composition particularly suited as teat dip or udder wash for dairy cows comprising at least one phenyl alkanol as the antiseptic ingredient.

[0009] U.S. Pat. No. 4,695,453 to Tuominen, *et al.* discloses thickened alcoholic antibacterial compositions containing preferably ethanol, propanol, and benzyl alcohol as active ingredients.

[0010] U.S. Pat. No. 4,956,175 to Maignan, *et al.* discloses the use of high alcohol content antimicrobial gel compositions for disinfecting hands possessing moisturizing and conditioning agents.

[0011] U.S. Pat. No. 6,022,551 to Jampani, *et al.* discloses an antimicrobial composition comprising an antimicrobial selected from the group consisting of more than 30% by volume alcohol and an effective amount of triclosan; and an effective amount of phenoxy ethanol, an effective amount of benzalkonium chloride or benzethonium chloride; and an effective amount of PHOSPOLIPID CDM. This antimicrobial composition is intended for topical use, such as the hands.

[0012] U.S. Pat. No. 6,248,343 to Jampani, *et al.* relates to antimicrobial compositions which additionally provide therapeutic benefits to the skin. It discloses an antimicrobial composition comprising an antimicrobial selected from the group consisting of more than 30% by volume alcohol, an effective amount of triclosan and mixtures thereof; an effective amount of phenoxy ethanol, an effective amount of benzalkonium chloride or benzethonium chloride; and an effective amount of PHOSPOLIPID CDM; and an effective amount of a naturally occurring plant or extract thereof.

[0013] U.S. Pat. No. 6,617,294 to Narula *et al.* describes a waterless sanitizing hand cleanser comprising an effective amount of alcohol to produce a reduction in microorganisms on the surface of the skin, and emollients or oils for skin moisturizing.

[0014] U.S. Pat. Appl. Publication No. 2005/0271595 to Brown discloses a sanitizing composition in the form of a viscous liquid or gel suitable for use as a hand wash composition comprising alcohol, water, a thickener, and antimicrobial agents.

[0015] Eur. Pat. Appl. No. 82110376.9 describes an aqueous sterilizing agent for foods or food processing machines and utensils, comprising ethanol and at least one alkaline substance as active ingredients.

[0016] Eur. Pat. Appl. No. 83303799.7 relates to aqueous disinfectant solutions with residual biocidal activity for disinfecting hard surfaces in hospitals, comprising from 60 to 80% v/v of C₁ to C₄ alkanol and at least two antimicrobial agents with a combined concentration in the solution of up to 2% w/v. The first antimicrobial agent is a biguanide compound and the second is a quaternary ammonium compound.

[0017] U.S. Pat. No. 4,678,658 to Casey, *et al.* describes an aerosol spray for use in disinfecting a surface with a fine spray consisting essentially of lower alkyl alcohol, a disinfecting surfactant, a pH sensitive dye, and alkali means for adjusting the pH of the fluid to produce a color in the liquid so upon the fast neutralization by air the dye loses color.

[0018] U.S. Pat. No. 5,180,749 to Cusack, *et al.* discloses an aqueous antimicrobial composition that includes up to about 30 percent by weight ethyl alcohol and about 2 to 5 percent by weight of benzyl alcohol and the remainder to 100% water, and a method of use of the composition for destroying or reducing the number of microbes on an inanimate surface contaminated therewith.

[0019] U.S. Pat. Appl. Publication No. 2004/0213750 to Bennett *et al.* discloses an aqueous hard surface antimicrobial treatment compositions comprising an alcohol and an a pH adjusting agent such the pH range of the composition is from about 7.0 to about 13.0.

[0020] U.S. Pat. Appl. Publication No. 2005/0202137 to Awad describes a method for sanitizing red meat for human consumption with an aqueous solution containing lower alkanol and pH modifying agents.

[0021] U.S. Pat. No. 6,821,940 to Bullock, *et al.* describes premoistened wipes containing a substrate and a cleaning composition using toxicologically-acceptable ingredients for treating food such as produce, *e.g.*, fruits and vegetables, edible animal proteins, toys, baby highchairs and the like.

[0022] The widespread prevalence of health-care associated diarrhea caused by *Clostridium difficile* and the recent occurrence in the United States of human *Bacillus anthracis* infections (11 cases inhalation anthrax and 11 cases of cutaneous anthrax) as a result of the intentional exposure to *Bacillus anthracis* via contaminated letters has raised concerns regarding the activity of antiseptic and disinfectant agents against spore-forming bacteria. More recently, a laboratory worker acquired anthrax as a result of contact with the surface of vials containing *Bacillus anthracis* (Page *et al.*, 2002). None of the agents reported in the prior art (including alcohols, chlorhexidine, hexachlorophene, iodophors, PCMX, and triclosan) whether used in antiseptic (hand-

wash or hand-rub) preparations or in hard surface disinfectants are reliably sporicidal against *Clostridium* spp. or *Bacillus* spp. (Boyce and Pittet, 2002). Moreover, some of these agents (e.g., triclosan) have been linked to antibiotic-resistant bacteria in lab tests. Examples of sporicidal reagents, using relatively high concentrations, include glutaraldehyde, formaldehyde, chlorine oxyacids compounds, peroxy acids, and ethylene oxide. In general, all of these compounds are considered to be toxic. On the other hand, all the chemical antimicrobial agents reported in the prior art (whether sporicidal or not), including ethylene oxide sterilization, ethanol, formalin, beta-propiolactone, detergents, quaternary ammonium compounds, Lysol® disinfecting solution (Reckitt Benckiser, Berkshire, UK), alcoholic iodine, acetone, potassium permanganate, hydrogen peroxide and chlorine dioxide, are ineffective in inactivating the infectivity of conformationally altered infectious prions (Rosenberg *et al.*, 1986) and, their effect on chemical warfare agents is not reported.

[0023] Terrorists' threats involving chemical and biological agents, in the context of weapon of mass destruction, are of great concerns to national defense and local law enforcement. For decades, these worries were the quiet domain of U.S. military and national weapon labs, funded by the Department of Energy or the Defense Advanced Research Projects Agency. Future bioterror weapons, scientists say, could include genetically engineered pathogens, prions, and bioregulators (Brown, 2004). During a simulated dirty-bomb attack staged in Seattle in the spring of 2003, one of the lessons learned that responders had nothing to stop the spread of radioactive dust (Weiss, 2005). By the same token, the spread of biological and chemical warfare agents, should a terrorist attack occur, is also very hard, if not impossible, to contain using the technology of the prior art. Should a large scale attack take place, its perpetrators will probably be monitoring the speed and efficacy of the clean-up to decide the value of launching another attack. The anthrax decontamination of the Hart Senate Office Building (Hsu, 2002), using chlorine dioxide, has raised concerns about the readiness to deal with large scale biological attacks. Chlorine dioxide and sodium hypochlorite (household bleach) are used for disinfection of environmental surfaces and are not used as antiseptics applied to skin.

[0024] U.S. Pat. No. 6,566,574 to Tadros, *et al.* teaches the use of an aqueous formulation for neutralizing both chemical and biological agents. The formulation comprises at least two solubilizing agents (a cationic surfactant such as quaternary ammonium salts and a cationic hydrotrope such as tetrapentyl ammonium bromide), at least one reactive compound and water to produce an aqueous formulation. The

technical problems associated with this technology include: (1) the need for a different formulation for each specific chemical and biological agent; (2) it has no effect on infectious prions; (3) it cannot be used on living tissues, *e.g.*, topical treatment on skin due to the corrosiveness and toxicity of the reagents used; (4) it cannot be used to decontaminate food products, in case of an agroterrorists attack, because the reagents used are not food grade (GRAS); and (5) it cannot be used in healthcare facilities as a hand sanitizer to replace soap and water.

[0025] U.S. Pat. Appl. Publication No. 2004/0022867 to Tucker *et al.* teaches the use of an aqueous formulation for neutralizing toxants which comprises at least two solubilizing agents (a cationic surfactant and a cationic hydrotrope), a reactive compound (selected from the group consisting of hydrogen peroxide, urea hydrogen peroxide, hydroperoxycarboante, peracetic acid, sodium perborate, sodium peroxyphosphate, sodium peroxydicarbonate, and percarbonate), a bleaching activator, and a sorbent additive. The technical issues associated with this technology include: (1) preparation of the composition in the field due to the instability of the bleaching activator; (2) short shelf life (about eight hours), therefore, it cannot be used in healthcare facilities as a hand sanitizer to replace soap and water; (3) have no effect on infectious prions; (4) it cannot be used on wounds, *e.g.*, topical treatment on wounded skin due to the corrosiveness and toxicity of the reagents used; and (5) it cannot be used to decontaminate food products, in case of an agroterrorist attack, because the reagents used are not food grade (GRAS).

[0026] U.S. Patent No. 3,835,057 to Campbell *et al.* discloses embalming fluid including glutaraldehyde, an aromatic ether of ethanol, at least one alcohol, and a polyhydric alcohol humectant.

[0027] U.S. Patent No. 6,106,854 to Belfer *et al.* relates to a disinfectant composition which includes hydrogen peroxide, iodophors, and an acidifying agent.

[0028] WO 2000/05330 to Weller *et al.* describes a cleaning and disinfecting composition that includes quaternary ammonium surfactants, glycol ethers, amine oxide compounds, a low molecular weight monohydric alcohol, and alkylpolyglycoside compounds.

[0029] U.S. Patent No. 3,835,057 to Cheng *et al.* relates to antibacterial soap bars including antibacterial compounds such as 3,4,4'-trichlorocarbanilide, 3-trifluoromethyl 4,4'-dichlorocarbanilide, 3,5,4'-tribromosalicylanilide, 3,5,3',4'-tetrachlorosalicylanilide, and 3,5-dibromo-2'-trifluoromethylsalicylanilide.

[0030] EP 0848907 to Widulle is directed to an spray disinfectant composition including, water, ethanol, amines, and terpene hydrocarbons.

[0031] EP 0689767 to Hoang et al. describes a skin disinfectant formulation including an alcohol, a block copolymer (polydimethyl siloxane-polyethylene oxide), a foaming surfactant, an emulsifier, a cleaning agent, polyalkylene glycol, an emollient, a preservative, and water.

[0032] U.S. Patent No. 4,714,563 to Kajs et al. relates to antibacterial toilet bars made with a surfactant (soap and/or anionic synthetic surfactant) and a chlorhexidine antimicrobial (including its salts).

[0033] U.S. Patent No. 6,080,387 to Zhou et al. describes an aerosol antimicrobial composition including a quaternary ammonium compound, an anionic polymer or prepolymer, a water-soluble or water-dispersible organic solvent, a propellant, and water.

[0034] Collectively, the prior art has recognized the real and continuing need for a single, effective, general, safe for humans and the environment, and easy to use formulation for decontaminating both inanimate objects and living tissues of harmful contaminants consisting of chemical warfare (VX, mustard, sarin, soman, and tabun), toxins, insects (e.g., disease vectors), and pathogenic infectious agents such as bacteria, fungi, viruses, fungal and bacterial spores, and conformationally altered prions (CJD, CWD, BSE, Scrapie).

OBJECTS

[0035] It is an object of the present invention to provide compositions and methods for sanitizing a material. These and other objects will become increasingly apparent by reference to the following discussion.

SUMMARY OF THE INVENTION

[0036] The present invention provides a method for improving the germicidal and sporicidal spectra and activities of lower alkanols (C_1 – C_6) for disinfecting living tissues (skin, hands, *etc.*) and inanimate objects (instruments, papers and printed materials, medical equipment, hard surfaces, military and civilian facilities, *etc.*) with unprecedented speed, economy, safety, gentleness, and residual antimicrobial effects. Further, the present invention provides a lower alkanol (C_1 – C_6) composition that can decontaminate skin/wound following chemical and biological warfare (CBW) agent exposure to contain, and destroy the CBW preventing cutaneous penetration and

further contamination. The composition can decontaminate fresh produce such as apples, baby carrots, strawberry, hard cheese blocks, shell eggs, and fresh red meat carcasses to eliminate infectious agents such as conformationally altered prions, bacteria, fungi, parasites and viruses to provide the highest possible health protection standards to the consumers. Further still, the composition can be used to decontaminate animal by-products used in feeds, and therefore replace traditional rendering techniques. Further still, the composition can be used to decontaminate homes, building materials, and furniture infected with black mold spores. The composition can be used for insect vector control (e.g. mites, mosquitoes *etc.*) to reduce the transmission of infectious pathogens. Further still, the composition contains materials that are affirmed as GRAS (Generally Recognized As Safe), e.g., food-grade, to protect against possible misuse by the consumer.

[0037] The disclosure generally relates to a composition for sanitizing (or treating) a material (or modifying a chemical contained thereon). The composition includes an aqueous composition mixture that includes: (a) lower alkanol containing 1 to 6 carbon atoms; (b) an alkalinating agent, and (c) a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof; wherein the lower alkanol, the alkalinating agent, and the fatty acid derivative are present in an effective amount to sanitize (or treat) a material (or modifying a chemical contained thereon) to which the composition is applied.

[0038] The disclosure generally also relates a method for sanitizing (or treating) a material. The method includes: (a) providing an aqueous composition comprising in admixture: (i) a lower alkanol containing 1 to 6 carbon atoms, (ii) an alkalinating agent, and (iii) a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof; wherein the lower alkanol, the alkalinating agent, and the fatty acid derivative are present in an effective amount to sanitize the material; (b) applying the aqueous composition to the material to sanitize the material; and (c) optionally removing a resulting composition of step (b).

[0039] Also disclosed is a method of modifying a chemical. The method includes: (a) providing an aqueous composition comprising in admixture: (i) a lower alkanol containing 1 to 6 carbon atoms, (ii) an alkalinating agent, and (iii) a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof; wherein the lower alkanol, the alkalinating agent, and the fatty acid derivative are present in an effective amount to modify the chemical; (b) applying the aqueous composition to a

material to modify the chemical; and (c) optionally removing a resulting composition of step (b).

[0040] The aqueous composition can be formed by a variety of methods, generally based on whether the fatty acid derivative is formed *in situ* in the aqueous composition upon mixing of its various components or whether the fatty acid derivative is added directly to the aqueous composition (or a combination of both methods). In an embodiment, a method of making the aqueous composition includes: (a) providing a lower alkanol containing 1 to 6 carbon atoms; (b) providing a fatty acid derivative soluble in the lower alkanol, the fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof; (c) providing an alkalinating agent; and (d) mixing the lower alkanol, the fatty acid derivative, the alkalinating agent, and water, thereby forming the aqueous composition. In another embodiment, a method of making the aqueous composition includes: (a) providing a lower alkanol containing 1 to 6 carbon atoms; (b) providing a fatty acid soluble in the lower alkanol; (c) providing an alkalinating agent; and (d) mixing the lower alkanol, the fatty acid, the alkalinating agent, and water, thereby (i) reacting *in situ* the fatty acid and the alkalinating agent to form a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof, and (ii) forming the aqueous composition.

[0041] In various embodiments of the disclosed compositions and methods, the lower alkanol can include one or more of methanol, ethanol (preferable, for example as substantially the only alcohol present), n-propanol, isopropanol, and n-butanol. The alkalinating agent generally can include one or more alkali metal hydroxides, alkaline earth metal hydroxides, alkali metal carbonates, and alkali metal hydrogen carbonates. More specifically, the alkalinating agent can include one or more of ammonium hydroxide, aluminum hydroxide, sodium hydroxide, potassium hydroxide, lithium hydroxide, calcium hydroxide, magnesium hydroxide, sodium carbonate, and sodium hydrogen carbonate. The fatty acid derivative, when it includes the fatty acid salt, can include an alkali or alkaline earth metal salt (e.g., Na, K, Li, Ca, and/or Mg salts) of a fatty acid containing 4 to 22 carbon atoms (e.g., 8 to 22, 10 to 22, or 12 to 20 carbon atoms). In an embodiment, the fatty acid salt includes one or more saponified natural fats or oils such as saponified coconut oil, corn oil, cottonseed oil, lard, olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, safflower oil, sesame oil, soybean oil, sunflower oil, and/or tallow. The fatty acid derivative, when it includes the fatty acid ester, can include one or more of a butyl ester, an ethyl ester, a methyl ester, an ester of a fatty alcohol having from 8 to 16 carbon atoms (e.g., saturated and/or unsaturated

fatty alcohols having 8 to 16 carbon atoms), a fatty acyl-Coenzyme A ester, a sucrose ester, and a monoglyceride (particularly suitable) of a fatty acid containing 4 to 22 carbon atoms (e.g., 8 to 22, 10 to 22, or 12 to 20 carbon atoms). In some embodiments, the fatty acid derivative can include one or more lauric acid derivatives (e.g., salts and/or esters); in a refinement, the fatty acid derivative includes substantially only lauric acid derivatives.

[0042] In various embodiments of the disclosed compositions and methods, the component concentrations and the composition pH generally can be varied according to the particular application. For example, the aqueous composition can have a pH of about 10 or more (e.g., about 10 to about 11), and the lower alkanol (e.g., ethanol) can be present in an amount from about 1 wt.% to about 40 wt.% (e.g., about 10 wt.% to about 30 wt.%). Alternatively, the aqueous composition can have a pH of about 14 or more (e.g., about 14 to about 15), and the lower alkanol (e.g., ethanol) can be present in an amount from about 40 wt.% to about 95 wt.% (e.g., about 50 wt.% to about 65 wt.%). More generally, the lower alkanol (e.g., ethanol) can be present in an amount up to about 95 wt.% (e.g., from about 3 wt.% to about 95 wt.%) of the aqueous composition, the alkalinating agent (e.g., one or more hydroxides) can be present in an amount from about 0.01 wt.% to about 10 wt.% of the aqueous composition, and/or the fatty acid derivative (e.g., lauric acid salt) can be present in an amount from about 0.1 wt.% to about 25 wt.% of the aqueous composition.

[0043] The disclosed aqueous compositions can include various optional components, for example one or more thickeners, emollients, moisturizers, corrosion inhibitors, propellants, perfumes, flavoring agents, defoamers, antioxidants, and dyes. In an embodiment, the aqueous composition further comprises a scented oil comprising one or more terpenes. The aqueous composition further can comprise an essential oil (e.g., comprising one or more terpenes, terpenoids, derivatives thereof, and combinations thereof; present in an amount from about 0.01 wt.% to about 5 wt.% of the aqueous composition), for example one or more of thyme oil, eucalyptus oil, cinnamon oil, orange oil, lemon oil, clove oil, lime oil, rosemary oil, citronnella oil, cedar wood oil, camphor oil, calamus oil, geranium oil, lavender, lemongrass oil, peppermint oil, vetiver oil, palmarosa oil, and nutmeg oil. The aqueous composition additionally can comprise a polyol (e.g., propylene glycol, glycerol, sorbitol, xylitol, and/or maltitol; present in an amount from about 1 wt.% to about 30 wt.% of the aqueous composition). A saponified natural fat or oil can be included in the aqueous composition, for example one or more of saponified coconut oil, corn oil, cottonseed

oil, lard, olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, safflower oil, sesame oil, soybean oil, sunflower oil, and tallow. In an embodiment, the composition can be an oral hygiene composition in which (i) the aqueous composition further comprises (A) about 5 wt.% to about 50 wt.% of a toothpaste carrier and (B) about 30 wt.% to about 80 wt.% of a carbonate alkalinizing agent, a bicarbonate alkalinizing agent, or a combination thereof; and (ii) the material to be sanitized/treated includes teeth (e.g., human teeth).

[0044] The disclosed methods of treatment, sanitization, and/or chemical modification can include various additional and/or more specific features. In an embodiment, once the aqueous composition is applied to a material, at least a portion of the lower alkanol and water is allowed to evaporate, thereby forming a film adhered to the material, the film comprising the fatty acid derivative (e.g., the film essentially consists of the aqueous composition components, less the evaporated alkanol and water); wherein the film physically entraps one or more infectious agents (or hazardous chemicals) on the material. In an embodiment, the material includes one or more infectious agents (or hazardous chemicals) that are sanitized, treated, or chemically modified by the aqueous composition. The infectious agent generally can include one or more of a fungus, a bacterium, a fungal spore, a bacterial spore, a virus, a conformationally altered prion, and a chemical warfare agent. For example, the infectious agent can include one or more of *Enterococcus faecium*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Trichophyton mentagrophytes*, *Salmonella choleraesuis*, *Serratia marcescens*, *Staphylococcus aureus*, and *Staphylococcus epidermis*. In various embodiments, the infectious agent can include a *Stachybotrys chartarum* fungal spore, a *Bacillus atropheus* bacterial spore, a chemical warfare agent (e.g., VX, mustard, sarin, soman, and/or tabun), and/or a conformationally altered prion (e.g., CJD, CWD, BSE, and/or Scrapie).

[0045] Thus, the present invention provides a method for sanitizing a material which comprises: providing an aqueous composition which comprises a mixture of a lower alkanol containing 1 to 6 carbon atoms and a fatty acid derivative which is a salt or ester at a pH of about 14 or above, wherein the fatty acid derivative is between about 0.1% and 25% by weight of the composition; applying the composition to the material in an effective amount to sanitize the material; and optionally removing a resulting composition of step (b).

[0046] In further embodiments of the method the fatty acid derivative is an alkali or alkaline earth metal salt. In further embodiments, the fatty acid is a sodium (Na),

potassium (K), lithium (Li), calcium (Ca) or magnesium (Mg) salt. In still further embodiments, the fatty acid derivative is an alkali or alkaline metal salt of a fatty acid comprising 4 to 22 carbon atoms. In still further embodiments, the fatty acid derivative is an alkali or alkaline metal salt of lauric acid. In still further embodiments, the fatty acid derivative is potassium laurate. In still further embodiments, the fatty acid derivative is an ester selected from the group consisting of a butyl ester, ethyl ester, methyl ester, fatty acyl-Coenzyme A, sucrose ester and a monoglyceride. In still further embodiments, the monoglyceride comprises a glycerol moiety attached by ester or ether linkage to one or more fatty acids having from 4 to 22 carbon atoms. or to one or more saturated or unsaturated fatty alcohols having from 8 to 16 carbon atoms. In still further embodiments, the toxin is a *Stachybotrys* toxin. In further embodiments, the microorganism or other infectious agent is a fungus, a bacterium, a fungal spore, a bacterial spore, a virus or a conformationally altered prion. In still further embodiments, the fungal spore is a *Stachybotrys chartarum* spore. In still further embodiments, the bacterial spore is a *Bacillus atropheus* spore. In still further embodiments, the chemical warfare agent is VX, mustard, sarin, soman, or tabun. In still further embodiments, the conformationally altered prion selected from the group consisting of CJD, CWD, BSE, and Scrapie.

[0047] The present invention provides a composition which comprises in a mixture: a lower alkanol containing 1 to 6 carbon atoms; and a fatty acid derivative which is a salt or ester soluble in the alkanol, wherein the composition has a pH of 14 or above wherein the fatty acid derivative is between about 0.1% to 25% by weight of the composition. In further embodiments, the composition is provided as an aqueous solution. In further embodiments, the lower alkanol is methanol, ethanol, n-propanol, isopropanol, n-butanol or mixtures thereof. In further embodiments, the fatty acid derivative is an alkali or alkaline earth metal salt. In still further embodiments, the fatty acid is a sodium (Na), potassium (K), lithium (Li), calcium (Ca) or magnesium (Mg) salt. In still further embodiments, the fatty acid derivative is an alkali or alkaline metal salt of a fatty acid comprising 4 to 22 carbon atoms. In still further embodiments, the fatty acid derivative is an alkali or alkaline metal salt of lauric acid. In still further embodiments, the fatty acid derivative is potassium laurate. In still further embodiments, the fatty acid derivative is an ester selected from the group consisting of a butyl ester, ethyl ester, methyl ester, fatty acyl-Coenzyme A, sucrose ester and a monoglyceride. In still further embodiments, the monoglyceride comprises a glycerol moiety attached by ester or ether linkage to one or more fatty acids having from 4 to

22 carbon atoms or to one or more saturated or unsaturated fatty alcohols having from 8 to 16 carbon atoms. In still further embodiments, the composition further comprises one or more ingredients selected from the group consisting of thickeners, emollients, moisturizers, corrosion inhibitors, propellants, perfumes, flavoring agents, defoamers, antioxidants and dyes.

[0048] The present invention provides a method of treating a material, which comprises: (a) providing an aqueous composition which comprises a mixture of a lower alkanol containing 1 to 6 carbon atoms and a fatty acid derivative which is a salt or ester at a pH of about 14 or above, wherein the fatty acid derivative is between about 0.1% and 25% by weight of the composition; and (b) applying the composition to the material in an effective amount to treat the material. In further embodiments, a resulting composition of step (b) is removed from the material.

[0049] The present invention provides a method of making a composition, which comprises: providing a lower alkanol containing 1 to 6 carbon atoms; providing a fatty acid derivative which is a salt or ester soluble in the alkanol; and mixing the lower alkanol and fatty acid derivative to provide the composition, wherein the composition has a pH of 14 or above and wherein the fatty acid derivative is between about 0.1% to 25% by weight of the composition. In still further embodiments, the lower alkanol is ethanol. In still further embodiments, the fatty acid derivative is an alkali or alkaline earth metal salt. In still further embodiments, the fatty acid is a sodium (Na), potassium (K), lithium (Li), calcium (Ca) or magnesium (Mg) salt. In still further embodiments, the fatty acid derivative is an alkali or alkaline metal salt of a fatty acid comprising 4 to 22 carbon atoms. In still further embodiments, the fatty acid derivative is an alkali or alkaline metal salt of lauric acid. In still further embodiments, the fatty acid derivative is potassium laurate. In still further embodiments, the fatty acid derivative is an ester selected from the group consisting of a butyl ester, ethyl ester, methyl ester, fatty acyl-Coenzyme A, sucrose ester and a monoglyceride. In still further embodiments, the monoglyceride comprises a glycerol moiety attached by ester or ether linkage to one or more fatty acids having from 4 to 22 carbon atoms or to one or more saturated or unsaturated fatty alcohols having from 8 to 16 carbon atoms.

[0050] The present invention provides a method of making a composition, which comprises: providing a lower alkanol containing 1 to 6 carbon atoms; providing a fatty acid; providing an alkalinating agent; and mixing the lower alkanol, fatty acid and alkalinating agent to provide the composition, wherein the composition has a pH of 14 or above and wherein the fatty acid derivative is between about 0.1% to 25% by weight

of the composition. In still further embodiments, the lower alkanol is ethanol. In still further embodiments, the fatty acid is a fatty acid comprising 4 to 22 carbon atoms. In still further embodiments, the fatty acid is lauric acid. In still further embodiments, the alkalinating agent is selected from the group consisting of an alkali metal hydroxide, alkaline earth metal hydroxides, alkali metal or hydrogen carbonates and mixtures thereof. In still further embodiments, the alkalinating agent is selected from the group consisting of ammonium hydroxide, aluminum hydroxide, sodium hydroxide, potassium hydroxide, lithium hydroxide, calcium hydroxide, magnesium hydroxide, sodium carbonate, sodium hydrogen carbonate, and mixtures thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051] Figures 1A-E show the effect of different concentrations of composition FB on the killing of black mold (*Stachybotrys chartarum*) spores. Figure 1A shows the effect of 100% FB on the reduction of black mold spores. Figure 1B shows the effect of 60% FB on the reduction of black mold spores. Figure 1C shows the effect of 50% FB on the reduction of black mold spores. Figure 1D shows the effect of 40% FB on the reduction of black mold spores. Figure 1E shows the effect of 30% FB on the reduction of black mold spores.

[0052] Figure 2 is a graph showing the effect of different concentrations (30, 60, and 100%) of composition (FB) on the killing of black mold (*Stachybotrys chartarum*) spores.

[0053] Figures 3A-C show the effect of different concentrations of household Clorox® bleach on the killing of black mold (*Stachybotrys chartarum*) spores. Figure 3A shows the effect of 12.5% NaOCl on the killing of black mold spores. Figure 3B shows the effect of 7.5% NaOCl on the killing of black mold spores. Figure 3C shows the effect of 3.75% NaOCl on the killing of black mold spores.

[0054] Figure 4 shows the effect of different concentrations of chlorine bleach (3.75, 7.5, and 12.5% sodium hypochlorite) on the killing of black mold (*Stachybotrys chartarum*) spores.

[0055] Figure 5 shows the effect of composition (50%FB) and household Clorox® bleach on carpets inoculated with *Stachybotrys chartarum* spores.

[0056] Figure 6 shows the effect of composition (50%FB) and household Clorox® bleach on ceiling tiles inoculated with *Stachybotrys chartarum* spores.

[0057] Figure 7 shows the effect of composition (50%FB) and household Clorox® bleach on general purpose printing papers inoculated with *Stachybotrys chartarum* spores.

[0058] Figure 8 shows the growth of black mold on carpets inoculated with *Stachybotrys chartarum* spores and incubated for 30 days in the dark.

[0059] Figure 9 shows the growth of black mold on general purpose printing papers inoculated with *Stachybotrys chartarum* spores and incubated for 30 days in the dark.

[0060] Figure 10 shows the growth of black mold on ceiling tiles inoculated with *Stachybotrys chartarum* spores and incubated for 30 days in the dark.

[0061] Figures 11A-F show the effect of spraying composition FB on wood after inoculation of the wood with black mold (*Stachybotrys chartarum*) spores. Figures 11A and 11B show the inoculation of black mold spores on wood as the porous material. Figures 11C and 11D show the performance of 50% FB sprayed onto wood. Figures 11E and 11F show the effect of 1.84% sodium hypochlorite sprayed onto wood.

[0062] Figure 12 is a log killing curve for *Bacillus atrophaeus* spores using composition 6 (Example 3; pH 14.9) at room temperature and different time points: 5 min, 10 min, 15 min, 20 min and 30 min. All plates were incubated at 32°C and monitored for six days. Minimum population of the discs is 2.4×10^6 spores/unit.

[0063] Figure 13 is a log killing curve for *Bacillus atrophaeus* spores using composition 12 (Example 3; pH 14.7) at room temperature and different time points: 5 min, 10 min, 15 min, 20 min and 30 min. All plates were incubated at 32°C and monitored for six days. Minimum population of the discs is 2.4×10^6 spores/unit.

DETAILED DESCRIPTION OF THE INVENTION

[0064] All patents, patent applications, government publications, government regulations, and literature references cited in this specification are hereby incorporated herein by reference in their entirety. In case of conflict, the present description, including definitions, will control.

[0065] The term “CFU” as used herein refers to colony forming units.

[0066] The term “treat” as used herein is a broad term meaning to coat, change, alter, vary, and/or modify a material so that the material becomes different in one or more aspects from the starting material. The term can refer to a physical and/or chemical change including, but not limited to, those resulting from a chemical reaction, solubilization and/or emulsification are also encompassed by the term.

[0067] The term “FB” as used herein refers to one embodiment of the composition of

the present invention as set forth in Table 1.

[0068] The term “material” as used herein refers to any solid, liquid and/or gaseous matter, such as but not limited to air, a chemical, a non-living surface, living tissue, soil or an atmosphere.

[0069] The term “sanitizing” as used herein refers to decreasing or eliminating the level or detrimental capacity of agents that are capable of being injurious to health of a living animal. Some examples of agents capable of being injurious to health of a living animal are contaminants, such as but not limited to toxins, chemical warfare agents, insects, prions, microorganisms or other infectious agents. Examples of sanitizing include chemical modification and degradation, however removal of the agents by solubilizing is also encompassed by the term.

[0070] The present invention provides compositions and methods to improve the decontaminating effect of lower alkanols containing 1 to 6 carbon atoms (C_1-C_6) for sanitizing materials such as, but not limited to living tissues (skin, hands, *etc.*) and inanimate objects (instruments, medical equipment, military and civilian facilities, furniture, papers and printed materials, *etc.*) of harmful contaminants such as but not limited to chemical warfare agents (VX, mustard, sarin, soman, and tabun), toxins, protozoa, insects (*e.g.*, disease vectors), and pathogenic infectious agents such as bacteria, fungi, viruses, fungal and bacterial spores, and conformationally altered prions (CJD, CWD, BSE, Scrapie). The continuing challenge in developing new germicides is to strike a balance between safety, convenience, and efficacy. The ease of use and safety are as important, and sometimes more important, than using the best efficacious chemical technologies. Bacterial spores, fungal spores, and infectious prions are highly resistant to chemical and physical disinfecting agents. Processes designed to achieve sterilization of food, pharmaceutical, medical, and other products have thus, of necessity, had to take this high level of resistance into account. From this scheme, it can be envisaged that activity against the more resistant infectious agents (*e.g.*, *Bacillus atropheus* spores and infectious prions) implies activity against the least resistant infectious agents (*e.g.*, vegetative bacteria, lipid viruses).

[0071] U.S. Patent Application Publication No. 2005/0202137 (Application No. 11/031,935) to Awad, hereby incorporated herein by reference in its entirety, teaches a method for treating biological tissue, particularly meats for human consumption, so as to sanitize the tissue. The method inactivates microorganisms and pathogenic prions (proteins) in the tissue. The method of sanitizing comprises treating the tissue with an aqueous solution selected from the group consisting of an alkali metal hydroxide,

alkaline earth metal hydroxide and mixtures thereof and a lower alkanol containing 1 to 6 carbon atoms such that any prions in contact with the solution are inactivated. The present invention describes a method for improving the decontaminating properties of lower alkanols C₁-C₆ by mixing them with GRAS constituents essentially comprising fatty acids derivatives, alkalinating agents, water and mixtures thereof. Optionally, one or more ingredient selected from the group consisting of thickeners, emollients, moisturizers, corrosion inhibitors, defoamers, flavoring agents, propellants, perfumes, antioxidants, and dyes can be added. The resulting compositions can be used for disinfecting living tissues (skin, hands, *etc.*) and inanimate objects (instruments, medical equipment, military and civilian facilities, furniture, papers and printed materials, *etc.*) of harmful contaminants consisting of chemical warfare agents (VX, mustard, sarin, soman, and tabun), toxins, protozoa, insects (*ie.*, disease vectors), and pathogenic infectious agents such as bacteria, fungi, viruses, fungal and bacterial spores, and conformationally altered prions (CJD, CWD, BSE, Scrapie).

[0072] Moreover, the activity of the compositions is retained for a considerable time after the evaporation of the solvent. In a biological weapon attack, the first step has to be to prevent further migration of the pathogens. Immobilizing biological warfare agents (*e.g.*, bacterial spores, *etc.*) may also enable rescue workers to do their jobs without becoming contaminated. A very important aspect of the present invention is that the film that results after the evaporation of the solvent will physically entrap bacterial or fungal spores, and therefore prevent the resuspension of spores, which is a major cause of transmission of infection and contamination of environmental surfaces. The compositions of this invention can be very easily prepared by simply mixing measured amounts of the necessary constituents with the lower alkanols followed by any optional ingredients and packaging.

[0073] The lower alkanols (C₁-C₆) useful in the present invention are selected from the group consisting of, but not limited to, methanol, ethanol, n-propanol, isopropanol, n-butanol, and mixtures thereof which are present in an amount up to about 95%, for example ranging from about 3 and 95%. In certain embodiments, the lower alkanol is included at relatively high levels, for example ranging from about 40 wt.% to about 95 wt.%, about 40 wt.% to about 80 wt.%, or about 50 wt.% to about 65 wt.%. In other embodiments, the lower alkanol is included at relatively lower levels, for example ranging from about 1 wt.% to about 40 wt.%, about 1 wt.% to about 35 wt.%, about 2 wt.% to about 10 wt.%, about 10 wt.% to about 30 wt.%, or about 15 wt.% to about 30 wt.%. Ethanol or isopropanol is most preferred.

[0074] Examples of suitable fatty acid derivatives include alkali and alkaline earth metal salt (Na, K, Li, Mg *etc.*) of fatty acids containing 4 to 22 carbon atoms (C₄-C₂₂; more particularly fatty acids containing 8 to 22, 10 to 22, or 12 to 20 carbon atoms). Other fatty acid derivatives useful herein include fatty acid esters, for example derivatives such as butyl-, ethyl-, methyl esters (e.g., C₁-C₄ or C₁-C₆ aliphatic esters), an ester of a saturated and/or an unsaturated fatty alcohol having from 8 to 16 carbon atoms (i.e., a fatty acid ester of a fatty alcohol), fatty acyl-Coenzyme A, sucrose esters, and monoglycerides of a desirable fatty acid (e.g., those listed above for fatty acid salts). The monoglycerides useful for the present invention are glycerol moieties attached by ester or ether linkage to fatty acids having from 4 to 22 carbon atoms (C₄-C₂₂; more particularly fatty acids containing 8 to 22, 10 to 22, or 12 to 20 carbon atoms). In certain embodiments, the fatty acid derivative can be based on a single fatty acid (e.g., lauric acid and its salt/ester derivatives). In other embodiments, the fatty acid derivative can be based on a distribution of fatty acids, for example including fatty acids derived from animal/vegetable fats/oils, in particular saponified fats/oils from natural triglyceride sources. The saponified fats/oils generally include fatty acid salts (e.g., sodium, potassium, or other alkali/alkali earth metal) having a distribution of saturated, monounsaturated, and/or polyunsaturated fatty acid chains ranging in length from 8 to 18 carbon atoms (C₈-C₁₈) (or from 12 to 18 carbon atoms (C₈-C₁₈)) depending on the source of the fat or oil. Preferably, the fats/oils are saponified prior to addition to the composition (i.e., not saponified *in situ* by a strong hydroxide base). Examples of suitable saponified fats/oils include coconut oil, corn oil, cottonseed oil, lard (swine), olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, safflower oil, sesame oil, soybean oil, sunflower oil, tallow (beef, mutton), and mixtures thereof. Saponified coconut oil, olive oil, and/or tallow are particularly suitable. Generally, the inclusion of fatty acid derivatives in amounts from 0.1% by weight to about 25% by weight, for example from 1 to 5% by weight, from 3 to 5% by weight, from 5 to 10% by weight, or from 10 to 20% by weight have been observed to be useful. Lauric acid derivatives are most preferred, for example at the foregoing levels. When included, the saponified fats/oils suitably can be included in larger amounts, for example from about 1 wt.% to about 80 wt.%, about 10 wt.% to about 70 wt.%, or about 20 wt.% to about 50 wt.%.

[0075] In some preferred embodiments, the alkalinating agents are selected from the group comprising ammonium hydroxide, aluminum hydroxide, alkali metal hydroxides (Na, K, Li), alkaline earth metal hydroxides (Ca, Mg), alkali metal carbonates or

hydrogen carbonates (bicarbonates), e.g., sodium carbonate or sodium hydrogen carbonate, or mixtures thereof. The alkalinating agent is included at a level sufficient to create an alkaline/basic environment for the composition. In some embodiments, the fatty acid derivative is formed *in situ* upon formulation of the composition using a fatty acid as a precursor, so the alkalinating agent is included at a level sufficient to both neutralize the fatty acid and create the alkaline/basic environment (e.g., addition of lauric acid with excess potassium hydroxide to form potassium laureate *in situ* with enough excess hydroxide to achieve a desired pH). Generally, the quantity of the alkalinating agents may vary from 0.01% by weight to 10% by weight, and most preferably within the range of 3 to 6% by weight, e.g. 5% by weight, in particular when the strong alkalinating agents are used (e.g., hydroxides). When weaker alkalinating agents (e.g., carbonates, bicarbonates) are used, they may be incorporated at higher levels (e.g., up to about 80 wt.%, from about 10 wt.% to about 80 wt.%, or from about 20 wt.% to about 70 wt.%) to additionally provide a solid/semi-solid suspension having a gel-like consistency.

[0076] The pH of a particular composition is selected so that the composition has a sufficient sanitizing/treatment effectiveness for a target material/infectious agent and further to reduce potential caustic side effects due to human exposure to the composition (whether intentional or accidental). Thus, in various embodiments, the pH of the composition is about 9 or more, about 10 or more, about 11 or more, or about 12 or more. Alternatively or additionally, the pH of the composition is desirably about 15 or less or about 16 or less. Moreover, the composition can suitably have a pH of about 10, about 11, about 12, about 13, about 14, or about 15. Preferably, embodiments with a relatively low content of the lower alkanol (e.g., about 1 wt.% to about 40 wt.% or a sub-range thereof) also have a relatively low pH (e.g., about 9 or more, about 10 or more, about 11 or less, and/or about 12 or less). Low pH/low alkanol content compositions can be particularly effective against infectious agents such as fungus, bacteria, and other less resilient infectious agents. Similarly, embodiments with a relatively high content of the lower alkanol (e.g., about 40 wt.% to about 95 wt.% or a sub-range thereof) preferably also have a relatively high pH (e.g., about 12 or more, about 13 or more, about 14 or more, about 15 or less, and/or about 16 or less). High pH/high alkanol content compositions can be particularly effective against infectious agents such as fungal spores, bacterial spores, viruses, conformationally altered prions, chemical warfare agents, and other more resilient infectious agents, although they are generally effective against fungus and bacteria as well.

[0077] The compositions of the present invention include water as solvent and most preferably deionized water. The quantity of water may vary from about 5 to 95% by weight, and most preferably within the range of 15 to 60% by weight. The compositions can optionally include thickeners selected from the group consisting of, but are not limited to, fumed silica, xanthan gum, pectin, guar gum, hydroxyl propyl cellulose, gelatin, natural gums, carrageenan, polyethylene glycol, polypropylene glycol, carboxypolymethylene, Acrylates/C10-30 alkyl acrylate crosspolymer, and water soluble waxes; such ingredient may be included in any effective amount. The compositions can also optionally include one or more corrosion inhibitors. Examples of suitable corrosion inhibitors include mono- and triethanolamine, dicyclohexyl amine nitrite, and N,N-dibenzylamine, and such ingredient may be included in any effective amount.

[0078] The compositions of the present invention can optionally be formulated with emollients and/or moisturizers. Emollients and/or moisturizers which may be used are well known and conventional in the art and include, but are not limited to, propylene glycol, isopropyl myristate, glycerin, acetamidopropyl trimonium chloride. Such ingredient may be included in any effective amount. Particularly preferred are food-safe/food-grade polyols (e.g., propylene glycol, glycerin/glycerol, sorbitol, maltitol, xylitol), for example at levels of about 1 wt.% to about 30 wt.%, about 2 wt.% to about 20 wt.%, or about 5 wt.% to about 15 wt.%, based on the total weight of the composition. The compositions can also optionally be formulated with conventional propellants for dispensing as aerosols for conventional pressurized containers. Examples of suitable propellants include, but are not limited to, isobutene, n-butane, propane, dimethyl ether and mixtures thereof; such ingredient may be included in any effective amount. In addition, the compositions can optionally include one or more perfumes. Any material that provides a desirable scent may be used. Especially preferred are oils derived from citrus fruit, e.g., orange, lemons, limes, etc. which contain large amounts of terpenes. Such ingredient can be included in any effective amount.

[0079] In an embodiment, the compositions can include one or more essential oils, whether or not such oils have a desirable scent. In addition to potentially providing a fragrance, essential oils can have antibacterial, antifungal, antiviral, and/or sporicidal effects when included in the disclosed compositions. An essential oil is a concentrated, generally hydrophobic liquid extracted from a plant material that may include some volatile aroma compounds from the plant material. Essential oils contain

a variety of constituents, in particular terpenes and terpenoids (e.g., biosynthetic derivatives of isoprene, for example including monoterpenes and sesquiterpenes). Representative terpenes include camphene, caryophyllene, germacrene, limonene, menthone, myrcene, nerol, ocimene, phellandrene, α -pinene, β -pinene, pulegone, terpinene, terpinen-4-ol, thujone, sabinene, isomers thereof, etc. Representative terpenoids include borneol, camphor, citral (or lemonal; geranial and neral isomers) citronellal, eucalyptol (or 1,8-cineole), linalool, isomers thereof, etc. Other terpene/terpenoid-related constituents common in essential oils include carvacrol, cymene (p-), linalyl acetate, menthol, thymol, isomers thereof, etc. Examples of specific suitable plant material extracts include thyme oil, eucalyptus oil, cinnamon oil, orange oil, lemon oil, clove oil, lime oil, rosemary oil, citronella oil, cedar wood oil, camphor oil, calamus oil, geranium oil, lavender, lemongrass oil, peppermint oil, vetiver oil, palmarosa oil, nutmeg oil. When included in the composition, essential oils are preferably incorporated at levels of about 0.01 wt.% to about 5 wt.%, about 0.1 wt.% to about 2 wt.%, about 0.1 wt.% to about 1 wt.%, or about 0.3 wt.% to about 0.7 wt.%, based on the total weight of the composition. As used herein, "essential oil" can generally refer to any of the foregoing specific compounds, classes of compounds, plant extracts, or mixtures/combinations thereof.

[0080] The compositions of the present invention can optionally include one or more defoamers. Examples of suitable defoamers include, silicone (e.g., polydimethyl siloxane), C_8 to C_{18} aliphatic alcohol or C_9 to C_{12} -alkyl substituted phenol or a mixture thereof. The compositions can also optionally include one or more antioxidants. Examples of suitable antioxidants include, but are not limited to, tocopherols (e.g., vitamin E, or tocopherol acetate), vitamin C and mixtures thereof. The ingredients can be included in any effective amount. The compositions can also optionally include one or more dyes and/or coloring agents. Examples of suitable dyes/coloring agents include, but are not limited to, titanium dioxide, pH dependent dyes (e.g., blue dye thymophtalein), nonstaining dye, and such ingredient can be included in any effective amount. The compositions can also optionally include one or more flavoring agents. Any material that provides a desirable flavor can be used, and the ingredient can be included in any effective amount.

[0081] The present invention incorporates the combined effect of certain GRAS constituents on the decontaminating activity of lower alkanols C_1 - C_6 for the purpose of improving the germicidal and sporicidal spectra and activities of these alkanols. Constituents tested in the examples herein were selected from the standpoint of safety

and include fatty acids derivatives, alkalinating agents, water and mixtures thereof. Optionally, one or more ingredients selected from thickeners, emollients, moisturizers, corrosion inhibitors, propellants, perfumes, flavoring agents, defoamers, antioxidants, and dyes are also included in the composition. The compositions of the present invention attack pathogens at multiple points in their life cycles with more than one antimicrobial compound. The antimicrobial compounds inactivate pathogens, acting not only individually but also acting additionally and synergistically. The compositions disclosed herein are non-corrosive, non-toxic, and can be incorporated into a wide variety of carriers. Therefore, they can be packaged in aerosol form in conventional aerosol containers, fog generating devices, or in liquid form in trigger pumps spray bottles and squeeze bottles (liquid/gel). They can be impregnated into towelettes (woven or non-woven nature) and packaged individually or packaged in bulk for individual dispensing to satisfy a wide variety of operational objectives. The compositions can be incorporated into an oral hygiene product (e.g., for brushing teeth with a toothbrush having the oral hygiene product applied thereto). In such cases, the oral hygiene product can include a toothpaste carrier (e.g., any conventional toothpaste formulation generally including an abrasive, fluoride, etc., for example a bleaching agent-free formulation) at levels of about 5 wt.% to about 50 wt.% or about 10 wt.% to about 30 wt.%. The oral hygiene product preferably also includes a carbonate/bicarbonate alkalinating agent at levels of about 30 wt.% to about 80 wt.% or about 50 wt.% to about 70 wt.%, with the remainder including the general aqueous/lower alkanol/fatty acid derivative composition described herein.

[0082] The present invention provides an aqueous formulation to improve the decontaminating properties of lower alkanols C_1-C_6 for disinfecting living tissues and inanimate objects of harmful contaminants. The composition of the present invention includes lower C_1-C_6 alkanols including, but not limited to, methanol, ethanol, n-propanol, isopropanol, n-butanol, and mixtures thereof which are present in an amount of from about 3 and 95%. Ethanol or isopropanol is most preferred. The composition also includes fatty acid derivatives including, but not limited to, alkali and alkaline earth metal salts (Na, K, Li, Mg etc.) of fatty acids having 4 to 22 carbon atoms, and mixtures thereof. Other useful fatty acids derivatives include ester derivatives such as butyl-, ethyl-, methyl esters, esters of saturated and/or unsaturated fatty alcohols having from 8 to 16 carbon atoms, fatty acyl-Coenzyme A, sucrose esters, and monoglycerides of a desirable fatty acid. The monoglycerides useful for the present invention are glycerol moieties attached by ester or ether linkage to fatty acids having

from 4 to 22 carbon atoms (C₄-C₂₂). Generally, the inclusion of fatty acid derivatives in amounts from 0.1% by weight to about 25% by weight, especially from 5 to 10% by weight have been observed to be useful. Lauric acid derivatives are most preferred. Alkalinating agents include, but are not limited to, ammonium hydroxide, aluminum hydroxide, alkali metal hydroxides (Na, K, Li), alkaline earth metal hydroxides (Ca, Mg), alkali metal or hydrogen carbonates, *e.g.*, sodium carbonate or sodium hydrogen carbonate, or mixtures thereof. Generally, the quantity of the alkalinating agents may vary from 0.01% by weight to 10% by weight, and most preferably within the range of 3 to 6% by weight, *e.g.* 5% by weight. And optionally, one or more constituents selected from the group consisting of thickeners, emollients, moisturizers, corrosion inhibitors, propellants, perfumes, flavoring agents, defoamers, antioxidants, and dyes.

[0083] The harmful contaminants acted upon by the present invention include chemical warfare agents (VX, mustard, sarin, soman, and tabun), toxins, insects (*e.g.*, disease vectors), and pathogenic infectious agents such as bacteria, fungi, viruses, fungal and bacterial spores, and conformationally altered prions (CJD, CWD, BSE, Scrapie). The inanimate objects acted upon include, but are not limited to, instruments, medical equipment, military and civilian facilities, furniture, papers and printed materials, *etc.* stainless steel, plastic, fiberglass, ceramics, marble, enamel and porcelain.

[0084] In some embodiments, the solvent is water. In further embodiments, the alkanol is ethanol. In some embodiments, the solvent is ethanol. In further embodiments, the contaminant is a chemical warfare agent, biological warfare agent, protein, (*e.g.*, infectious prions), a toxin, (*e.g.*, Stachybotrys toxins, botulinum), an insect, (*e.g.*, disease vectors), a pathogenic infectious agent (such as bacteria, fungi, viruses), a fungal spore, (*e.g.*, Stachybotrys chartarum) or a bacterial spore (*e.g.*, Bacillus atropheus spore). In further embodiments, the contaminant is on a surface, in the atmosphere, in soil, on medical and surgical instruments, on food products, in animal feeds, in papers and printed materials, on military equipment or in living tissues including, but not limited to, skin, hands, muscle, biological tissues from animal and plant origin.

[0085] The following examples are intended to promote a further understanding of the present invention. The compositions of the invention are illustrated by examples of specific formulations as described below without, however, being limited thereto. It is to be understood that these examples are provided by way of illustration only and that further useful formulations falling within the scope of the present invention may be

readily produced by one skilled in the art without deviating from the scope of the invention.

EXAMPLE 1

Table 1:

Component	Composition (FB)	Amount
Alkanol (ml):	Ethanol	62
Fatty acid (g):	Lauric acid	10
Alkalinating agent(g):	Potassium hydroxide	3.5
Water (ml):	Deionized	26
pH:		14.42

The mixture was made up to a volume of 100 ml with deionized water.

[0086] The following summary of results and data is based on tests performed on black mold spores using the composition (FB) of Table 1. *Stachybotrys chartarum*, commonly known as the “black house-mold”, has become a major problem in homes and office buildings, costing the building and insurance industries billions of dollars each year. The fungus grows best on cellulose containing materials such as mill paper, fiber board, wood and gypsum board, in moist warm environments such as homes previously subjected to water damage from condensation, leakage and flooding. There are nearly 120 million housing units and 5 million commercial buildings in the U. S. that are potentially susceptible to this water damage. Individuals who have come in contact with *Stachybotrys* contaminated straw or grains and found to be infected, manifests symptoms such as dermatitis, pain and inflammation of the mucous membranes of the mouth and throat, a burning sensation of the nasal passages, tightness of the chest, cough, bloody rhinitis, fever, headache, rash, and fatigue. Those who consumed contaminated grains reported a burning sensation in the mouth, nausea, vomiting, diarrhea and abdominal pain. *Stachybotrys* has been implicated in both the “sick building syndrome”, and pulmonary hemorrhage in infants. This fungus produces a number of trichothecene mycotoxins, amongst which are the satratoxins (G, F and H), roridin, trichodermol and trichoverrol. Although the mode of action of satratoxin is not well understood, it is thought to be an immunosuppressant even at very low concentrations, as well as a potent protein synthesis inhibitor. Remediation typically involves demolition and removal of *Stachybotrys* contaminated areas. Destruction of this fungus and its toxins with the composition of the present invention will greatly reduce remediation costs.

[0087] *Fungal Spore Preparation: Stachybotrys chartarum* spores which were determined to be highly toxic and satratoxin extracts with known satratoxin concentration (ng/g), were used in this experiment. A known concentration of *Stachybotrys* spores was sub-cultured on potato dextrose agar (PDA) or malt extract agar (MEA) plates. The plates were incubated in the dark at room temperature (26 °C) for five to seven (5-7) days, until confluent growth was achieved. Spores were collected with phosphate buffer saline (PBS), pH 7.0, with final concentrations of 10^5 and 10^7 spores/ml of phosphate buffered saline (PBS).

[0088] *Determination of Treatment Efficacy: Spores.* Nine milliliters (ml) of the composition (FB) was inoculated with one milliliter (1 ml) of spore concentration. Initial spore concentration was 6.65 log colony forming units per ten milliliters (CFU/10 ml) solution. Sampling was done in sterile test tubes. Tubes were agitated vigorously, three times per minute for the first ten minutes and then once every five minutes for a total of ten (10), thirty (30), and sixty (60) minutes. The tubes were then emptied and rinsed three times with deionized water (5 ml) for five minutes (5 min) each, in the same manner, as the treatment was performed. Solutions from each treatment were combined. Positive (spores inoculated without experimental treatments) and negative (experimental treatments without spores) controls were included. One hundred microliters (μl) from the combined solution of each treatment was plated on PDA plates at room temperature in the dark for seven days. This procedure was replicated three times. Spores were counted after a week.

[0089] Three concentrations of the composition (FB) were used (30%, 60% and 100%). Dilutions were made with distilled water. Aqueous solutions of chlorine bleach 3.75%, 7.5% and 12.5% sodium hypochlorite were also used. Treatments were sampled at 0, 1, 5, 30 and 60 minutes. Complete inhibition of spore growth was observed for 30% FB after five (5) minutes. No growth was observed with 60 and 100% FB after one (1) minute as illustrated in Figure 2. Figures 1A-E show the effect of different concentrations of composition FB on the killing of black mold (*Stachybotrys chartarum*) spores. Figure 1A shows the effect of 100% FB on the reduction of black mold spores. Figure 1B shows the effect of 60% FB on the reduction of black mold spores. Figure 1C shows the effect of 50% FB on the reduction of black mold spores. Figure 1D shows the effect of 40% FB on the reduction of black mold spores. Figure 1E shows the effect of 30% FB on the reduction of black mold spores.

[0090] In the case of chlorine bleach, complete inhibition of spore growth was observed for all three concentrations of detergent used (3.75%, 7.5% and 12.5%

sodium hypochlorite) after one (1) minute as illustrated in Figure 4. Figures 3A-C show the effect of different concentrations of household Clorox® bleach on the killing of black mold (*Stachybotrys chartarum*) spores. Figure 3A shows the effect of 12.5% NaOCl on the killing of black mold spores. Figure 3B shows the effect of 7.5% NaOCl on the killing of black mold spores. Figure 3C shows the effect of 3.75% NaOCl on the killing of black mold spores.

[0091] The results from these tests clearly indicate that the composition of the present invention is very effective in the decontamination of black mold spores. It is also clear that bleach is very effective decontaminant. The primary motivation for finding a replacement for bleach is due to its high corrosiveness and not its inability to kill germs. Composition (FB) was then further optimized, and 30%, 40%, 50% and 60% solutions were used to test for the optimum concentration that will prevent spore growth in one (1) minute. Samples were taken at one and five minutes. Growth was observed after five (5) minutes with the 30% concentration as previously observed. The 40% concentration inhibited growth after five (5) minutes and both the 50% and 60% concentrations inhibited growth after one (1) min as seen in Table 2. At this point, a 50% dilution was selected as the optimum concentration of composition (FB) that will inhibit spores within a minute, and this concentration was used in further studies on building materials.

Table 2: Effect of different concentrations of composition (FB) on the reduction of black mold (*Stachybotrys chartarum*) spore numbers with time (log CFU/10 ml).

Treatment	Spore counts	Spore counts	Spore counts
	0 min	1 min	5 min
Control	5.8	5.8	5.8
30% FB	5.8	4.75	3.7
40% FB	5.8	3.3	0
50% FB	5.8	0	0
60% FB	5.8	0	0

[0092] *Determination of Treatment Efficacy: Building Materials.* The composition has also been demonstrated to be effective in decontaminating a variety of substrate surfaces. Three different materials were obtained from Home Depot® Home Improvement Center (Homer TLC, Inc. Claymont, Delaware): 1) carpet (Journey's End

Loop Harbor Lig); 2) ceiling tile; 3) general purpose printing paper (white); and 4) wood. The samples were cut into two-inch squares, soaked overnight in ten milliliters (10 ml) deionized water, and sterilized by autoclaving for one hour at 121°C. The sterilized materials were allowed to cool off and were divided into two sets. The first set of sterilized materials was inoculated with 100 µL of spore suspension (10^7 spores/10ml solution) and allowed to air dry under the hood for thirty minutes, then sprayed with about 1 ml of water (control), composition (50% FB) and household Clorox® bleach (Clorox Company, Oakland, CA), respectively, and incubated at room temperature in the dark for thirty (30) days. After 30 days, growth was observed in all control treatments (materials treated with water). Growth was not observed on the materials treated with either composition (50% FB) or household Clorox® bleach (Figure 5, Figure 6, Figure 7 and Figures 11A-F). The second set of sterilized materials was inoculated with 100 µL of the same concentration of spore suspension (10^7 spores/10ml solution) and incubated at room temperature in the dark for thirty days. Growth was observed in all samples, with growth on the samples were in the following order: ceiling tile > carpet > paper (Figure 8, Figure 9 and Figure 10). These samples were then immersed in thirty milliliters (30 ml) of water (control), the composition (50% FB) and household Clorox® bleach, respectively, for five minutes (5 min) and they were allowed to air dry under the hood for 1.5 hours. The satratoxin was extracted with ten milliliters (10 ml) of methanol. Extracts, about four milliliters (4 ml), were allowed to air dry overnight under the hood to a final volume of about 1.5 ml. A minimum amount (100 µL) from each sample was re-suspended in 900 µL of deionized water, and 8 µl of each treatment/suspension was used for the Yeast Toxicity Assay.

[0093] *Yeast Toxicity Assay:* Cultures of *Kluyveromyces marxianus* (No. 8554; ATCC, Manassas, VA) were grown at 37°C and stored at 4°C on yeast-peptone-glucose (YPG) agar (1% (wt/vol) yeast extract; 1% (wt/vol) bacteriological peptone; 2% (wt/vol) glucose; and 2% (wt/vol) agar). For the assay, a single colony from an agar plate was added to 5 ml of YPG-50 liquid medium (1% (wt/vol) yeast extract; 1% (wt/vol) bacteriological peptone; and 50 mM glucose) in a culture tube. The tube was incubated in a rotary incubator for about sixteen (16) hours at 37°C to obtain a culture with final density of 1×10^8 cells/ml in YPG-50. YPG-50 was supplemented with a stock solution of polymixin B sulfate (PMBS) (ICN Biomedicals, Aurora, Ohio), to give a final concentration of fifteen milligrams per milliliter (15 mg/ml) for the bioassay procedure. The tests were run in triplicate. For the bioassay procedure, 136

microliters (μl) of PMBS-supplemented YPG-50 medium were added to the wells of a 96-well polystyrene microtiter plate. Eight microliters ($8\ \mu\text{l}$) of the test or control sample were added to each well, followed by sixteen microliters ($16\ \mu\text{l}$) of yeast inoculum, to yield an initial cell density of approximately 1×10^8 cells/ml. Blank wells (negative control) contained $152\ \mu\text{l}$ of medium and $8\ \mu\text{l}$ of water. Control wells (positive control) contained $144\ \mu\text{l}$ of medium and $16\ \mu\text{l}$ of yeast inoculum. The plates were sealed and incubated on a plate shaker at 37°C for eight hours (when cells reach stationary phase). Cell density was measured every two hours by measuring the absorbance in a microtiter plate reader at a wavelength of 570nm . The absorbance was correlated with *K. marxianus* 8-hour growth curve to determine cell density. These cultures are sensitive to trichothecene mycotoxins, and will not grow in the presence of very small quantities ($100\text{--}200\ \text{ng/ml}$). A high optical density (OD) will be as a result of increased turbidity, which will signify growth of the organism, and a low OD will be due to little or no growth of the organism. The OD value of all the treatments (medium + (composition (50% FB) or household Clorox® bleach treatment) + yeast inoculum) was higher than of their positive controls (medium + water treatment + yeast inoculum) at all the sampled time points (0, 2, 4, 6.5 and 8 hours). This showed that composition (50% FB) was able to degrade the toxins in the building materials within five minutes (5 min), and thus methanol extraction of the detoxified materials did not yield any traces of satratoxin, compared to the water treated samples (Tables 3, 4, 5).

Table 3: Optical density (570nm) of carpet samples treated with composition (50% FB) and household Clorox® bleach (CB) after mold growth.

Time (h)	Positive Control	Control	50% FB	CB
0	0.335	0.395	0.952	0.35
2	0.33	0.292	0.912	0.325
4	0.319	0.293	0.808	0.37
6.5	0.318	0.301	0.714	0.436
8	0.318	0.301	0.714	0.436

Table 4: Optical density (570nm) of multi-purpose paper samples treated with composition (50% FB) and household Clorox® bleach (CB) after mold growth.

Time (h)	Positive Control	Control	50% FB	CB
0	0.335	0.399	0.645	0.490
2	0.33	0.381	0.60	0.474
4	0.319	0.44	0.614	0.470
6.5	0.318	0.497	1.008	0.482
8	0.318	0.497	1.008	0.482

Table 5: Optical density (570nm) of ceiling tile samples treated with composition (50% FB) and household Clorox® bleach (CB) after mold growth.

Time (h)	Positive Control	Control	50% FB	CB
0	0.335	0.318	0.811	0.472
2	0.33	0.296	0.895	0.456
4	0.319	0.350	0.798	0.530
6.5	0.318	0.424	0.699	0.596
8	0.318	0.424	0.699	0.596

EXAMPLE 2

[0094] The antimicrobial effect on *Stachybotrys chartarum* spores using compositions with pre-made fatty acid soaps and fatty acid soaps generated *in situ* by neutralizing the free fatty acids with an excessive amount of alkalinating agent was investigated.

Table 6:

Component (l)	Composition (l)	Amount (l)
Alkanol (ml):	Ethanol	62
Free fatty acid (mole):	Lauric acid	0.05
Alkalinating agent (mole):	Potassium hydroxide	0.06
Water (ml):	Deionized	26
pH:		14.42

The mixture was made up to a volume of 100 ml with deionized water.

[0095] The killing of *Stachybotrys chartarum* spores by the composition of Table 6 was complete.

Table 7:

Component (II)	Composition (II)	Amount (II)
Alkanol (ml):	Ethanol	62
Fatty acid soaps (mole):	Potassium laurate	0.05
Alkalinating agent (mole):	Potassium hydroxide	0.01
Water (ml):	Deionized	26
pH:		14.42

The mixture was made up to a volume of 100 ml with deionized water.

[0096] The killing of *Stachybotrys chartarum* spores by the composition of Table 7 was complete.

[0097] Thus, there was no difference in the antimicrobial effect between compositions using pre-made fatty acids soaps and fatty acid soaps generated *in situ* by adding an excessive amount of alkalinating agent to neutralize the free fatty acids. In subsequent experiments, fatty acid soaps were generated *in situ*.

EXAMPLE 3

[0098] Bacterial spores are highly resistant to chemical and physical agents. They are recognized as the most difficult microorganisms to kill. The most important spore forming bacteria are members of the genera *Bacillus* and *Clostridium*. *Bacillus anthracis* and *Clostridium difficile* have nearly a worldwide distribution. Large outbreaks of *Clostridium difficile* have been described in hospitals. The spores of this pathogen are able to survive for long periods in hospital environments, e.g., on floors and around toilets. *Bacillus* spores, which are abundant in the soil, cause infection in farm and wild animals, and human who are in contact with infected animals or ingested contaminated meat. *Bacillus anthracis* spores have been recognized as a very dangerous biological warfare agent. It is extremely important to find an efficient control measure to neutralize these infectious agents. The sterilizing effect of the compositions of this invention was examined on *Bacillus atropheus* spores adhering to the surface of stainless steel discs. *Bacillus atropheus*, a well known surrogate for *Bacillus anthracis*, was used in all the experiments. Triplicate samples (three separate disks) are performed for all treatments and time points.

[0099] *Procedure for Quantitative Viable Spore Population Assay on Stainless Steel Discs.*

[00100] *Materials:* Stainless steel discs inoculated with 2×10^6 spores of *Bacillus atrophaeus* per disk (SGM Biotech Inc); Sterile 6 mm glass beads; 0.1% Tween 80 in water; and Tryptic soy agar plates.

[00101] *Experimental procedure:* Place a single inoculated disc in a sterile flat-bottomed scintillation vial. Add 10 ml of treatment (water, composition of the present invention, etc.) and incubate at room temperature for specified time (15 sec, 5 min, 30 min, etc.). After treatment, remove disc with flamed forceps and blot by touching one edge of the disk on sterile filter paper to remove excess treatment. Place treated disc in a flat-bottom test tube (21.5 X 95 mm) filled with four 6 mm glass beads and 5.0 ml of 0.1% Tween 80. Sonicate each tube for 5 minutes and then vortex each tube for 5 minutes (at speed 5 on a Vortex Genie 2). Add 5.0 ml sterile purified water and vortex again for five minutes. Heat shock at 82°C for ten minutes. Vortex the heat-shocked tubes for ten seconds. Perform serial ten-fold dilutions by transferring 0.1 ml to dilution tubes containing 0.9 ml sterile water. Vortex each tube for ten seconds. Plate 1.0 ml of the initial heat-shocked tube, as well as 0.1 ml of the initial heat-shocked tube and of each dilution, in triplicate on tryptic soy agar plates. Incubate plates at 32°C. Count colonies recovered after 24, 48, and 72 hours of incubation. Finally, calculate percent survival and percent killing in comparison to control disks incubated in water only.

[00102] *Procedure for Qualitative Spore Survival Assay.*

[00103] *Materials:* Stainless steel discs inoculated with 2×10^6 spores of *Bacillus atrophaeus* per disk (SGM Biotech Inc.); and Tryptic soy broth.

[00104] *Experimental procedure:* Place a single inoculated disc in a sterile flat-bottomed scintillation vial. Add 10 ml of treatment (water, composition of the present invention, etc) and incubate at room temperature for specified time (15 sec, 5 min, 30 min, etc.). After treatment, remove disc with flamed forceps and blot by touching one edge of the disk on sterile filter paper to remove excess treatment. Place treated disc in 50 ml sterile screw capped test tube containing ten milliliters (10 ml) of tryptic soy broth. Incubate the tubes at 32°C. Each day for fourteen days or until all tubes have reached maximum turbidity, then observe tubes for growth by comparing turbidity to MacFarland turbidity standards. Score from 0-7 with 0 = no visible growth and 7 = dense growth. Once a tube reaches a score of 7, it is recorded as a 7 for the remainder of the experiment.

[00105] *Qualitative analysis of spore killing by the inventive composition:* Twelve compositions were formulated according to the disclosure, as shown in Table 8, and compositions 1-11 were tested qualitatively for their ability to kill spores of *Bacillus atropheus*, as shown in Table 9. Three stainless steel disks inoculated with 2×10^6 *B. atropheus* spores were individually exposed to each formulation for thirty (30) minutes at room temperature. Exposed disks were removed from treatment, blotted to remove excess treatment, placed in 10 ml of tryptic soy broth growth medium, and incubated at 32°C. Cultures were observed for growth daily for fourteen days. Results of these experiments, shown in Table 9, were recorded as the sum of the scores for three separate cultures for each treatment; maximum score = 21. A score of 6 or higher indicates significant growth.

Table 8: Combination of compositions of different constituents

Composition	Lauric acid (g)	KOH (g)	EDTA (g)	Propylene glycol (ml)	Ethanol (ml)	pH
1	10	3.5	0	0	62	14.42
2	10	4.24	1	0	62	14.4
3	10	4.25	2	0	62	10.2
4	10	5.01	2	0	62	14.21
5	10	6.5	4	0	62	11.04
6	10	5.5	0	0	62	14.94
7	10	8.6	0	0	62	15.27
8	17.5	7.6	0	0	56.3	14.87
9	0	0	0	0	62	7
10	0	0.56	0	0	62	14.02
11	10	0	0	0	62	4.61
12	10	5.5	0	12	51	14.71

The mixture was made up to a volume of 100 ml with deionized water.

Table 9: Results of the sporicidal activity of different compositions

Compositions	Maximum score	Days required to reach max. score	Days required to reach significant score
1	21	4	2
2	21	3	2
3	21	2	1
4	21	4	3
5	21	13	1
6	3	3	NA
7	3	4	NA
8	3	3	NA
9	21	2	1
10	21	3	3
11	21	3	2
Water	21	1	1

[00106] These results suggest that compositions 6, 7, and 8 are the most effective. The chelating agent EDTA has a very detrimental effect on the sporicidal effect of the compositions. The results for these tests clearly show a synergism between potassium laurate, ethanol, and KOH, which account for the dramatic sporicidal effect of the compositions. It is seen from these results that the use of the three ingredients in combination (*i.e.* ethanol, fatty acid soaps, and alkalinating agent) produced a much stronger synergistic sterilizing effect than could be expected from the individual or conjoint use of ethanol and alkalinating agents or the conjoint use of ethanol and free lauric acid, and could markedly reduce the required concentrations of the individual ingredients. The antimicrobial compounds of the composition work synergistically to decrease both the concentration of individual compounds required for inactivating pathogens and, as importantly, greatly reduce the time needed for pathogen inactivation. The more rapidly pathogens are inactivated the less likely they are to establish an infection. Surprisingly, we found that the total antimicrobial effect provided by the composition appears to be far more than can be elucidated by examining the antimicrobial effect of each compound individually.

[00107] *Quantitative analysis of spore killing by the inventive compositions 1, 6, 8, 11, and 12:* Five compositions were tested for their ability to kill spores of *Bacillus atropheus*, using a quantitative assay to measure the number of spores surviving

treatment. Three stainless steel disks inoculated with 2×10^6 *B. atropheus* spores were individually exposed to each composition for either 15 seconds or 30 minutes at room temperature. Exposed disks were removed from treatment and processed to remove spores from the disks. Spore suspensions removed from the disks were diluted and dilutions plated in triplicate on tryptic soy agar plates. Plates were incubated for 72 hours at 32° and colonies counted at 24, 48, and 72 hours. Results for these experiments, presented as the average of three replicate samples are shown in Table 10.

Table 10: Percent reduction of *Bacillus atropheus* spores using selected compositions

Composition	Viable spores after 30 min	% Killing after 30 min
1	6.9×10^2	99.96%
6	No growth	>99.99995%
8	No growth	>99.99995%
11	5.2×10^5	74%
12	3	99.9999%
Water control	2×10^6	0%

[00108] These results demonstrate that compositions 6, 8, and 12 yield complete or almost complete killing of 2×10^6 spores in 30 minutes at room temperature. Compositions 6 and 12 then were tested at different time points at room temperature using the same stainless steel discs and quantitative procedure described above. The results are illustrated in Figures 12 and 13, respectively.

EXAMPLE 4

[00109] Insect vector (e.g., mosquitoes, etc.) control is an integral part of controlling the transmission of infectious diseases (West Nile, malaria, encephalitis, etc.). The compositions of the present invention are effective in killing the pathogens that cause these infectious diseases as well as the vectors that transmit these pathogens and, therefore lead to a reduced infectious disease risk. Insecticide toxicity has increased interest in alternative and integrated implementation of vector control methods that include biological control. The composition of the present invention is not toxic and safe for humans and the environment and need no rinsing for surfaces with direct contact with food, because it is made with GRAS ingredients.

Table 11:

Component	Composition	Amount
Alkanol (ml):	Ethanol	62
Fatty acid (g):	Lauric acid	10
Alkalinating agent (g):	Potassium hydroxide	5.5
	Potassium bicarbonate	1
pH:		14.94

The mixture is made up to a volume of 100 ml with deionized water.

[00110] Insecticidal activity is determined using third instar larvae of the mosquito *Culex pipiens quinquefasciatus*. Ten larvae are placed in a six ounce paper cup containing 100 ml of the composition of the present invention. The treated larvae are stored at 70°F and 48 hours later the mortalities are recorded.

EXAMPLE 5

[00111] Chemical warfare agents which are likely to pose threat from terrorists include sarin (O-isopropyl methylphosphonofluoridate), soman (O-pinacolyl methylphosphonofluoridate), tabun (O-ethyl N,N-dimethyl phosphoramidocyanidate) and VX (O-ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate). The chemical structures of these agents illustrate the similarity in the fact that they are phosphorus containing compounds and can be chemically altered by nucleophilic attack, using the composition of the present invention (e.g., as illustrated in Table 12), and thereby neutralized as chemical warfare agents.

Table 12:

Component	Composition	Amount
Alkanol (ml):	Ethanol	62
Fatty acid (g):	Lauric acid	10
Alkalinating agent (g):	Potassium hydroxide	5.5
	Aluminum hydroxide	1
pH:		14.94

The mixture is made up to a volume of 100 ml with deionized water.

[00112] The alkalinating agents are added to the composition in an amount up to 1-3 times more than is sufficient to neutralize the free fatty acids present. The excessive amount is added beyond the neutralization of lauric acid to provide enough

nucleophiles to hydrolyze chemical warfare agents and denature infectious prions. The nucleophiles in this inventive composition comprise hydroxides and alkoxides. KOH reacts with ethanol to produce ethoxide. Ethoxide is more alkaline than hydroxides and stronger.

[00113] *The following test procedure is used to measure the reaction rate:* All tests are conducted with CASARM-grade agents (Chemical Agent Standard Analytical Reference Material). All tests are conducted at room temperature in a jacketed reaction vessel equipped with a mixer. The composition of the present invention (100 ml) is placed in the reaction vessel and stirred. At the beginning of the test, two milliliters (2 ml) of the chemical warfare agent is placed in the reaction vessel. Samples are removed from the mixing vessel at different time points. The samples are quenched with solvent and are analyzed by gas chromatography mass spectrometry (GC MS) for unreacted agent. All test samples are analyzed in triplicate.

[00114] Compositions 6 and 12 from Example 3 were tested against chemical warfare surrogate pesticides (malathion, 2-chloroethyl phenyl sulfide and diphenyl phosphoryl chloride) in the two procedures described below.

[00115] *Test Tube Procedure:* The tests were conducted at room temperature in a beaker and stirred with a magnetic stirring bar. One hundred millileters of Composition 6 described in Table 8 (Example 3) were placed in the beaker and stirred. Initially, 50 ug of malathion, 556 ug of 2-chloroethyl phenyl sulfide, or 260 ug diphenyl phosphoryl chloride were each added to individual beakers of 100 ml of composition 6. Each beaker contained only one of the three surrogates. Samples were removed from the mixing vessel at 15 sec, 30 sec, 45 sec, 1 min, 5 min, 10 min, 15 min and 30 min for all three analytes. The samples are quenched with dichloromethane and analyzed by gas chromatography/mass spectrometry (GC/MS) for any unreacted surrogate. All test samples were analyzed in triplicate and the results are reported in Table 13A. The ions for MS detection of malathion were 125 and 172, 2-chloroethyl phenyl sulfide were 123 and 172, and diphenyl phosphoryl chloride were 268 and 232.

Table 13A: Percent weight residue of chemical warfare surrogate pesticides remaining after treatment with composition 6 in test tube procedure.

Chemical warfare surrogate pesticide	Rep	Contact Time							
		15 (sec)	30 (sec)	45 (sec)	1 (min)	5 (min)	10 (min)	15 (min)	30 (min)
Diphenyl chlorophosphate	1	ND	ND	ND	ND	ND	ND	ND	ND
	2	ND	ND	ND	ND	ND	ND	ND	ND
	3	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl phenyl sulfide	1	100%	96%	95%	96%	97%	99%	92%	90%
	2	99%	100%	98%	97%	96%	97%	98%	98%
	3	100%	97%	97%	97%	96%	97%	96%	96%
Malathion	1	ND	ND	ND	ND	ND	ND	ND	ND
	2	ND	ND	ND	ND	ND	ND	ND	ND
	3	ND	ND	ND	ND	ND	ND	ND	ND

"ND": Not Detected at a level of <1 ppb

[00116] *Surface Test Procedure:* Test coupons made from 25-cm² printer paper were inoculated with 25 mg of malathion, 25 mg of 2-chloroethyl phenyl sulfide, or 25 mg diphenyl phosphoryl chloride and allowed to dry for 15 minutes. Each coupon was inoculated with only one of the three surrogates. After that time, each test coupon was placed into a test tube with 8 ml of Composition 12 described in Table 8 (Example 3). For malathion and diphenyl phosphoryl chloride, sample times were 15 sec, 30 sec, 45 sec and 1 min. Sample times for 2-chloroethyl phenyl sulfide were 1 min, 5 min, 10 min, 15 min and 30 min. The samples are quenched with 4 ml dichloromethane and analyzed by gas chromatography/mass spectrometry (GC/MS) for unreacted surrogate. All test samples were analyzed in triplicate and the results are reported in Table 13B. Diphenyl chlorophosphate and malathion were undetectable at all contact times tests; notwithstanding the relatively high data variability for 2-chloroethyl phenyl sulfide, the data indicate that a substantial portion of 2-chloroethyl phenyl sulfide (e.g., at least about 95 wt.% or at least about 98 wt.%) could be treated at longer contact times with composition 12. The ions for MS detection of malathion were 125 and 172, 2-chloroethyl phenyl sulfide were 123 and 172, and diphenyl phosphoryl chloride were 268 and 232.

Table 13B: Percent weight residue of chemical warfare surrogate pesticides remaining after treatment with composition 12 in surface test procedure.

Chemical warfare surrogate pesticide	Rep	Contact Time							
		15 (sec)	30 (sec)	45 (sec)	1 (min)	5 (min)	10 (min)	15 (min)	30 (min)
Diphenyl chlorophosphate	1	ND	ND	ND	ND	—	—	—	—
	2	ND	ND	ND	ND	—	—	—	—
	3	ND	ND	ND	ND	—	—	—	—
2-Chloroethyl phenyl sulfide	1	—	—	—	30%	0%	0.7%	0.44%	0%
	2	—	—	—	30%	1.5%	1.2%	0%	18.2%
	3	—	—	—	0.03%	0.2%	1.2%	0%	3.4%
Malathion	1	ND	ND	ND	ND	—	—	—	—
	2	ND	ND	ND	ND	—	—	—	—
	3	ND	ND	ND	ND	—	—	—	—

“ND”: Not Detected at a level of <1 ppb; “—”: Not Tested

EXAMPLE 6

[00117] Glass slides artificially contaminated with tissue sections are obtained at autopsy from a human subject with sporadic Creutzfeldt-Jacob disease (with the absence of germline prion protein gene (PRNP) mutation, homozygous methionine at PRNP codon 129), are exposed to 1 min and 10 minute treatments with the following compositions shown in Table 14 at room temperature.

Table 14: Combination of compositions of different constituents.

Compositions	Lauric acid (g)	KOH (g)	Ethanol (ml)	pH
1	10	3.5	62	14.42
6	10	5.5	62	14.94
8	17.5	7.6	56.3	14.87

The mixture is made up to a volume of 100 ml with deionized water.

[00118] Following exposure, tissue is homogenized in lysis buffer as described by Castelleni *et al.*, (1996). Control CJD tissue and tissue exposed the compositions reported in Table 13 subsequently are treated with 2X sample buffer and boiled for ten minutes. A control CJD sample is also subjected to limited proteolysis (100 micrograms/ml proteinase K) for one hour at 37°C, protease inhibitor (Pefabloc, Roche Applied Science, Indianapolis, IN) stops the reaction and equal volume of 2X sample buffer is added followed by boiling for ten minutes. All samples are then loaded on 12% polyacrylamide minigel and are electrophoresed at 150V, before transferring to an Immobilon® transfer membrane (Millipore Corporation, Billerica, Massachusetts) for two hours at 4°C. The samples on the membrane are reacted with monoclonal antibody 3F4, which recognizes the residues 109–112 of human prion protein. Immunoreactivity is visualized by chemiluminescence and detected by standard autoradiography.

EXAMPLES 7-16

[00119] Examples 7-16 illustrate various suitable compositions according to the disclosure, including formulations generally having a pH of about 10 and ethanol content of about 5% to about 30%. Examples 7-16 were formulated according to the following tables. In addition to the components listed, the formulations were supplemented, if necessary, with a small amount of 50% KOH solution to bring the final pH of the formulation to 10. Examples 7 and 9 were further tested for antimicrobial activity as described below. Examples 11 and 12 illustrate suitable antibacterial soap compositions, Example 15 illustrates a suitable oral hygiene composition, and Example 16 illustrates a suitable antibacterial toilet bowl cleaning composition.

Example 7		
Component	Composition	Amount
Alkanol (g):	Ethanol	29.5
Fatty acid (g):	Lauric acid	6.43
Alkalinating agent (g):	Potassium hydroxide	2.46
Water (g)	Deionized	61.61
pH:		10

[00120] The fungicidal property of Example 7 was tested on the fungus *Trichophyton mentagrophytes* by the Methods of the AOAC Fungicidal Test 955.17 at $20\pm 1^\circ\text{C}$ using different exposure times. The data were collected according to EPA Good Laboratory Practice Standards, 40 CFR, Part 160 and U.S. Environmental Protection Agency, Pesticide Assessment Guidelines, Subdivision G, Section 91-2 (3) (1) (2) and the results are reported in Table 15. Lot numbers in Table 15 refer to multiple preparations of the Example 7 composition used to evaluate reproducibility as specified by the AOAC test.

Table 15:

Lot No.	Exposure Time	Growth (+) or No Growth (-)
Lot #1	1.0 min	(+)
	5.0 min	(-)
	10.0 min	(-)
Lot #2	1.0 min	(-)
	5.0 min	(-)
	10.0 min	(-)

[00121] The antibacterial activity of Example was tested on *Salmonella choleraesuis* ATCC 10708, *Staphylococcus aureus* ATCC 6538 and *Pseudomonas aeruginosa* ATCC 15442, by the Methods of the AOAC Use Dilution Test with 5.0 Minutes Exposure at $20\pm 1^\circ\text{C}$. The data were collected according to EPA Good Laboratory Practice Standards, 40 CFR, Part 160 and U.S. Environmental Protection Agency, Pesticide Assessment Guidelines, Subdivision G, Section 91-2 (d) (1) (2). The number of stainless steel cylinders positive for the growth of the test bacteria after 5.0 minutes exposure time to the composition at $20\pm 1^\circ\text{C}$ is reported in Table 16. Lot identifiers in Table 16 refer to multiple preparations of the Example 7 composition used to evaluate reproducibility as specified by the AOAC test. There was an average of 1.76×10^6 CFU of *S. aureus*, 2.47×10^6 CFU of *S. choleraesuis* and 1.51×10^7 CFU of *P. aeruginosa* per stainless steel cylinder.

Table 16:

Test Bacteria	Lot A	Lot B	Lot C
<i>S. aureus</i>	1/60	1/60	0/60
<i>S. choleraesuis</i>	0/60	0/60	0/60
<i>P. aeruginosa</i>	0/60	0/60	0/60

Example 8

Component	Composition	Amount
Alkanol (g):	Ethanol	29.5
Fatty acid (g):	Lauric acid	6.43
Alkalinating agent (g):	Potassium hydroxide	2.46
Water (g)	Deionized	61.31
Essential Oils (g)	Thyme oil	0.3
pH:		10

Example 9

Component	Composition	Amount
Alkanol (g):	Ethanol	14.75
Fatty acid (g):	Lauric acid	3.21
Alkalinating agent (g):	Potassium hydroxide	1.23
Water (g)	Deionized	80.81
pH:		10

[00122] The evaluation of efficacy of Example 9 against *Escherichia coli*, *Staphylococcus aureus*, *Enterococcus faecium*, *Serratia marcescens*, *Proteus mirabilis*, *Klebsiella pneumoniae*, and *Staphylococcus epidermis* was performed in accordance with the protocol outlined in the ASTM E 2315 "Standard Guide for Assessment of Antimicrobial Activity Using a Time-Kill Procedure." Samples were tested in duplicate using a 15 second contact time. The composition achieved complete kill of all microorganisms in 15 seconds.

Example 10

Component	Composition	Amount
Alkanol (g):	Ethanol	14.75
Fatty acid (g):	Lauric acid	3.21
Alkalinating agent (g):	Potassium hydroxide	1.23
Water (g)	Deionized	80.51
Essential oils (g)	Thyme oil	0.3
pH:		10

Example 11

Component	Composition	Amount
Alkanol (g):	Ethanol	14.75
Fatty acid (g):	Lauric acid	3.21
Alkalinating agent (g):	Potassium hydroxide	1.23
Polyol (g):	Glycerol	15
Saponified oil (g)	Coconut and olive oils	23
Water (g)	Deionized	42.81
pH:		10

Example 12

Component	Composition	Amount
Alkanol (g):	Ethanol	14.75
Fatty acid (g):	Lauric acid	3.21
Alkalinating agent (g):	Potassium hydroxide	1.23
Polyol (g):	Glycerol	15
Saponified oil (g)	Coconut and olive oils	23
Essential oils (g)	Thyme oil	0.3
Water (g)	Deionized	42.51
pH:		10

Example 13

Component	Composition	Amount
Alkanol (g):	Ethanol	14.75
Fatty acid (g):	Lauric acid	0.3
Alkalinating agent (g):	Potassium hydroxide	0.13
	Sodium bicarbonate	3
Polyol (g):	Glycerol	15
Essential oil (g)	Eucalyptus, peppermint and thyme oil	0.7
Water (g)	Deionized	66.12
pH:		10

Example 14

Component	Composition	Amount
Alkanol (g):	Ethanol	7.2
Fatty acid (g):	Lauric acid	1.54
Alkalinating agent (g):	Potassium hydroxide	0.59
	Sodium bicarbonate	55.5
Essential oils (g)	Orange oil	2
	Peppermint oil	1
Polyol (g):	Glycerol	6
Thickening agent (g):	Caragennan and gums	5.5
	Corn starch	6
Water (g)	Deionized	14.78
pH:		10

Example 15

Component	Composition	Amount
Alkanol (g):	Ethanol	5.4
Fatty acid (g):	Lauric acid	1.15
Alkalinating agent (g):	Potassium hydroxide	0.44
	Sodium bicarbonate	41.62
Essential oils (g)	Orange oil	1.5
	Peppermint oil	0.75
Polyol (g):	Glycerol	4.5
Thickening agent (g):	Caragennan and gums	4.12
	Corn starch	4.5
Tooth paste (g)	Bleaching agent-free tooth paste	25
Water (g)	Deionized	11.08
pH:		10

Example 16

Component	Composition	Amount
Alkanol (g):	Ethanol	29.5
Fatty acid (g):	Lauric acid	1
Alkalinating agent (g):	Potassium hydroxide	0.38
Polyol (g):	Glycerol	12.56
Essential oils (g)	Orange oil	1
Saponified fat/oil (g):	Coconut and tallow	46.56
Water (g)	Deionized	9.5
pH:		10

[00123] While the present invention is described herein with reference to

illustrated embodiments, it should be understood that the invention is not limited hereto. Those having ordinary skill in the art and access to the teachings herein will recognize additional modifications and embodiments within the scope thereof. Therefore, the present invention is limited only by the claims attached herein.

[00124] Throughout the description, where the compositions, processes, or apparatus are described as including or comprising components, steps, or materials, it is contemplated that the compositions, processes, or apparatus generally can comprise, consist essentially of, or consist of, any combination of the recited components or materials, unless described otherwise. Combinations of components are contemplated to include homogeneous and/or heterogeneous mixtures, as would be understood by a person of ordinary skill in the art in view of the foregoing disclosure.

WHAT IS CLAIMED IS:

1. A method for sanitizing a material, the method comprising:
 - (a) providing an aqueous composition comprising in admixture: (i) a lower alkanol containing 1 to 6 carbon atoms, (ii) an alkalinating agent, and (iii) a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof; wherein the lower alkanol, the alkalinating agent, and the fatty acid derivative are present in an effective amount to sanitize the material;
 - (b) applying the aqueous composition to the material to sanitize the material;
 - and
 - (c) optionally removing a resulting composition of step (b).
2. The method of claim 1, wherein the lower alkanol is selected from the group consisting of methanol, ethanol, n-propanol, isopropanol, n-butanol, and combinations thereof.
3. The method of claim 1, wherein the lower alkanol comprises ethanol.
4. The method of claim 1, wherein the alkalinating agent is selected from the group consisting of alkali metal hydroxides, alkaline earth metal hydroxides, alkali metal carbonates, alkali metal hydrogen carbonates, and mixtures thereof.
5. The method of claim 1, wherein the alkalinating agent is selected from the group consisting of ammonium hydroxide, aluminum hydroxide, sodium hydroxide, potassium hydroxide, lithium hydroxide, calcium hydroxide, magnesium hydroxide, sodium carbonate, sodium hydrogen carbonate, and mixtures thereof.
6. The method of claim 1, wherein the fatty acid derivative comprises the fatty acid salt, and the fatty acid salt comprises an alkali or alkaline earth metal salt of a fatty acid containing 4 to 22 carbon atoms.
7. The method of claim 6, wherein the alkali or alkali earth metal is selected from the group consisting of sodium (Na), potassium (K), lithium (Li), calcium (Ca), magnesium (Mg), and combinations thereof.
8. The method of claim 6, wherein the fatty acid comprises lauric acid.
9. The method of claim 1, wherein the fatty acid derivative comprises the fatty acid salt, and the fatty acid salt comprises a saponified natural fat or oil selected from the group consisting of coconut oil, corn oil, cottonseed oil, lard, olive oil, palm oil,

palm kernel oil, peanut oil, rapeseed oil, safflower oil, sesame oil, soybean oil, sunflower oil, tallow, and mixtures thereof.

10. The method of claim 1, wherein the fatty acid derivative comprises the fatty acid ester, and the fatty acid ester comprises one or more of a butyl ester, an ethyl ester, a methyl ester, an ester of fatty alcohol having from 8 to 16 carbon atoms, a fatty acyl-Coenzyme A ester, a sucrose ester, and a monoglyceride of a fatty acid containing 4 to 22 carbon atoms.

11. The method of claim 10, wherein the fatty acid ester comprises the monoglyceride.

12. The method of claim 1, wherein:
the aqueous composition has a pH of about 10 or more, and
the lower alkanol is present in an amount from about 1 wt.% to about 40 wt.%.

13. The method of claim 1, wherein:
the aqueous composition has a pH of about 14 or more, and
the lower alkanol is present in an amount from about 40 wt.% to about 95 wt.%.

14. The method of claim 1, wherein the lower alkanol is present in an amount from about 3 wt.% to about 95 wt.% of the aqueous composition, the alkalinating agent is present in an amount from about 0.01 wt.% to about 10 wt.% of the aqueous composition, and the fatty acid derivative is present in an amount from about 0.1 wt.% to about 25 wt.% of the aqueous composition.

15. The method of claim 14, wherein:
the aqueous composition has a pH ranging from about 10 to about 11, and
the lower alkanol comprises ethanol and is present in an amount from about 10 wt.% to about 30 wt.% of the aqueous composition.

16. The method of claim 14, wherein:
the aqueous composition has a pH ranging from about 14 to about 15, and
the lower alkanol comprises ethanol and is present in an amount from about 50 wt.% to about 65 wt.% of the aqueous composition.

17. The method of claim 1, wherein the aqueous composition further comprises a scented oil comprising one or more terpenes.

18. The method of claim 1, wherein the aqueous composition further comprises an essential oil comprising one or more terpenes, terpenoids, derivatives thereof, and combinations thereof.

19. The method of claim 18, wherein the essential oil is selected from the group consisting of thyme oil, eucalyptus oil, cinnamon oil, orange oil, lemon oil, clove oil, lime oil, rosemary oil, citronnella oil, cedar wood oil, camphor oil, calamus oil, geranium oil, lavender, lemongrass oil, peppermint oil, vetiver oil, palmarosa oil, nutmeg oil, and combinations thereof.

20. The method of claim 18, wherein the essential oil is present in an amount from about 0.01 wt.% to about 5 wt.% of the aqueous composition.

21. The method of claim 1, wherein the aqueous composition further comprises a polyol selected from the group consisting of propylene glycol, glycerol, sorbitol, xylitol, maltitol, and combinations thereof.

22. The method of claim 21, wherein the polyol is present in an amount from about 1 wt.% to about 30 wt.% of the aqueous composition.

23. The method of claim 1, wherein:

- (i) the aqueous composition further comprises (A) about 5 wt.% to about 50 wt.% of a toothpaste carrier and (B) about 30 wt.% to about 80 wt.% of a carbonate alkalinating agent, a bicarbonate alkalinating agent, or a combination thereof; and
- (ii) the material in step (b) comprises teeth.

24. The method of claim 1, further comprising:

after step (b), allowing at least a portion of the lower alkanol and water to evaporate, thereby forming a film adhered to the material, the film comprising the fatty acid derivative;

wherein the film physically entraps one or more infectious agents on the material.

25. The method of claim 1, further comprising one or more ingredients selected from the group consisting of thickeners, emollients, moisturizers, corrosion inhibitors, propellants, perfumes, flavoring agents, defoamers, antioxidants and dyes.

26. The method of claim 1, wherein the material comprises an infectious agent selected from the group consisting of *Enterococcus faecium*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Trichophyton*

mentagrophytes, *Salmonella choleraesuis*, *Serratia marcescens*, *Staphylococcus aureus*, *Staphylococcus epidermis*, and combinations thereof.

27. The method of claim 1, wherein the material comprises an infectious agent selected from the group consisting of a fungus, a bacterium, a fungal spore, a bacterial spore, a virus, a conformationally altered prion, a chemical warfare agent, or combinations thereof.

28. The method of claim 27, wherein the infectious agent comprises a *Stachybotrys chartarum* fungal spore.

29. The method of claim 27, wherein the infectious agent comprises a *Bacillus atropheus* bacterial spore.

30. The method of claim 27, wherein the infectious agent comprises a chemical warfare agent selected from the group consisting of VX, mustard, sarin, soman, tabun, and combinations thereof.

31. The method of claim 27, wherein the infectious agent comprises conformationally altered prion selected from the group consisting of CJD, CWD, BSE, and Scrapie.

32. A composition comprising an aqueous composition, the aqueous composition comprising in a mixture:

(a) lower alkanol containing 1 to 6 carbon atoms;

(b) an alkalinating agent, and

(c) a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof;

wherein the lower alkanol, the alkalinating agent, and the fatty acid derivative are present in an effective amount to sanitize a material to which the composition is applied.

33. The composition of claim 32, wherein:

the aqueous composition has a pH of about 10 or more, and

the lower alkanol is present in an amount from about 1 wt.% to about 40 wt.%.

34. The composition of claim 32, wherein:

the aqueous composition has a pH of about 14 or more, and

the lower alkanol is present in an amount from about 40 wt.% to about 95 wt.%.

35. The composition of claim 32, wherein:
- (i) the lower alkanol comprises ethanol;
 - (ii) the alkalinating agent comprises one or more of ammonium hydroxide, aluminum hydroxide, sodium hydroxide, potassium hydroxide, lithium hydroxide, calcium hydroxide, and magnesium hydroxide; and
 - (iii) the fatty acid derivative comprises a lauric acid salt.
36. The composition of claim 35, wherein the ethanol is present in an amount from about 3 wt.% to about 95 wt.% of the aqueous composition, the alkalinating agent is present in an amount from about 0.01 wt.% to about 10 wt.% of the aqueous composition, and the lauric acid salt is present in an amount from about 0.1 wt.% to about 25 wt.% of the aqueous composition.
37. The composition of claim 36, further comprising an essential oil is selected from the group consisting of thyme oil, eucalyptus oil, cinnamon oil, orange oil, lemon oil, clove oil, lime oil, rosemary oil, citronnella oil, cedar wood oil, camphor oil, calamus oil, geranium oil, lavender, lemongrass oil, peppermint oil, vetiver oil, palmarosa oil, nutmeg oil, and combinations thereof.
38. The composition of claim 36, further comprising a saponified natural fat or oil selected from the group consisting of coconut oil, corn oil, cottonseed oil, lard, olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, safflower oil, sesame oil, soybean oil, sunflower oil, tallow, and mixtures thereof.
39. The composition of claim 36, further comprising a polyol selected from the group consisting of propylene glycol, glycerol, sorbitol, xylitol, maltitol, and combinations thereof.
40. A method of modifying a chemical, the method comprising:
- (a) providing an aqueous composition comprising in admixture: (i) a lower alkanol containing 1 to 6 carbon atoms, (ii) an alkalinating agent, and (iii) a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof; wherein the lower alkanol, the alkalinating agent, and the fatty acid derivative are present in an effective amount to modify the chemical;
 - (b) applying the aqueous composition to a material to modify the chemical; and
 - (c) optionally removing a resulting composition of step (b).
41. A method of making an aqueous composition, the method comprising:
- (a) providing a lower alkanol containing 1 to 6 carbon atoms;

(b) providing a fatty acid derivative soluble in the lower alkanol, the fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof;

(c) providing an alkalinating agent; and

(d) mixing the lower alkanol, the fatty acid derivative, the alkalinating agent, and water, thereby forming the aqueous composition.

42. A method of making an aqueous composition, the method comprising:

(a) providing a lower alkanol containing 1 to 6 carbon atoms;

(b) providing a fatty acid soluble in the lower alkanol;

(c) providing an alkalinating agent; and

(d) mixing the lower alkanol, the fatty acid, the alkalinating agent, and water, thereby (i) reacting *in situ* the fatty acid and the alkalinating agent to form a fatty acid derivative comprising a fatty acid salt, a fatty acid ester, or a combination thereof, and (ii) forming the aqueous composition.

**EFFECT OF 100% FB ON THE REDUCTION OF BLACK MOLD
SPORES**

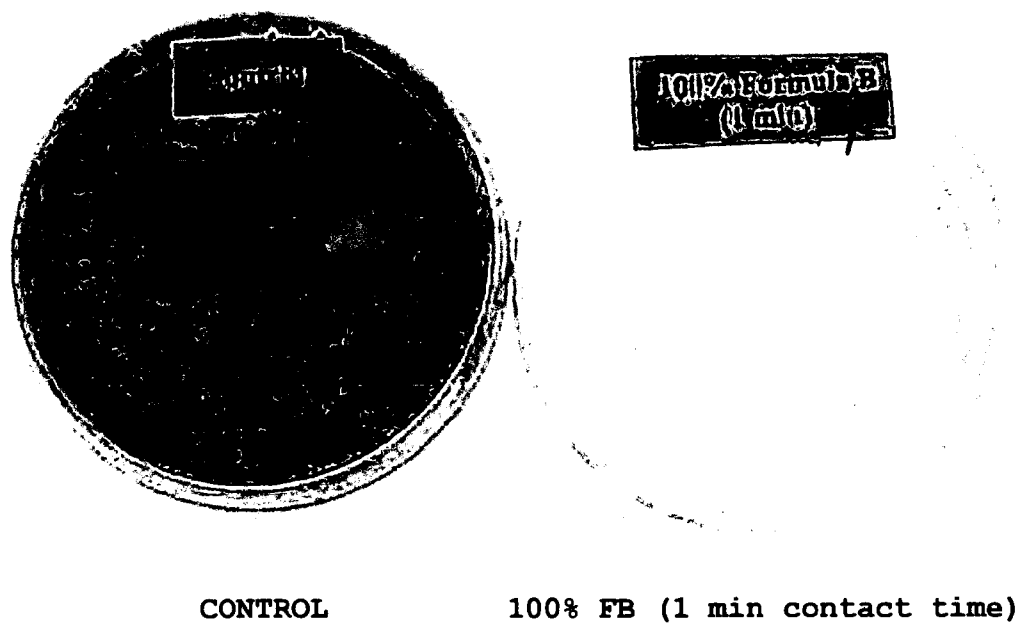


FIG. 1A

EFFECT OF 60% FB ON THE REDUCTION OF BLACK MOLD SPORES

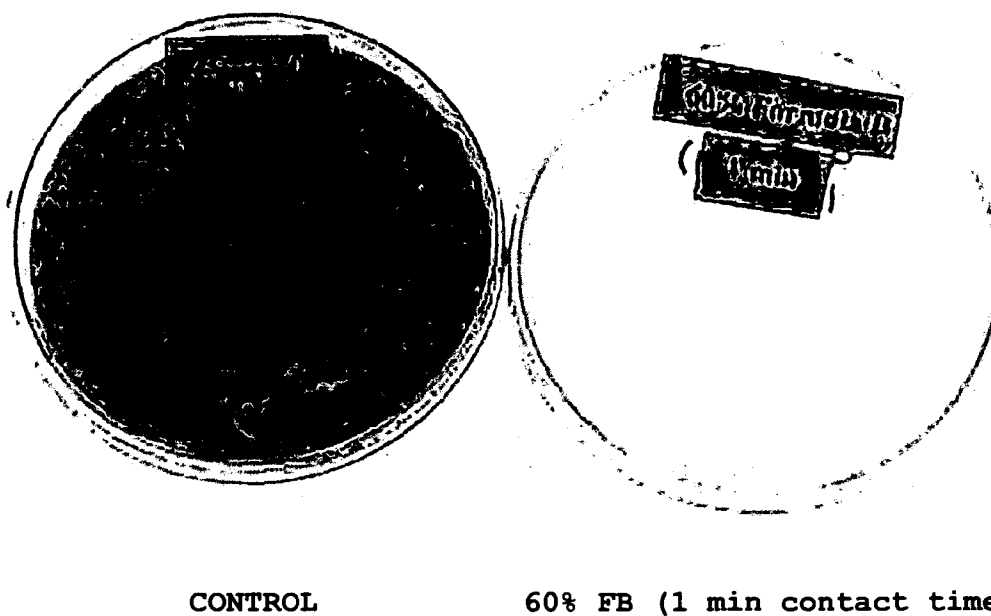


FIG. 1B

**EFFECT OF 50% FB ON THE REDUCTION OF BLACK MOLD
SPORES**

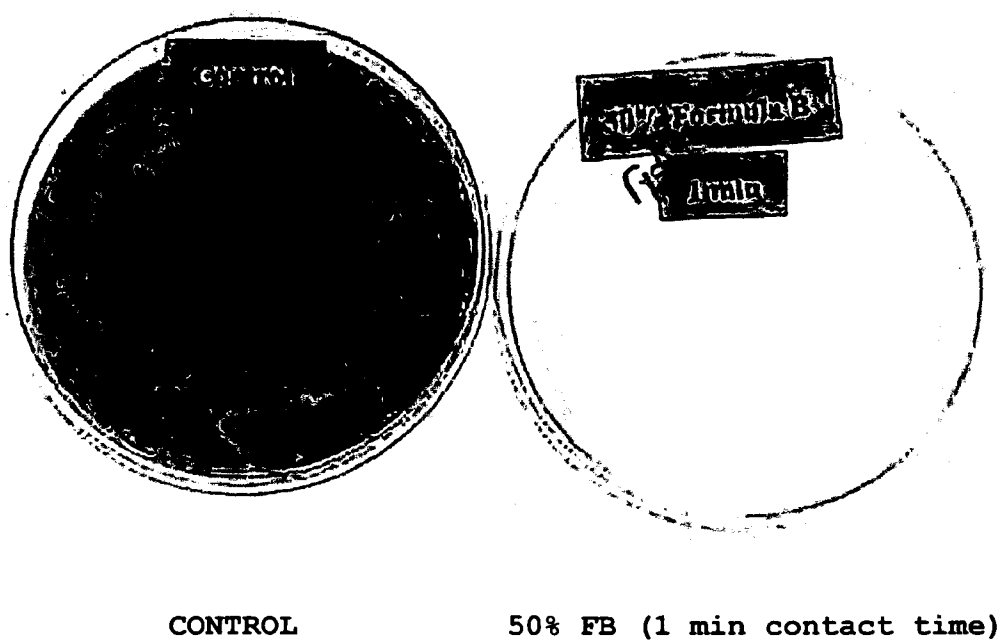
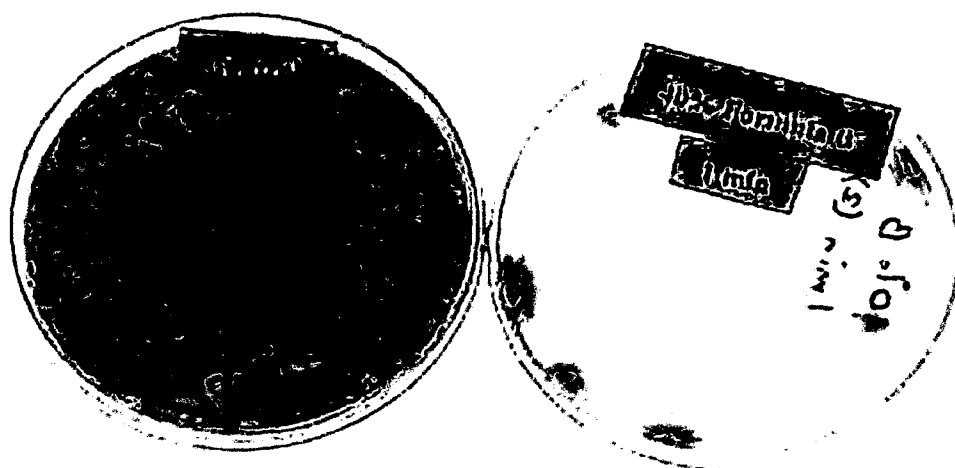


FIG. 1C

EFFECT OF 40% FB ON THE REDUCTION OF BLACK MOLD SPORES

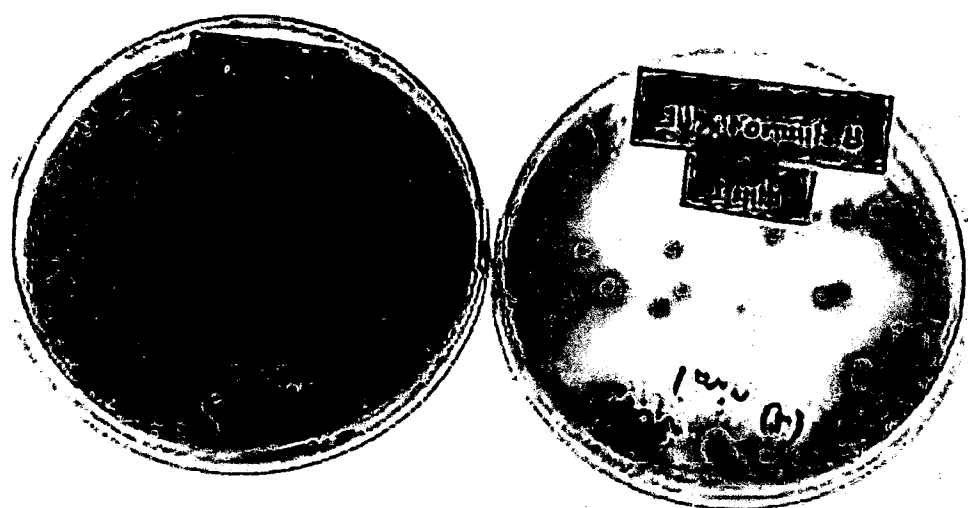


CONTROL

40% FB (1 min contact time)

FIG. 1D

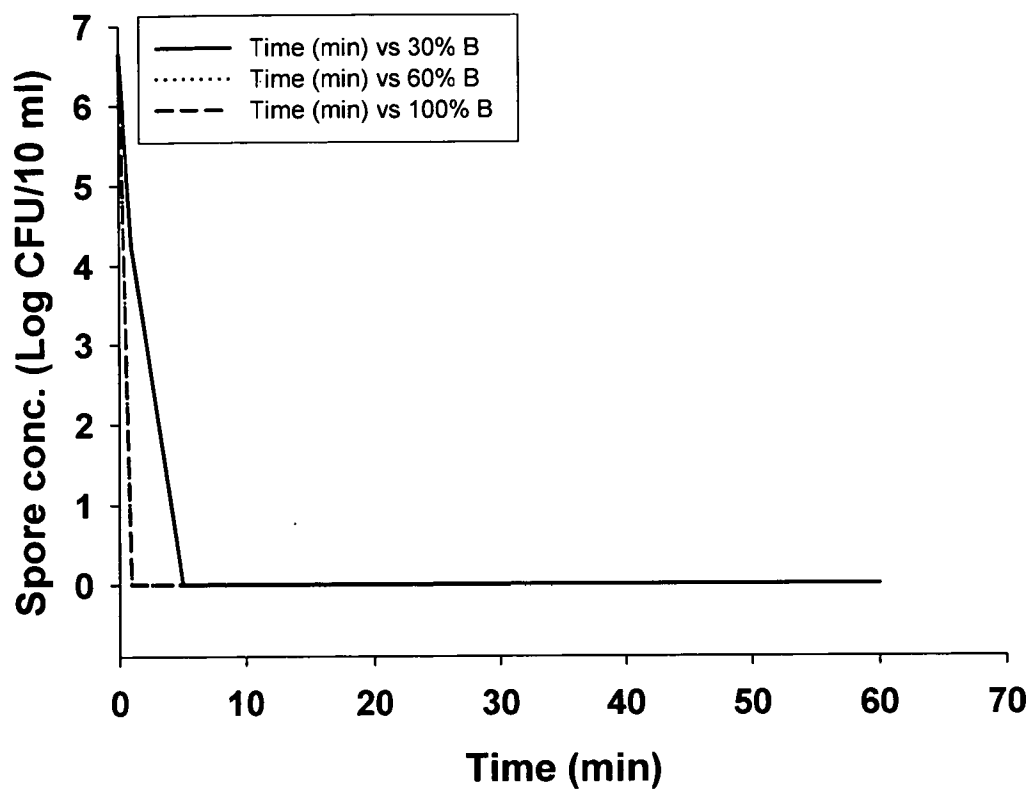
EFFECT OF 30% FB ON THE REDUCTION OF BLACK MOLD SPORES

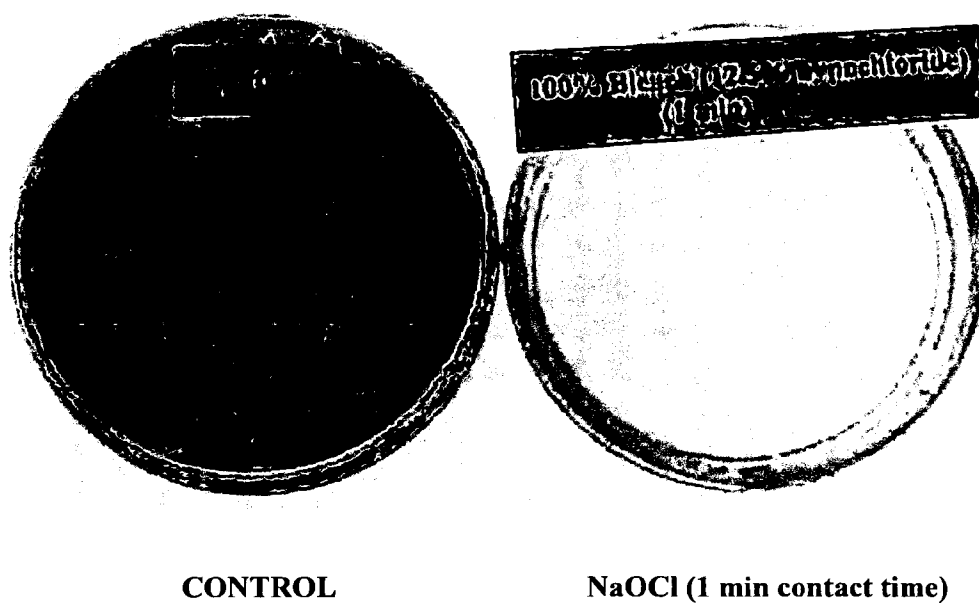


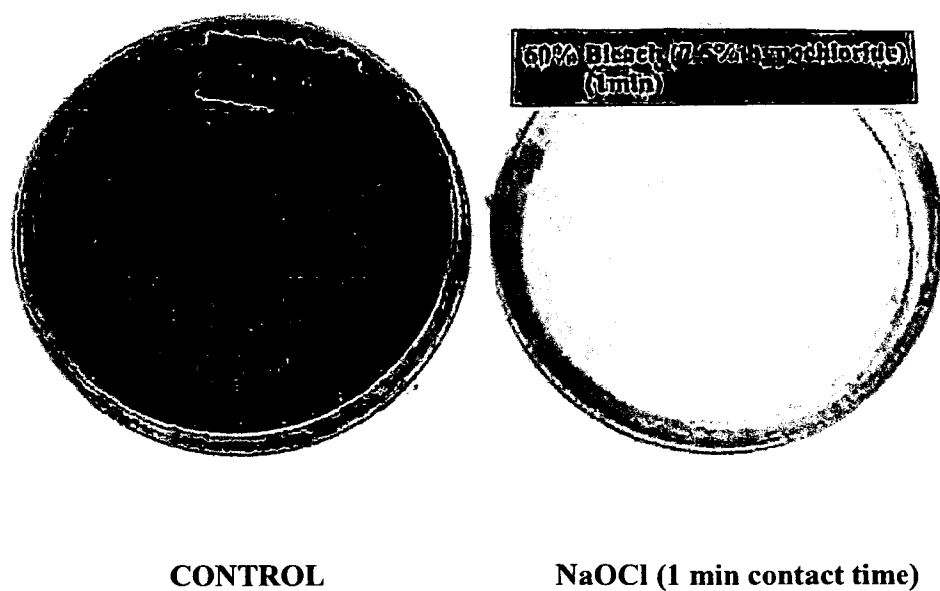
CONTROL

30% FB (1 min contact time)

FIG. 1E

Efficacy of formula B in killing *Stachybotrys* spores**Figure 2**

EFFECT OF 12.5% NaOCl ON THE KILLING OF BLACK MOLD SPORES**FIG. 3A**

EFFECT OF 7.5% NaOCl ON THE KILLING OF BLACK MOLD SPORES**FIG. 3B**

EFFECT OF 3.75% NaOCl ON THE KILLING OF BLACK MOLD SPORES

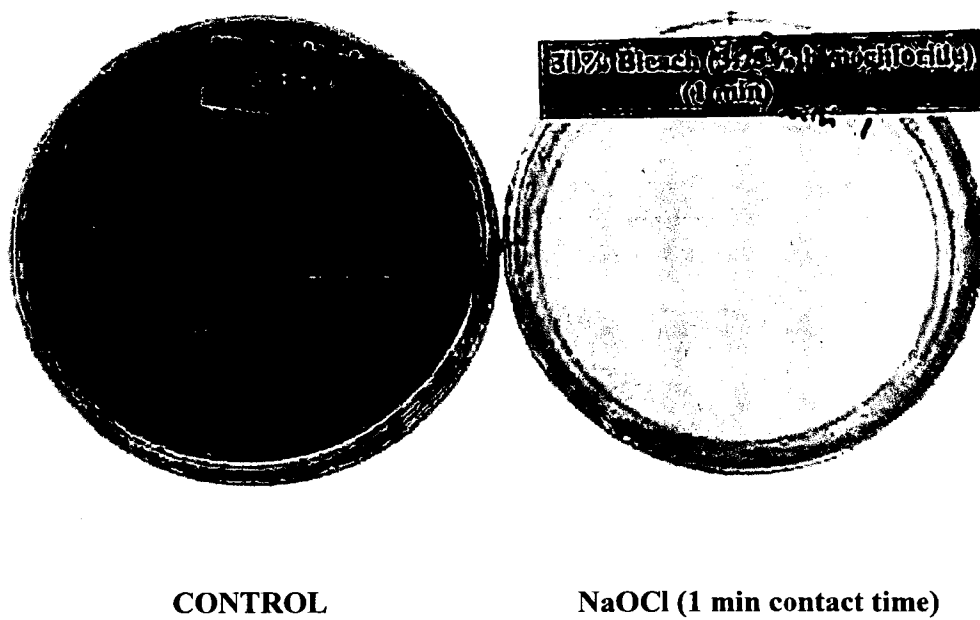


FIG. 3C

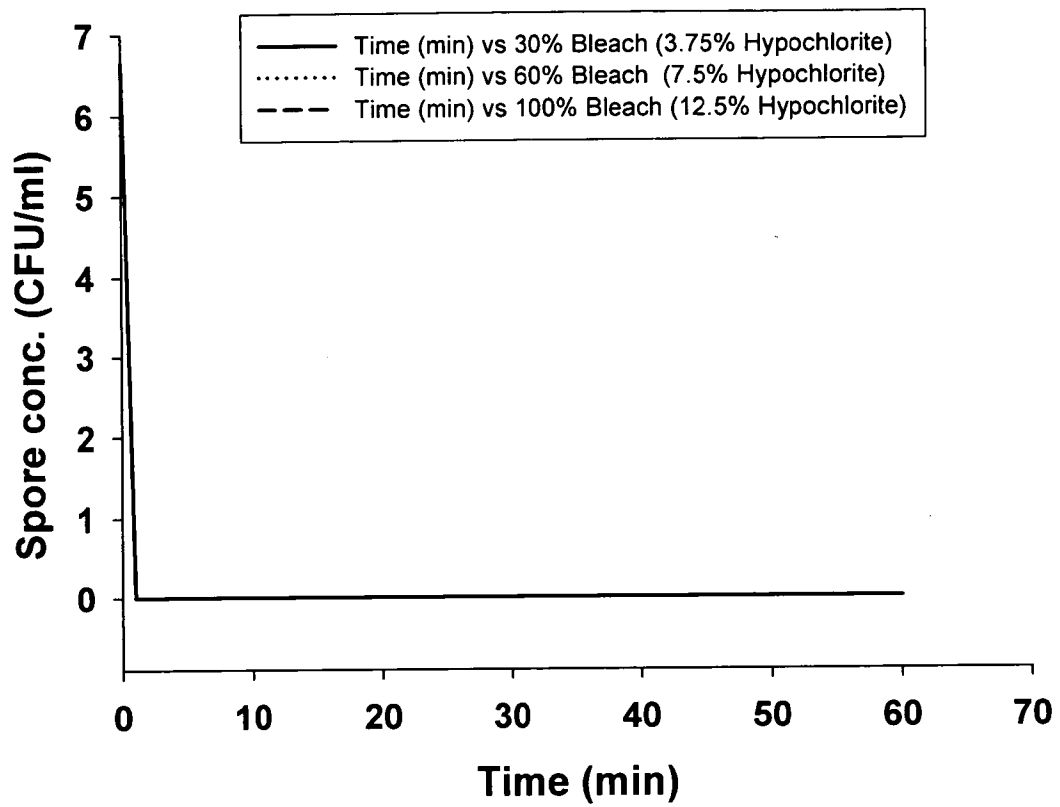


Figure 4



Inoculated with *Stachybotrys*



Inoculated/Treated with
composition (50% FB)

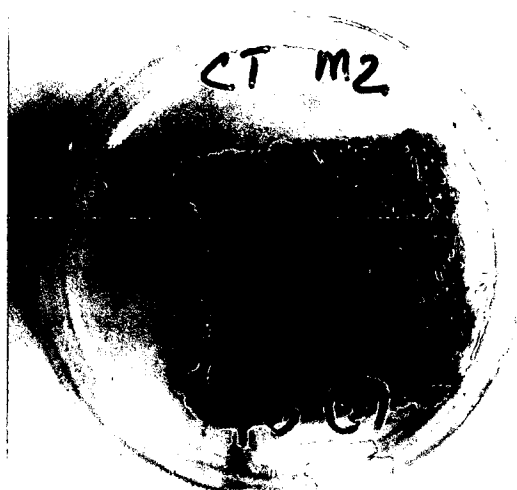
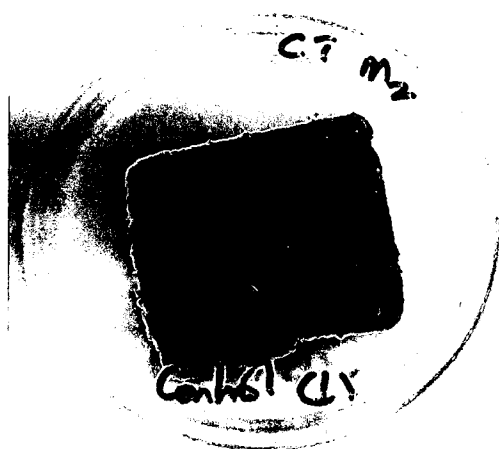
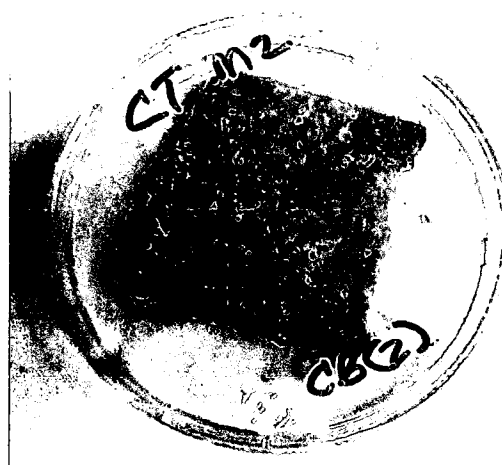


Inoculated with *Stachybotrys*

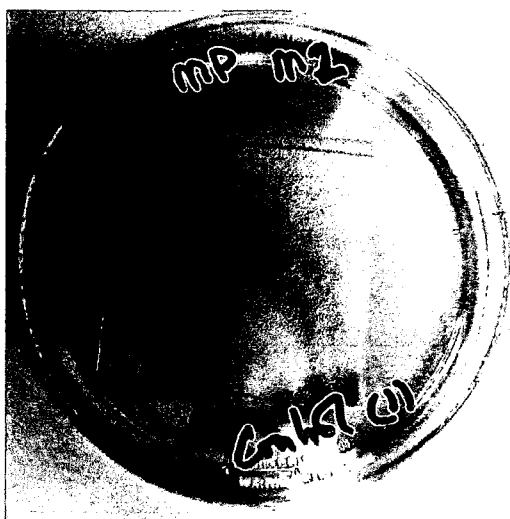


Inoculated/Treated with
Household Clorox bleach

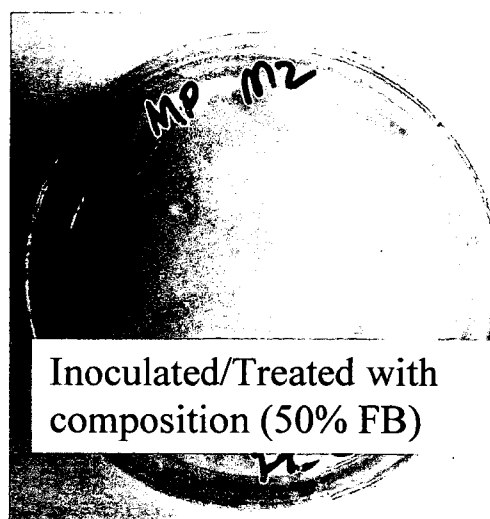
FIG. 5

Inoculated with *Stachybotrys*Inoculated/Treated with
composition (50% FB)Inoculated with *Stachybotrys*Inoculated/Treated with
Household Clorox® bleach**FIG. 6**

13/20



Inoculated with *Stachybotrys*



Inoculated/Treated with
50% Formula B



Inoculated with *Stachybotrys*



Inoculated/Treated with
Household Clorox® bleach

Figure 7

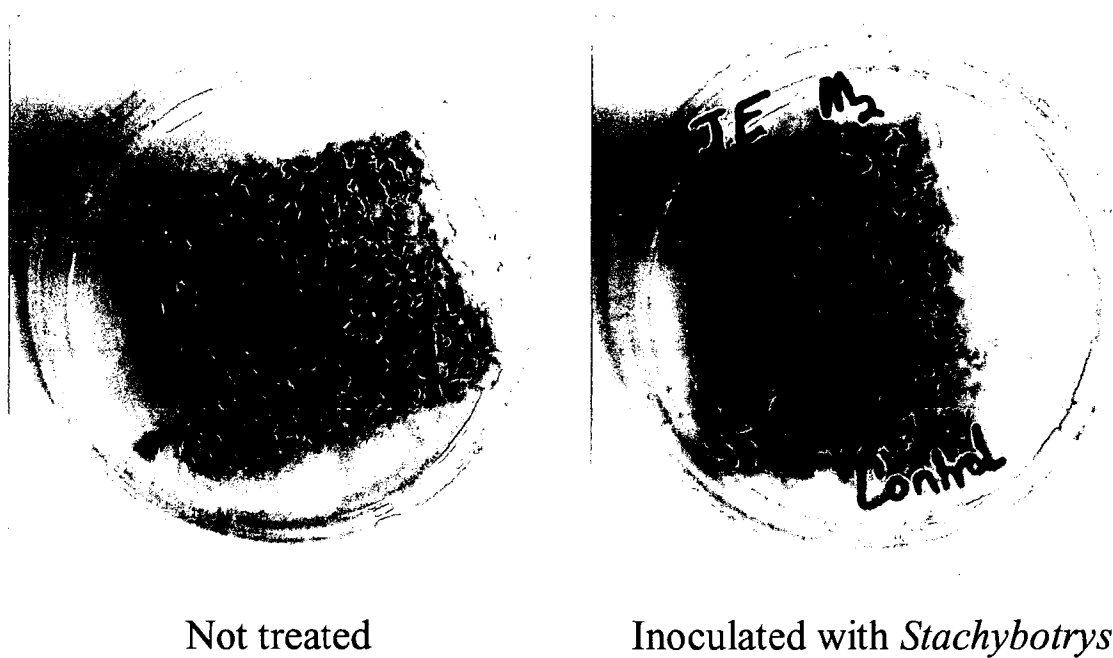


FIG. 8

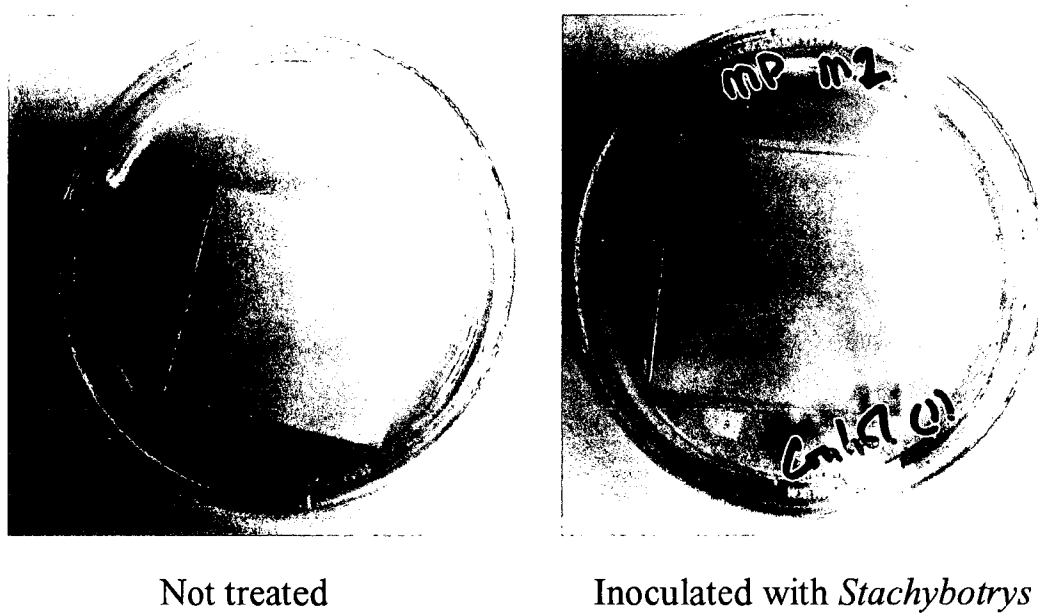


FIG. 9

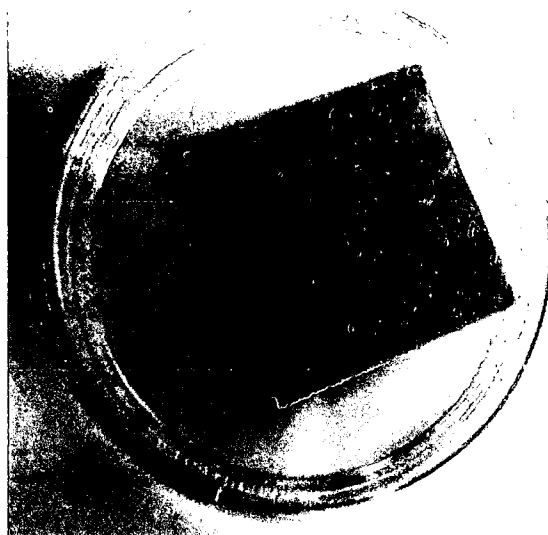


Not treated



Inoculated with *Stachybotrys*

FIG. 10



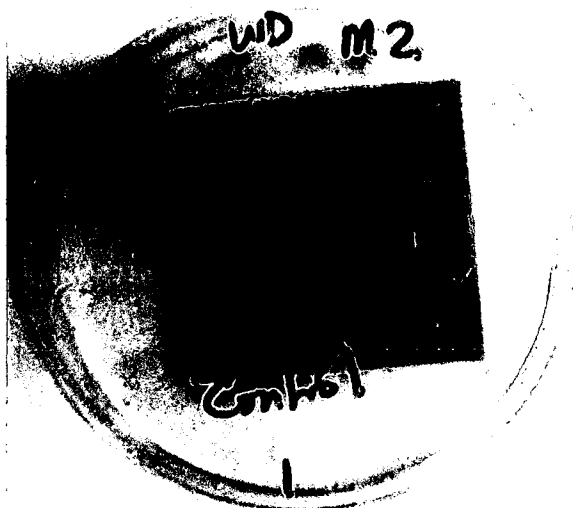
CONTROL (Not treated)

FIG. 11A



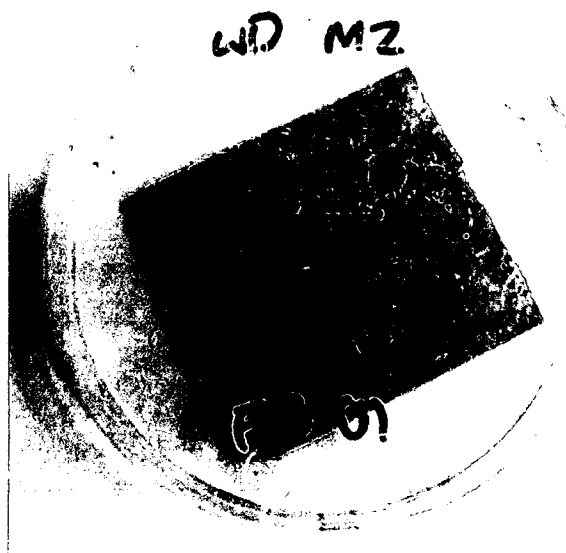
Inoculated with Black Mold Spores

FIG. 11B



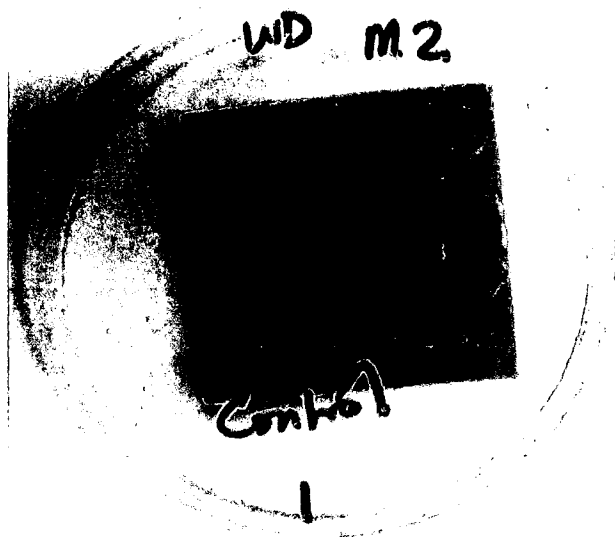
Inoculated with Black Mold Spores

FIG. 11C



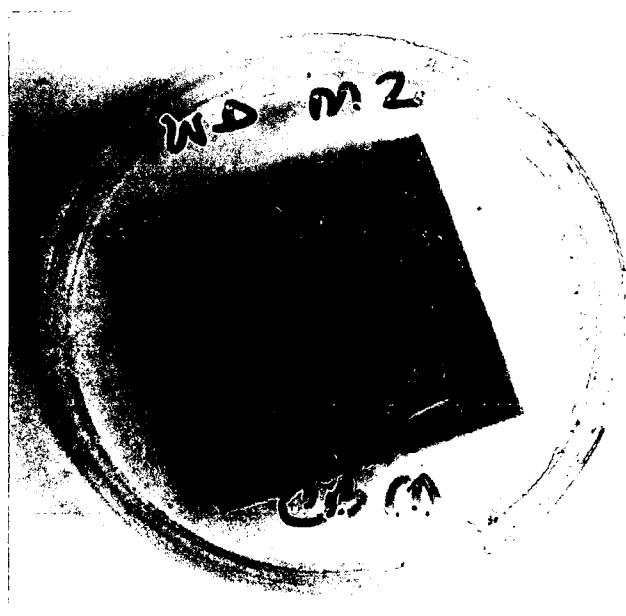
Inoculated/Treated with 50% FB

FIG. 11D



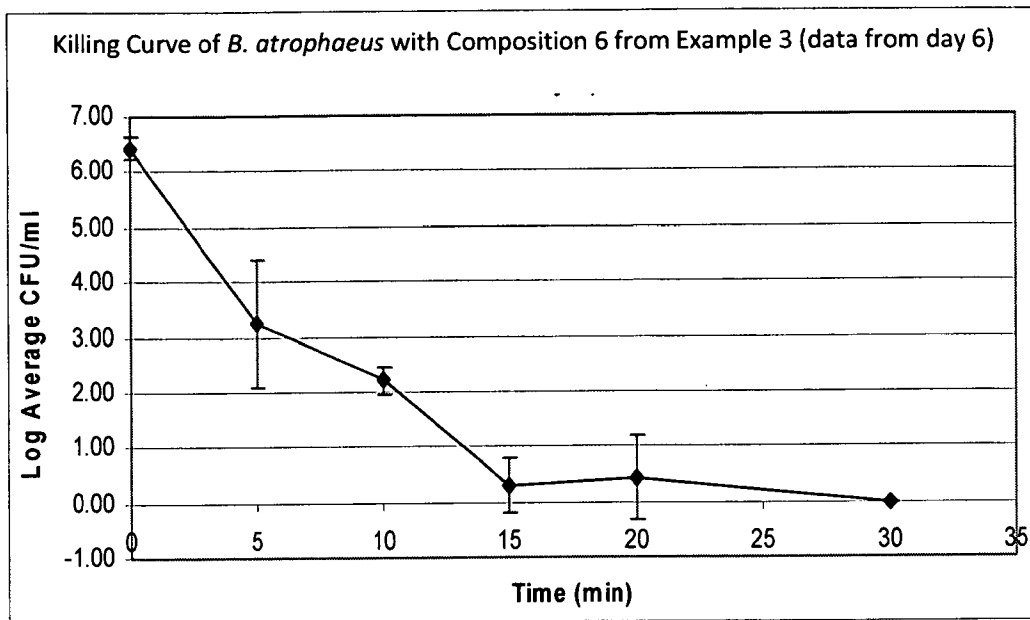
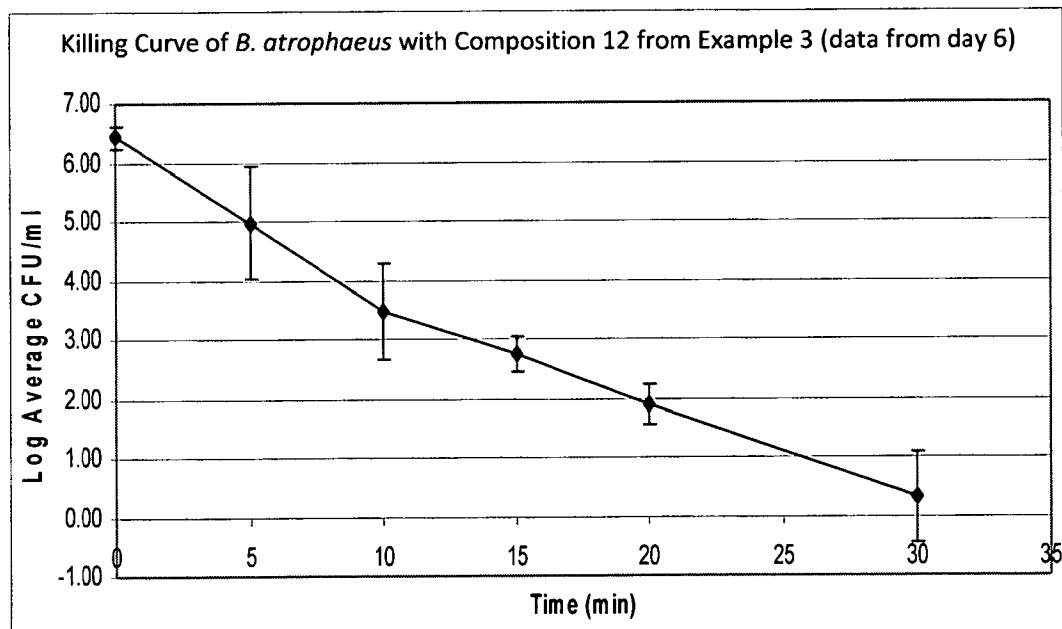
Inoculated with Black Mold Spores

FIG. 11E



Inoculated/Treated with NaOCl

FIG. 11F

**Figure 12****Figure 13**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 10/01134

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - A01N 31/00 (2010.01) USPC - 424/405 According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC: A01N 31/00 (2010.01) USPC: 424/405 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched IPC: A01N 31/00 (2010.01) (text search only) USPC: 424/405 (text search only) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) (USPT, PGPB, EPAB, JPAB); Google Patent, Google Scholar Search terms on extra sheet														
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>WO 2008/008161 A2 (Awad) 17 Jan 2008 (17.01.2008) (para [0031], [0032], [0033], [0035], [0036], [0054], [0055], [0056], [0057], [0060], [0061], [0063], [0064], [0066], [0076], [0079], Claims 1, 5, and 28).</td> <td>1-8, 10-37, 39-42</td> </tr> <tr> <td>Y</td> <td></td> <td>9, 38</td> </tr> <tr> <td>Y</td> <td>US 2008/0305531 A1 (Lam et al.) 11 Dec 2008 (11.12.2008) (Abstract, para [0108], [0718], Claim 1).</td> <td>9, 38</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	WO 2008/008161 A2 (Awad) 17 Jan 2008 (17.01.2008) (para [0031], [0032], [0033], [0035], [0036], [0054], [0055], [0056], [0057], [0060], [0061], [0063], [0064], [0066], [0076], [0079], Claims 1, 5, and 28).	1-8, 10-37, 39-42	Y		9, 38	Y	US 2008/0305531 A1 (Lam et al.) 11 Dec 2008 (11.12.2008) (Abstract, para [0108], [0718], Claim 1).	9, 38
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<table border="0"> <tr> <td> * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family										
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Date of the actual completion of the international search 01 Jun 2010 (01.06.2010)		Date of mailing of the international search report 18 JUN 2010												
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774												

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 10/01134

continued from box B

Search terms:

disinfectant, sanitizing, germicidal, antibacterial, antimicrobial, antiseptic, ethanol, methanol, propanol, isopropanol, isopropyl alcohol, ethyl alcohol, methyl alcohol, butyl alcohol, butanol, ammonium hydroxide, aluminum hydroxide, sodium hydroxide, potassium hydroxide, lithium hydroxide, calcium hydroxide, magnesium hydroxide, sodium carbonate, sodium hydrogen carbonate, fatty acid, lauric acid, dodecanoic acid, coconut oil, com oil, cottonseed oil, lard, olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, safflower oil, sesame oil, soybean oil, sunflower oil, tallow, butyl ester, ethyl ester, methyl ester, fatty alcohol, ester, fatty acyl-Coenzyme A ester, sucrose ester, monoglyceride, essential oil, terpene, terpenoid, thyme oil, eucalyptus oil, cinnamon oil, orange oil, lemon oil, clove oil, lime oil, rosemary oil, citron nella oil, cedar wood oil, camphor oil, calamus oil, geranium oil, lavender, lemongrass oil, peppermint oil, vetiver oil, palmarosa oil, nutmeg oil, propylene glycol, glycerol, sorbitol, xylitol, maltitol, thickeners, emollients, moisturizers, corrosion inhibitors, propellants, perfumes, flavoring agents, defoamers, antioxidants, dye, tooth, teeth, toothpaste, fungus, bacterium, fungal spore, bacterial spore, virus, prion, chemical warfare agent, CWA, Stachybotrys chartarum, VX, mustard, sarin, soman, tabun, Bacillus atropheus, CJO, CWO, BSE, Scrapie