



(51) International Patent Classification:

C11D 7/22 (2006.01) C11D 7/44 (2006.01)
C11D 7/26 (2006.01) C11D 7/10 (2006.01)

(21) International Application Number:

PCT/US2011/062743

(22) International Filing Date:

30 November 2011 (30.11.2011)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

PCT/US2011/046042 29 July 2011 (29.07.2011) US

(72) Inventor; and

(71) Applicant : CHADEAYNE, Andrew R. [US/US]; 1304
N. Herndon Street, Arlington, VA 22201 (US).

(74) Agent: O'BRIEN, Michelle, E.; O'Brien Jones, PLLC,
1951 Kidwell Drive, Suite 740, Vienna, VA 22182 (US).

(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, QA, RO, RS, RU, RW, 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, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU,
TJ, TM), European (AL, 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, RS, 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))



WO 2013/019258 A1

(54) Title: COMPOSITIONS AND METHODS FOR MITIGATING ADVERSE EFFECTS OF EXPOSURE TO CHLORINATING AND/OR BROMINATING AGENTS

(57) Abstract: Disclosed are compositions and methods for mitigating the adverse effects of chlorinating and/or brominating agents on body fibers and/or materials.

Compositions and Methods for Mitigating Adverse Effects of Exposure to Chlorinating and/or Brominating Agents

CROSS-REFERENCE TO RELATED APPLICATION

[001] This application is a continuation in part of PCT Application No. PCT/US11/46042, which claims priority under 35 U.S.C. § 119 to U.S. Provisional Application 61/369,360, filed July 30, 2010, each of which is incorporated herein by reference.

TECHNICAL FIELD

[002] The invention relates to compositions and methods for decreasing or eliminating adverse effects of chlorinating and/or brominating agents. In one aspect of the invention, the compositions and/or methods reduce the chlorine/bromine bonded to the surface of objects that have been exposed to chlorinating and/or brominating agents.

BACKGROUND

[003] Chlorine (including, for example, gaseous or solvated Cl₂, chlorine comprising oxidizing agents, and salts thereof) has a multitude of uses. For example, it can be used for disinfecting, whitening, bleaching, and clarifying materials. Chlorine is often used as an antimicrobial agent. For example sodium hypochlorite (a chlorinating agent) is known to kill a broad array of microbes. Owing to the efficacy, cost, and versatility of chlorinating agents, they are amazingly attractive reagents for a variety of home and industrial applications.

[004] A down side to using chlorinating agents in the home and industry is that they can react with many of the materials to which they are exposed—often materials that the user would like to keep free from chlorination. Because materials and surfaces that are exposed to chlorine and chlorinating agents undergo a chemical reaction with the chlorine, their chemical composition becomes altered. Part of the chlorine and/or chlorinating agent becomes bound to the material or surface. Accordingly, one cannot

simply wash away the residual chlorine. The bound chlorine must first be liberated before it can be washed away.

[005] By way of non-limiting example, one may desire to kill microbes present on a particular surface, without altering the makeup of the surface that is disinfected. A user may, for example, wish to sterilize biological materials, metal, glass, textiles, floors, etc. with a chlorinating agent, but not wish to chlorinate the surface. If the chlorine is not liberated, it can react with other molecules that later come into contact with the material or surface.

[006] As a further non-limiting example, sometimes the user wishes to sterilize water with a chlorinating agent but does not necessarily want to chlorinate everything that comes into contact with the water. For example, a swimming pool operator may wish to chlorinate the water to remove microbes but might not necessarily want to chlorinate all of the pool's users and their swimming attire.

[007] Swimming is a popular form of exercise and pastime. By its nature, swimming requires immersing oneself in a body of water. People may swim in either natural bodies of water (such as lakes, oceans, rivers, etc.), or man-made swimming pools.

[008] Man-made swimming pools (including traditional swimming pools, hot tubs, etc., collectively referred to generally herein as "pools") are usually smaller than naturally occurring bodies of water. They are also usually self-contained structures, consisting of a finite body of water separated from the surrounding environment, for example by walls. Pools provide an aqueous environment that is kept within a biologically habitable temperature range, such as about 65 – 90 °F. Some pools may be kept cooler or warmer. For example, a hot tub may be maintained at more than 90 °F.

[009] A swimmer brings a variety of living and non-living substances into the pool. For example, the swimmer's skin, hair, saliva, urine, sweat, and other secretions may come into contact with the pool water. Owing to the aqueous medium and adequate temperature, pools provide a suitable environment for living organisms, such as bacteria, to thrive.

[0010] Pools are usually treated with chemicals chosen to prevent the growth of harmful organisms, such as bacteria. Properly used, these chemicals keep the pool water substantially free from harmful contaminants. For example, many pools are treated with chlorinating agents (e.g., chlorine, hypochlorite salts such as calcium hypochlorite or sodium hypochlorite, hypochlorous acid) or brominating agents (e.g., bromine, salts comprising bromine, etc).

[0011] The chemicals used to treat pool water work by reacting with certain molecules that come into contact with the pool water. For example, these chemicals may react with bacteria's biologically important molecules, thereby killing the bacteria.

[0012] In addition to reacting with bacteria and other contaminants, however, some pool chemicals react with the swimmer's body and swimming attire, as well as other objects placed in the pool.

[0013] As used herein, the term "body fibers" refers to relatively exterior portions of the body, where the body meets the external environment. For example, in a mammal, the body fibers would include, e.g., skin, hair, eyes, and nails (collectively referred to herein as "body fibers," and intending to include keratinous fibers that make up the hair, skin, and nails, as well as mucous membranes), comprise proteins. By way of example, human hair is made largely from alpha keratin (α -keratin). Those proteins are made from amino acids. All amino acids, including those making up proteins, have one or more N-H bonds. In α -keratin, the most abundant amino acid is cystine, which accounts for about 15% of the protein. Monomeric L-cystine has two N-H bonds. The oxidized dimer of cystine has four N-H bonds. When present within a protein, each cystine residue has one N-H bond.

[0014] The N-H bonds in the amino acids in body fibers can react with the chemicals found in pool water. For example, one or more N-H bonds in an amino acid in the protein of hair or skin can react with a chlorinating agent used in pool water to form N-Cl, an amino chloride. Notably, the reacted amino acid, now containing an N-Cl bond, is still part of the protein in the hair or skin.

[0015] Although a swimmer can rinse off residual pool water after swimming, such rinsing may not effectively eliminate all the adverse effects of exposure to the chemically-treated pool water. Specifically, where the body's proteins have chemically

reacted with the pool chemicals, they are physically changed but, at least in part, remain part of the body, i.e. they are not all rinsed away with a traditional washing such as during normal showering.

[0016] Those remaining pool chemicals can be released throughout the day, for example as a result of exposing the skin to moisture, namely water. As discussed above, after swimming in a pool with a chlorinating and/or brominating agent, proteins of the human body may become chlorinated and/or brominated. Subsequent exposure of those chlorinated and/or brominated amino groups to water (e.g. rain or sweat) may release these volatile chemicals, which may be corrosive or irritating.

[0017] Some of these corrosive molecules may be harmful to body fibers, or may cause an unpleasant sensation upon contact with body fibers. Additionally, some of the volatile molecules may be perceived by the nose when liberated from the body, giving rise to odors. These odors are commonly referred to as simply "chlorine" or "pool odor," and are considered a more chemical odor, rather than the type of odor naturally produced by the body.

[0018] Although some people have reported liking "pool odor," as reminiscent of the pleasures associated with swimming itself, others do not like pool odor or, if strong enough, find the odor irritating, such as to the eyes, nose, and/or lungs. Additionally, since the chemicals liberated may irritate the skin and/or damage the hair, many people wish to prevent "pool odor" and/or the symptoms associated with it.

[0019] Also, when pool chemicals, such as chlorine or bromine, react with the biological molecules forming the skin and/or eyes, those reactions may cause irritation. For example, some swimmers report itchy or inflamed skin following swimming in pools. Some swimmers indicate that mucous membranes, such as the sensitive nasal skin, becomes itchy and irritated following swimming.

[0020] As discussed above, showering alone does not completely eliminate pool odor and/or skin irritation. Mitigating (i.e. decreasing to some extent or eliminating entirely) the effects of exposure to chlorinating and/or brominating agents requires reversing the chemical reaction between those chemicals and the proteins making up the human body. This requires converting the amino-halide bonds, e.g., chloramine (N-Cl) and/or bromamine (N-Br) groups into amino (N-H) groups. However, the soaps,

shampoos, and conditioners currently known do not effectively convert N-Cl and/or N-Br bonds on body fibers back into N-H bonds. Accordingly, N-Cl and/or N-Br remain bonded to the body fibers following washing, shampooing, and/or conditioning the body fibers, such as the skin and/or hair.

[0021] Some known shampoo and soap formulations are directed to mitigating the effects of exposure to chlorinating and/or brominating agents. For example, U.S. Patent No. 4,295,985 discloses “a method of removal of chlorine retained by human skin and hair after exposure to chlorinated water, and soap and shampoo compositions adapted to effect said removal.” That patent teaches applying urea and thiosulfate salts to the hair and/or body following exposure to chlorinating agents.

[0022] Other known formulations have sought to remove minerals from hair in an effort to prevent discoloration of the hair. For example, U.S. Patent No. 5,804,172 discloses compositions aimed at removing mineral deposits from hair exposed to hard water, particularly the calcium, magnesium, iron, and copper present in some municipal water sources. That patent discloses compositions including four ingredients, which are said to remove minerals from the hair due to the “synergistic combination” of ingredients. Within those compositions, a reducing agent, such as ascorbic acid, is included in an amount chosen to reduce oxidized cysteine-iron bonds. The patent discloses four-component compositions comprising 2.1 percent w/w of ascorbic acid, which is said to be sufficient to reduce the oxidation state of iron ions bonded to hair.

[0023] Additional known formulations have sought to remove chlorine from hair by treating the hair with ammonium lauryl sulfate, cocamide diethanolamine, sodium bicarbonate, cocobetaine, and water. See U.S. Patent No. 4,547,364.

[0024] Finally, a host of other formulations promise to treat damaged hair and/or skin following exposure to swimming pools by using various combinations of ingredients. For example, U.S. Patent No. 4,690,818 discloses a combination of hair and skin conditioners and moisturizers, namely, “a combination of cocodimonium hydrolyzed keratin and a mixture of monosaccharides and disaccharides”

[0025] However, there still exists a need for a convenient and effective method for mitigating the effects “pool odor” and other adverse effects (e.g., skin and eye itching

and irritation, residual chlorine remaining, odor, color fading, etc.) associated with exposure to chlorinating and/or brominating agents, such as by swimming.

[0026] As a further non-limiting example, in the food industry, it may be desired to chlorinate the water that is used to chill chicken carcasses, but chicken producers would like to avoid chlorinating the biological tissues making up the chicken. Poultry is an important part of the worldwide animal food market. The poultry industry raises chickens, kills them, and then processes them into a form that is both convenient and safe for the consumer to use in preparing meals. Converting live chickens into healthy food presents challenges to the chicken industry. In particular, poultry provides an excellent medium for the growth of microorganisms, such as *Pseudomonas*, *Staphylococcus*, *Micrococcus*, *Acinetobacter*, *Moraxella*, and *Salmonella*.

[0027] Even a healthy chicken harbors a considerable amount and variety of microorganisms, such as bacteria. These bacteria can be present on the chicken's feathers, feet, skin, and/or innards. During the slaughtering and processing procedures, bacteria present on the chicken may be carried along to subsequent processing steps. Preventing microbial contamination is immensely important throughout each aspect of chicken processing.

[0028] When the birds have reached "harvest" time, they are deprived of food and water. This allows their digestive tracts to empty so that less feces and undigested food enter the later processing steps. Minimizing these products of the digestive system reduces the overall potential for contaminating the chicken during processing. The chickens are usually stunned before killing them. Stunning knocks the birds unconscious but it does not kill them. The birds are killed either by hand or by a mechanical rotary knife that cuts the jugular veins and the carotid arteries at the neck. The birds are permitted to bleed for a fixed amount of time, depending on size and species (*e.g.*, bleeding times of about 1.5 minutes for broilers).

[0029] Following bleeding, the birds go through scalding tanks. These tanks contain hot water that softens the skin, making it easier to remove the feathers. During scalding, the temperature of the water is carefully controlled, at least in part to control the chickens' color. If retaining the yellow skin color is desired, a soft-scald is used (about 50° C or 122° F). If a white bird is desired, a higher scald temperature is used,

resulting in the removal of the yellow pellicle. Turkeys and spent hens (egg-laying birds that have finished their laying cycles) are generally run at higher temperatures—59° to 60° C (138° to 140° F).

[0030] After bleeding and scalding, the carcasses go through the feather-picking machines, which beat off the feathers with rubber fingers. Throughout the feathering process, the carcasses are moved through a sequence of machines, each optimized for removing different sets of feathers. Then, the carcasses may be singed by passing through a flame that burns off any remaining feathers.

[0031] After feathering, the chickens' heads are pulled off mechanically; their legs are removed with a rotary knife (much like a meat slicer). Then, the preen, or oil, gland is removed from the tail; the vent is opened so that the internal organs can be removed ("evisceration").

[0032] Evisceration can be performed either by hand or by using an automated mechanical device. Automated evisceration lines can operate at a rate of about 70 birds per minute. The evisceration equipment is cleaned (with relatively high levels of chlorine) after each bird.

[0033] After eviscerating the chicken, the remaining carcasses are further cleaned. The viscera are separated from the carcasses. The edible offal are removed from the inedible offal. (The heart, stomach, and liver are all considered edible offal and are independently processed). Stomachs are usually cut open and the inside yellow lining of the stomach along with the stomach contents are removed.

[0034] The lungs and kidneys are removed separately from the other visceral organs using a vacuum pipe. The carcasses are then washed thoroughly. After the carcasses have been washed, they are chilled to a temperature below 4° C (40° F). The two main methods for chilling poultry are water chilling and air chilling. Water chilling is performed in chlorinated water.

[0035] Water chilling is used throughout North America and involves a prechilling step in which a countercurrent flow of cold water is used to lower the temperature of the carcasses. The carcasses are then moved into a chiller—a large tank specifically designed to move the carcasses through in a specific amount of time. Multiple tanks are often used to minimize cross-contamination.

[0036] A specified overflow of water for each tank is required by law in the United States and Canada. Although this renders the chilling process very water-intensive, it helps to minimize bacterial cross-contamination by diluting the microorganisms washed off the carcasses, thereby preventing recontamination.

[0037] During chilling, raw carcasses--already defeathered and eviscerated, as described above--are submerged in cold water. The bath chills the birds to 40 °F or lower, preserving its freshness and lengthening its shelf life. The carcasses entering this chilling bath may be warm because the bird's living temperature was warm and, after killing, hot water was used in scalding/defeathering. Owing to the warm temperature of these carcasses, they provide a suitable temperature for bacterial proliferation.

[0038] In poultry processing plants, thousands of poultry carcasses share communal chiller tubs. To prevent microorganisms carried by some chickens from contaminating the water and infecting other birds in the bath, many processors use chlorine to sanitize the water. This bath "is a critical point in the plant's control of cross-contamination by these microorganisms." Wood, M., *Agricultural Research*, Sept, 1994. In some commercial plants, the tanks are about 4 ft. X 10 ft. X 40 ft. and contain approximately 100,000 gallons of chilled, chlorinated water at around 33°F. They can have as many as a few thousand chickens in them at one time, on a continuous basis, for three shifts a day, with one two-hour cleanup period every 24 hours. The U.S.D.A. requires the plant operators to maintain a 38 ppm total chlorine residual in these tanks to provide adequate sanitation. Accordingly, during the chilling phase, the chicken is soaked in chlorinated water.

[0039] Exposing the chicken carcass to chlorinated water can lead to undesirable effects on the chicken ultimately entering the marketplace. In addition to reacting with bacteria and other contaminants, as desired, any chlorine present in the chiller water reacts with the body fibers of the eviscerated chicken. The body fibers that make up the exterior of the chicken comprise proteins made from amino acids, which, as described above, have one or more N-H bonds.

[0040] Similarly to that described above with regard to swimming, the N-H bonds in the amino acids making up chicken protein can react with the chlorine in chlorinated

water. For example, one or more N-H bonds in an amino acid in the protein of the chicken can react with a chlorinating agent to form N-Cl, an amino chloride. Notably, the reacted amino acid, now containing an N-Cl bond, is still part of the chicken protein.

[0041] As also described above, although the residual chlorinated water can be rinsed off after a chicken is removed from the chiller, that sort of rinsing may not effectively eliminate all the adverse effects of exposure of the chicken carcass to the chemically-treated water. For example, where the chicken's proteins have chemically reacted with one or more chlorinating agents, they are physically changed but, at least in part, remain part of the chicken, i.e. they are not all rinsed away by normal rinsing.

[0042] The remaining chicken-bound chemicals can be released after the chicken is packaged and sent to the marketplace. For example, chlorine-containing molecules may be released by exposing the chicken to additional water, pH changes, or merely allowing for the passage of time. As discussed above, after exposing chicken to chlorinated water, the chicken's protein may become chlorinated. Subsequent exposure of those chlorinated amino groups to air and water may release chlorine containing chemicals, which may cause packaged chicken to have undesirable properties. For example, the chicken may have an undesirable odor (e.g., of "chlorine" or "bleach"), the chicken may lose depth of color, and/or the chicken may include residual chloride and/or hypochlorite. Some of these released molecules may be harmful to the chicken meat.

[0043] Faced with the undesirable post-processing chlorine smell and taste, some members of the chicken industry have attempted to process chickens without using chlorinating agents. But, using chlorinated water during at least the chilling process has proven so effective as an antimicrobial, that for safety reasons it is desired to continue to use this process. Accordingly, there remains a need to eliminate the residual undesirable affects of chlorine on the chicken.

[0044] As described herein, for various applications, there is a significant but unresolved need for liberating bound chlorine and/or bromine from materials and surfaces after exposure to chlorine, bromine, chlorinating, and/or brominating agents.

DESCRIPTION

[0045] The disclosure relates to compositions and methods for treating materials that have been exposed to chlorine, bromine, and/or iodine. It is noted that, for ease of reference only, the disclosure references chlorine specifically, in at least certain exemplary embodiments. However, where compositions and methods pertaining to chlorine are disclosed, the disclosure also specifically contemplates analogous compositions and methods directed to bromine and iodine, whether or not so stated.

[0046] Disclosed herein are effective treatments for mitigating the adverse effects of chlorine and chlorinating agents on materials, such as, for example, body fibers and clothing fibers. Specifically, it has been discovered that these effects may be mitigated by converting the amino chloride (N-Cl) groups bonded to the fibers of the material back into amino (N-H) groups. Although not intending to be bound by theory, it is believed that this conversion reverses the effects of chlorine because eliminating the N-Cl groups from the fibers of the material prevents those groups from reacting with water to liberate corrosive, odorous, or irritating chemicals.

[0047] In various embodiments, compositions and methods for sanitizing, disinfecting, and/or bleaching materials comprising: (1) first treating said material with a chlorinating agent and, (2) thereafter treating the surface and/or material with a composition comprising an effective amount of ascorbic acid, are disclosed. In at least one embodiment, the above methods include one or more aqueous rinsing steps. As used herein "sanitizing" means cleaning. As used herein "disinfecting," means killing living organisms (e.g., bacteria). As used herein, "bleaching" means fading the color of a material, usually making it less intense.

[0048] In various embodiments, compositions and methods for eliminating odors from materials exposed to chlorinating agents comprising: (1) treating said material with a chlorinating agent, and (2) thereafter treating the surface and/or material with a composition comprising an effective amount of ascorbic acid, are disclosed. In at least one embodiment, the above methods include one or more aqueous rinsing steps.

[0049] In various embodiments, compositions and methods for eliminating residual chlorine from materials exposed to chlorinating agents comprising: (1) treating said surface and/or material with a chlorinating agent and, (2) thereafter treating the

surface and/or material with a composition comprising an effective amount of ascorbic acid, are disclosed. In at least one embodiment, the above methods include one or more aqueous rinsing steps.

[0050] In various embodiments, compositions and methods for preventing color fading of materials exposed to chlorinating agents comprising: (1) treating said surface and/or material with a chlorinating agent and, (2) thereafter treating the surface and/or material with a composition comprising an effective amount of ascorbic acid, are disclosed. In at least one embodiment, the above methods include one or more aqueous rinsing steps.

[0051] In various embodiments, compositions and methods for mitigating the adverse effects of swimming pool chemicals and "pool odor" on body fibers are disclosed. According to one aspect of the invention, treatment compositions for body fibers and materials are provided, said treatment compositions comprising an effective amount of ascorbic acid (the L-enantiomer of which is commonly known as vitamin C). By way of non-limiting example, one embodiment provides a hair and/or body treatment composition comprising an effective amount of ascorbic acid.

[0052] In various embodiments described herein, salts and/or derivatives (including but not limited to oxidized forms) of ascorbic acid may be used in place of, or in addition to, ascorbic acid. Salts and/or derivatives of ascorbic acid would function similarly within the context of the disclosed compositions and methods. As non-limiting examples, esters or ethers of ascorbic acid may be used in the compositions and methods of the invention. Unless otherwise noted, when the term "ascorbic acid" is used herein, it is intended to include salts and/or derivatives (e.g. oxidized forms or esters) thereof, whether or not so stated. For example, when present within an aqueous solution, the term "ascorbic acid" as used herein is intended to include products formed as a result of ascorbic acid reacting with water and/or oxygen, such as, for example, dehydroascorbic acid. In one example, when "ascorbic acid" is used in a non-aqueous solution, the length of the carbon chains on the ester derivatives may be selected in order to adjust the solubility of that ester in the particular solution by applying a "like dissolves like" rationale.

[0053] Furthermore, as known, each of ascorbic acid and its salts and esters have stereogenic centers in their structure, for example the carbons modified by the (R)- and (S) designations. This invention contemplates use of any combination of stereoisomers of ascorbic acid, salts, and esters, including isolated stereoisomers and all mixtures thereof.

[0054] The term “effective amount of ascorbic acid” as used herein is intended to include any amount of ascorbic acid that is sufficient to achieve any of the intended goals (e.g. eliminating odors, preventing fading of color, etc.) or convert any of the N-Cl bound to body fibers or the fibers of the material into N-H. In at least one embodiment, an effective amount of ascorbic acid means an amount sufficient to mitigate (i.e. reduce to any degree or eliminate completely) the perceptible adverse effects of exposure to chlorine or a chlorinating agent. By way of non-limiting example, in one embodiment where the material to be treated is the body fibers and/or clothing of a swimmer, an effective amount of ascorbic acid would be an amount sufficient to reduce or eliminate undesirable “pool odor” from the swimmer’s body fiber, clothes’ fibers, towel fibers, etc. By way of example only, with reference to compositions according to the disclosure, an effective amount of ascorbic acid, salts, and/or derivatives (e.g., oxidative degradation products) thereof, may be about 2.5 to about 25% within an aqueous solution. For example, an aqueous solution according to the disclosure may comprise a concentration of ascorbic acid ranging from about 0.5 to about 2 Molar.

[0055] Under some circumstances, the ascorbic acid present in an aqueous solution of vitamin C may degrade via oxidative pathways upon exposure to air. Various embodiments of the disclosure relate, therefore, to aqueous solutions comprising ascorbic acid and mixtures of these oxidative degradation products, such as dehydroascorbic acid.

[0056] In at least one exemplary embodiment, an effective amount of ascorbic acid is an amount sufficient to reduce the number of N-Cl and/or N-Br bonds in fibers of a material by at least 50%. In further exemplary embodiments, an effective amount may reduce the number of N-Cl and/or N-Br bonds in body fibers or material fibers by at least about 60%, at least about 70%, at least about 80%, at least about 90%, at least about 95%, at least about 98%, or at least about 99%.

[0057] In at least one exemplary embodiment, an effective amount of ascorbic acid means a saturated aqueous solution of ascorbic acid. At standard temperature and pressure, a "saturated solution of ascorbic acid" is commonly accepted to be a solution made of 330 grams of ascorbic acid per one Liter of water. This concentration will vary as a function of temperature. In various embodiments, the disclosure relates to saturated solutions of ascorbic acid at any temperature, meaning the maximum amount of ascorbic acid that is soluble in water at the given temperature.

[0058] The amount of ascorbic acid useful to mitigate adverse effects of exposure to chlorine or chlorinating agents may vary from one embodiment to another, or one application to another. For example, the amount needed to decrease or eliminate pool odor and/or itching and/or skin irritation may vary from person to person, depending on, for example, how much hair and/or skin that person has. Choosing an effective amount is within the skill of those of skill in the art, and may, optionally be done empirically, i.e. using more ascorbic acid where the pool odor and/or itching/ and/or skin irritation persists after applying ascorbic acid. By way of example only, an effective amount of ascorbic acid may range from about 0.2 to about 10 grams, such as about 0.5 to about 5 grams, or such as about 1 to about 3 grams.

[0059] In one embodiment, the composition or method includes an ascorbic acid solution having a pH of less than 6. In another embodiment, the ascorbic acid solution has a pH of less than 5. In another embodiment, the ascorbic acid solution has a pH of less than 4. In another embodiment, the ascorbic acid solution has a pH of between 3 and 4. In another embodiment, the ascorbic acid solution has a pH of less than 3. In another embodiment, the ascorbic acid solution has a pH of about 2. In one embodiment, the pH of the ascorbic acid solution is between about 1.9 - 2.2.

[0060] In at least one exemplary embodiment, the ascorbic acid used in the compositions and/or methods described herein may be supplemented with or replaced by one or more aqueous acids to form acidic aqueous solutions. Any acid that is safe for contact with the material to which it is intended to be applied, such as, for example, human hair and/or skin, may be used. For example, one or more of the following acids may be used in an acidic aqueous solution contemplated by this invention: acetic acid, citric acid, aconitic acid, adipic acid, benzoic acid, caprylic acid, cholic acid,

desoxycholic acid, erythorbic acid, formic acid, glutamic acid, glycocholic acid, hydrochloric acid, lactic acid, linoleic acid, malic acid, nicotinic acid, oleic acid, pectinic acid, phosphoric acid, propionic acid, sorbic acid, stearic acid, succinic acid, sulfamic acid, sulfuric acid, tannic acid, tartaric acid, taurocholic acid, and/or thiodipropionic acid.

[0061] In one embodiment, the acidic aqueous solution has a pH of less than 6. In another embodiment, the acidic aqueous solution has a pH of less than 5. In another embodiment, the acidic aqueous solution has a pH of less than 4. In another embodiment, the acidic aqueous solution has a pH of between 3 and 4. In another embodiment, the acidic aqueous solution has a pH of less than 3. In another embodiment, the acidic aqueous solution has a pH of about 2. In one embodiment, the pH of the acidic aqueous solution is between about 1.9 - 2.2.

[0062] Exemplary compositions according to the disclosure may be aqueous or non-aqueous, and may be in any known form. For example, they may be solutions, powders, tablets, creams, gels, emulsions, etc. In one embodiment, for example, the compositions may be in the form of a tablet, such as an effervescent tablet, which may be placed in water or another solvent before use. In yet a further exemplary embodiment, the composition may be an aqueous solution.

[0063] In another exemplary embodiment, the composition may be a soap or soap-like composition, comprising water, ascorbic acid, and soap. In one embodiment, the composition consists essentially of water, ascorbic acid, and soap. In a further embodiment, the composition consists essentially of water and ascorbic acid.

[0064] Exemplary aqueous ascorbic acid compositions may be made by mixing ascorbic acid and water. Exemplary ascorbic acid compositions comprising soap may be made by mixing (A) an aqueous solution of ascorbic acid, described herein, with (B) a liquid soap composition.

[0065] In another exemplary embodiment, the ascorbic acid composition may be a foaming composition, comprising water, ascorbic acid, and a foaming agent.

[0066] Exemplary foaming compositions may be made by mixing an aqueous solution of ascorbic acid with a foaming agent (e.g, an appropriate shampoo, soap, or body wash) to form a liquid that is capable of providing a foam when dispensed through a foaming dispenser, such as, for example, a hand-soap-type dispenser.

[0067] In one embodiment, the composition or method includes an ascorbic acid solution comprising soap and/or a foaming agent having a pH of less than 6. In another embodiment, the ascorbic acid solution comprising soap and/or a foaming agent has a pH of less than 5. In another embodiment, the ascorbic acid solution comprising soap and/or a foaming agent has a pH of less than 4. In another embodiment, the ascorbic acid solution comprising soap and/or a foaming agent has a pH of between 3 and 4. In another embodiment, the ascorbic acid solution comprising soap and/or a foaming agent has a pH of less than 3. In another embodiment, the ascorbic acid solution comprising soap and/or a foaming agent has a pH of about 2. In one embodiment, the pH of the ascorbic acid solution comprising soap and/or a foaming agent is between about 1.9 - 2.2.

[0068] In further embodiments described herein, in addition to ascorbic acid, salts, and/or derivatives thereof, the compositions of the invention may also optionally include other component(s) useful in compositions intended to be applied to body fibers (including, but not limited to emollients, preservatives, perfumes, thickeners, etc.), as long as the additional component(s) do not substantially interfere with the intended function of the ascorbic acid, i.e. the conversion of the N-Cl and/or N-Br bonds to N-H bonds. It may also be desirable in various embodiments that the additional components do not damage or otherwise adversely affect the body fibers. One of skill in the art would be able, through routine experimentation, to formulate acceptable compositions comprising an effective amount of ascorbic acid, salts, and/or derivatives thereof, and formulations thereof, for treatment of body fibers as described herein.\

[0069] In further embodiments, in addition to ascorbic acid, salts, and/or derivatives thereof, the compositions of the invention may also optionally include other component(s) useful in compositions intended to be applied to other materials, as described herein, such as materials intended to be sanitized. One of skill in the art will be able, through routine experimentation and knowledge generally available, to determine the appropriate types and amounts of such additional components, depending on, for example, the type of application intended.

[0070] Various compositions contemplated herein may be made, for example by mixing (A) an aqueous acidic solution not comprising ascorbic acid with (B) appropriate

additional components including, but not limited to, shampoo, soap, or body wash to form a liquid comprising ascorbic acid.

[0071] As non-limiting examples of compositions useful according to various embodiments of the disclosure, there may be any amount of (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and dehydroascorbic acid present in various embodiments of the invention, as long as at least some amount of each is present, such as, for example, one of the following:

[0072] In one embodiment, the aqueous solution of ascorbic acid comprises greater than 99% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and less than 1% dehydroascorbic acid.

[0073] In one embodiment, the aqueous solution of ascorbic acid comprises from 95-100% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and from 0-5% dehydroascorbic acid.

[0074] In one embodiment, the aqueous solution of ascorbic acid comprises from 90-100% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and from 0-10% dehydroascorbic acid.

[0075] In one embodiment, the aqueous solution of ascorbic acid comprises from 80-95% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and from 5-20% dehydroascorbic acid.

[0076] In one embodiment, the aqueous solution of ascorbic acid comprises from 60-80% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and from 20-40% dehydroascorbic acid.

[0077] In one embodiment, the aqueous solution of ascorbic acid comprises from 30-60% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and from 40-70% dehydroascorbic acid.

[0078] In one embodiment, the aqueous solution of ascorbic acid comprises from 0.1-30% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one and from 70-99.9% dehydroascorbic acid.

[0079] At least one embodiment of the disclosure provides methods for mitigating the adverse effects of subjecting poultry to chlorinated water. More specifically, it has been discovered that these effects may be mitigated by converting the amino chloride

(N-Cl) groups bonded to chicken protein back into amino (N-H) groups. Although not intending to be bound by theory, it is believed that this conversion reverses the effects of chlorinated water because eliminating the N-Cl groups from the protein fibers prevents those groups from subsequently liberating reactive (e.g., bleaching) or odorous chemicals after the chicken has been sent into the marketplace.

[0080] Within the context of treating chicken exposed to chlorinating agents, the term "effective amount of ascorbic acid" as used herein is intended to include any amount of ascorbic acid that is sufficient to convert any of the N-Cl groups bound to chicken fibers into N-H groups, or to achieve any of the goals described herein, such as, for example, eliminating residual chlorine and preventing fading of color. In at least one embodiment, an effective amount of ascorbic acid means an amount sufficient to mitigate (i.e. reduce to any degree or eliminate completely) the perceptible adverse effects of exposure to chlorinated water. For example, in one embodiment, an effective amount of ascorbic acid would be an amount sufficient to reduce or eliminate undesirable odor of "chlorine." By way of example only, with reference to compositions according to the disclosure, an effective amount of ascorbic acid, salts, and/or derivatives (e.g., dehydroascorbic acid) thereof may be about 5 to about 25 wt% within an aqueous solution. For example, an aqueous solution according to the disclosure may comprise a concentration of ascorbic acid ranging from about 0.5 to about 2 Molar. In another example, the amount of ascorbic acid, salts, and/or derivatives is present in an amount of about 0.001 to about 5 wt% of an aqueous solution.

[0081] In at least one exemplary embodiment, an effective amount of ascorbic acid is an amount sufficient to reduce the number of N-Cl bonds in chlorinated chicken by at least 50%. In further exemplary embodiments, an effective amount may reduce the number of N-Cl bonds in chlorinated chicken by at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 98%, or at least 99%.

[0082] The amount of ascorbic acid required to eliminate chlorine odor from chlorinated chicken may vary depending on the amount of chicken present, the degree of chlorination, and/or the temperature at which the ascorbic acid is applied. Selecting the correct amount can be done by any method, such as, for example, empirically, i.e.

using more ascorbic acid where the adverse effects (e.g., odor, discoloration, residual chlorine) persist after applying ascorbic acid.

[0083] Exemplary compositions according to the disclosure may be aqueous or non-aqueous, and may be in any known form.

[0084] In addition to ascorbic acid, salts, and/or derivatives thereof, the compositions of the invention may also optionally include other component(s) useful in compositions intended to be applied to chicken fibers, as long as the additional component(s) do not substantially interfere with the intended function of the ascorbic acid, i.e. mitigating the adverse effects of chlorine on chicken protein, or otherwise adversely affect the chicken. One of skill in the art would be able, through routine experimentation, to formulate acceptable compositions comprising an effective amount of ascorbic acid, salts, and/or derivatives thereof, and formulations thereof, for treatment of chlorinated chicken as described herein.

[0085] Further aspects of the invention provide methods of mitigating the adverse effects of exposing chicken to chlorinated water, said methods comprising treating chicken fibers with an effective amount of ascorbic acid. Additional embodiments comprise methods of treating chicken fibers with salts and/or derivatives of ascorbic acid, in place of or in addition to ascorbic acid. As above, any combination of stereoisomers of ascorbic acid are contemplated for use in the methods of the invention. Also, any and all degradation products of ascorbic acid are contemplated for use in the methods of the invention.

[0086] In at least one exemplary method, the effective amount of ascorbic acid is applied by spraying an effective amount of aqueous solution of ascorbic acid onto chicken after the chicken is removed from the chiller.

[0087] In at least one exemplary method, the effective amount of ascorbic acid is applied by submerging the chicken in an effective amount of an aqueous solution of ascorbic acid after the chicken is removed from the chiller.

[0088] In at least one exemplary method, the chicken is first removed from the chiller, then rinsed with plain water to remove excess chiller water, then treated with aqueous ascorbic acid.

[0089] In at least one exemplary method, the chicken is first removed from the chiller, then rinsed with plain water to remove excess chiller water, then treated with aqueous ascorbic acid, and then additionally rinsed to remove excess ascorbic acid.

[0090] In at least one exemplary method, the chicken is removed from the chiller and then treated with aqueous ascorbic acid.

[0091] In at least one exemplary method, the chicken is removed from the chiller, then treated with aqueous ascorbic acid, then additionally rinsed to remove excess ascorbic acid.

[0092] In one sense, applying an effective amount of ascorbic acid means applying an amount of ascorbic acid sufficient to reduce the adverse effects of chlorine means lessening the adverse effects perceived by the consumer, e.g., color bleaching, odor. In one context, applying an amount of ascorbic acid means treating the chicken with an amount of ascorbic acid sufficient to reduce the amount of residual chloride and/or hypochlorite after expose to aqueous chlorine (e.g., chlorine, hypochlorite, etc. in water) measured in a laboratory vis-à-vis a control group that is not exposed to ascorbic acid.

[0093] For various exemplary aqueous solutions of this invention, the chicken producer's requirements may depend on the volume and size of the chicken undergoing processing and/or the degree to which that chicken is chlorinated. Generally speaking, greater amounts of chicken and higher degrees of chlorination will require higher quantities of ascorbic acid to mitigate the unwanted chlorination of the chicken. A chicken processor may adjust the amount of ascorbic acid applied based on his/her observations (e.g., if the observer notices chlorine odor, bleaching, and/or measures elevated levels of residual chlorine) following treating the chicken with aqueous ascorbic acid, then that indicates that more ascorbic acid should be used.

[0094] In various additional embodiments, such methods comprise treating chicken fibers with compositions as described herein.

[0095] The ascorbic acid, salts and/or derivatives thereof, and/or the compositions comprising ascorbic acid, salts and/or derivatives thereof, may, in various embodiments, be applied to the chicken fibers and immediately removed (e.g. by rinsing the keratinous fibers right away), or may be left on the keratinous fibers for a period of

time after application. For example, the keratinous fibers may be washed (e.g. with plain water or brine) subsequent to the application of ascorbic acid. Although the present invention herein has been described with reference to various exemplary embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. Those having skill in the art would recognize that various modifications to the exemplary embodiments may be made, without departing from the scope of the invention.

[0096] Further embodiments of the disclosure provide methods of mitigating the adverse effects of exposure to swimming pool chemicals, including but not limited to itching, irritation, and/or "pool odor." Said methods comprise treating body fibers with an effective amount of ascorbic acid, e.g. applying an effective amount of said ascorbic acid to said body fibers. Additional embodiments comprise methods of treating body fibers with salts and/or derivatives of ascorbic acid, in place of or in addition to ascorbic acid. As above, any combination of stereoisomers of ascorbic acid are contemplated for use in the methods of the invention. Also, any and all degradation products of ascorbic acid are contemplated for use in the methods of the invention.

[0097] In at least one exemplary method, the effective amount of ascorbic acid is applied by spraying an effective amount of aqueous solution of ascorbic acid onto the body fibers of a subject, such as, for example, the skin and/or hair. The effective amount of ascorbic acid may be sprayed by any method known, such as, for example, an aerosol spray or a non-aerosol pump bottle.

[0098] In at least one exemplary embodiment, the effective amount of ascorbic acid is applied by using a foaming composition comprising ascorbic acid, water, and a foaming agent. In some exemplary embodiments, the foaming composition is applied by dispensing said foaming composition through a foaming hand soap dispenser, thereby creating a foaming lather, which is applied to the hair and/or skin. A foaming composition can be made by diluting a handsoap with aqueous ascorbic acid, such as a composition disclosed in this application.

[0099] In at least one exemplary embodiment, a person exposed to a swimming pool may optionally first rinse the residual pool water from his/her hair and/or body, then apply an effective amount of ascorbic acid to his/her hair and/or body. In some

embodiments, the person may thereafter immediately or substantially immediately wash the hair and/or body with soap, or may apply shampoo and/or conditioner. In further embodiments, the effective amount of ascorbic acid is sprayed onto the hair and/or body after rinsing off residual pool water without subsequently immediately or substantially immediately washing the hair and/or body.

[00100] This invention also contemplates, in certain embodiments, applying an effective amount of ascorbic acid without first rinsing. When ascorbic acid is applied without first rinsing, more ascorbic acid may, in at least some embodiments, be required than when applied subsequent to rinsing.

[00101] In at least one exemplary embodiment, the method of applying an effective amount of ascorbic acid is intended to include a method where a subject, such as a swimmer, applies an amount of ascorbic acid sufficient to reduce and/or eliminate his/her own "pool odor" and/or irritation as perceived by the subject. For a particular aqueous solution according to the disclosure, the effective amount of ascorbic acid required to reduce and/or eliminate the subject's odor and/or irritation may depend on the amount of hair and/or skin that the subject has. Generally speaking, a subject may adjust the amount of ascorbic acid applied based on his or her own observations—if the subject experiences "pool odor" and/or irritation following administering aqueous ascorbic acid, more may be applied.

[00102] In various embodiments, the methods according to the disclosure relate to methods of treating hair comprising applying an effective amount of a composition comprising ascorbic acid, as described herein. It is contemplated that a person with little or no hair would recognize that using a smaller amount of ascorbic acid provides effective reduction or elimination of "pool odor" and/or irritation, and thus, in at least certain embodiments, an effective amount may be less than in an embodiment where a person has a lot of hair.

[00103] In various additional embodiments, such methods comprise treating body fibers with compositions comprising ascorbic acid, as described herein.

[00104] The ascorbic acid, salts and/or derivatives thereof, and/or the compositions comprising ascorbic acid, salts and/or derivatives thereof, may, in various embodiments, be applied to the body fibers and immediately removed (e.g. by rinsing

the fibers right away), or may be left on the body fibers for a period of time after application. For example, the body fibers may be washed (e.g. with soap or shampoo) subsequent to the application of ascorbic acid.

[00105] Anytime the invention disclosed herein is set forth with regard to “people,” this convention is for ease of reference only. Various embodiments of the invention are not limited to humans, but rather are intended to include any mammal having body fibers that can form an N-Cl or N-Br bond. As such, the use of the terms “human,” “swimmer,” or “people” is intended to include any mammal that swims or is otherwise exposed to chemicals such as chlorine and/or bromine. Likewise, the use of the phrase “body fibers” is intended to include human body fibers, as well as body fibers of any mammal, whether or not living.

[00106] The use of the term “material” herein is intended to include any surface, other than body fibers, which may come into contact with chlorinating, bromating, etc., agents, including, by way of non-limiting example, textiles, metal, glass, organic polymer surfaces, and the like.

[00107] The use of the terms “treat” and “treating” and modifications thereof is intended to include the application of compositions described herein to the materials and/or body fibers by any method known, such as, for example, spraying onto the materials and/or body fibers, submerging the materials and/or body fibers in said compositions, etc.

[00108] The term “pool chemicals” and variations thereof should not be considered to be limited to chemicals in pools. Rather, the term is intended to cover chemicals typically used in pools, such as chlorinating agents (e.g., hypochlorite salts such as calcium hypochlorite or sodium hypochlorite, hypochlorous acid) or brominating agents (e.g., bromine, salts comprising bromine, hypobromous acid, etc.), whether or not the exposure to those chemicals actually occurs in a swimming pool.

[00109] It is also to be noted that, although various steps of exemplary methods described herein may be described in a particular order, modifications of the order are intended to be within the scope of the invention. By way of example only, the compositions, while described as being applied subsequently to exposure to

chlorinating, etc., agents, may be applied prior to or simultaneously to exposure, and yet be within the scope of the invention described and claimed.

[00110] Further embodiments of the disclosure are related to methods for treating textiles, such as, for example, towels and swimming attire exposed to chlorinated and/or brominated pool water, with an aqueous solution of ascorbic acid. Such treatment may reduce the "pool odor" of the textiles. For example, treating swimming attire exposed to chlorinated and/or brominated pool water with an aqueous solution of ascorbic acid as described herein has been found to reduce the "pool odor" of that swimming attire. Treating swimming attire exposed to chlorinated and/or brominated pool water with an aqueous solution of ascorbic acid has also been found to reduce the oxidative damage done to the swimming attire, thereby prolonging its life and reducing the fading and/or discoloration of its materials, typically associated with such textiles.

[00111] In at least one exemplary method, an effective amount of ascorbic acid is applied by contacting the textiles with an aqueous solution of ascorbic acid. In one exemplary embodiment, the textiles may first be rinsed with standard tap water before applying the ascorbic acid as described herein, and optionally thereafter rinsing the textiles a second time with standard tap water. In another embodiment, the effective amount of ascorbic acid is applied without first rinsing the textiles with standard tap water. In some embodiments the effective amount of ascorbic acid is applied by using an aerosol container. The textiles may optionally be washed as normal, subsequent to the application of the ascorbic acid as described herein.

[00112] In at least one exemplary embodiment, the textiles may be treated with about 0.2 to about 10 grams of ascorbic acid, such as about 0.5 to about 5 grams of ascorbic acid, or about 1 to about 3 grams of ascorbic acid.

[00113] Although the present invention herein has been described with reference to various exemplary embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. Those having skill in the art would recognize that various modifications to the exemplary embodiments may be made, without departing from the scope of the invention.

[00114] Moreover, it should be understood that various features and/or characteristics of differing embodiments herein may be combined with one another. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the scope of the invention.

[00115] It will be appreciated that there is an implied "about" prior to all numerical values recited herein, whether or not so stated. It should also be understood that the precise numerical values used in the specification and claims form additional embodiments. Efforts have been made to ensure the accuracy of the numerical values disclosed herein. Any measured numerical value, however, can inherently contain certain errors resulting from the standard deviation found in its associated measuring technique.

[00116] Furthermore, other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a scope and spirit being indicated by the claims.

[00117] Finally, it is noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the," include plural referents unless expressly and unequivocally limited to one referent, and vice versa. Thus, by way of example only, reference to "a composition" can refer to one or more compositions, and reference to "a salt of ascorbic acid" can refer to one or more salts of ascorbic acid. As used herein, the terms "comprise", "comprises", "comprising", "contain", "contains", "containing", "have", "having", "include", "includes", and "including" are intended to be non-limiting, such that recitation of an item or items is not to the exclusion of other like items that can be substituted or added to the recited item(s).

EXAMPLES

[00118] The following examples are illustrative only, and are not intended to be limiting of the invention, as claimed.

Example 1

[00119] At standard temperature and pressure, 330 grams of ascorbic acid were dissolved in 1 L of water. This solution 1 was then applied to hair that had been exposed to swimming pool chemicals.

Example 2

[00120] At standard temperature and pressure, 300 grams of ascorbic acid were dissolved in 1 L of water. This solution 2 was then applied to hair that had been exposed to swimming pool chemicals.

Example 3

[00121] At standard temperature and pressure, 270 grams of ascorbic acid were dissolved in 1 L of water. This solution 3 was then applied to hair that had been exposed to swimming pool chemicals.

Example 4

[00122] At standard temperature and pressure, 240 grams of ascorbic acid were dissolved in 1 L of water. This solution 4 was then applied to hair that had been exposed to swimming pool chemicals.

Example 5

[00123] At standard temperature and pressure, 210 grams of ascorbic acid were dissolved in 1 L of water. This solution 5 was then applied to hair that had been exposed to swimming pool chemicals.

Example 6

[00124] At standard temperature and pressure, 180 grams of ascorbic acid were dissolved in 1 L of water. This solution 6 was then applied to hair that had been exposed to swimming pool chemicals.

Example 7

[00125] At standard temperature and pressure, 150 grams of ascorbic acid were dissolved in 1 L of water. This solution 7 was then applied to hair that had been exposed to swimming pool chemicals.

Example 8

[00126] At standard temperature and pressure, 120 grams of ascorbic acid were dissolved in 1 L of water. This solution 8 was then applied to hair that had been exposed to swimming pool chemicals.

Example 9

[00127] At standard temperature and pressure, 90 grams of ascorbic acid were dissolved in 1 L of water. This solution 9 was then applied to hair that had been exposed to swimming pool chemicals.

Example 10

[00128] At standard temperature and pressure, 60 grams of ascorbic acid were dissolved in 1 L of water. This solution 10 was then applied to hair that had been exposed to swimming pool chemicals.

Example 11

[00129] At standard temperature and pressure, 30 grams of ascorbic acid were dissolved in 1 L of water. This solution 11 was then applied to hair that had been exposed to swimming pool chemicals.

Example 12

[00130] At standard temperature and pressure, 180 grams of ascorbic acid were dissolved in 1 L of water. The resulting solution 12 was transferred into 3 oz spray bottles. Following swimming in a chlorinated swimming pool, a subject's skin and hair were rinsed with warm shower water for about 30 seconds. Then, the solution 12 was applied to the subject by spraying the solution onto the skin and hair. A total of 10 mL of solution 12 was evenly sprayed onto the subject's skin, and a total of 20 mL of solution 12 was evenly sprayed onto the subject's hair. The subject was then allowed to wash and rinse their skin with soap, and shampoo, rinse, and condition their hair, as normal. The shampoo was applied to the hair without first rinsing out the solution 12, so that the shampoo and lather distributed the solution.

Example 13

[00131] At standard temperature and pressure, 240 grams of ascorbic acid were dissolved in 1 L of water. The resulting solution 13 was transferred into 3 oz spray bottles.

[00132] Six swimmers were immersed in a swimming pool (Washington Lee High School swimming pool in Arlington, Virginia) for a period of one hour. Each of the subjects was assigned to one of two groups: three to the Swim Spray group and three to the control group.

[00133] After exiting the pool, the three swimmers in the Swim Spray group rinsed their skin and hair with warm shower water for about 30 seconds and then applied the solution 13 by spraying the solution onto their skin and hair. A total of 5 mL of solution 13 was sprayed onto each subject's skin, and a total of 10 mL of solution 13 was sprayed onto each subject's hair. After exiting the pool, the three swimmers in the control group similarly rinsed their hair and skin with warm shower water, but did not apply the solution.

[00134] All six swimmers were then allowed to wash and rinse their skin with soap, and shampoo, rinse, and condition their hair, as normal. All subjects used the same shampoo and conditioner (Garnier Fructis for regular hair). In the Swim Spray group, the shampoo was applied to the hair without first rinsing out the solution 13, so

that the shampoo and lather distributed the solution. Both groups then towel dried and waited for 30 minutes.

[00135] After 30 minutes, water was applied to a 3 cm x 3 cm area of the subject's forearm, by gently swabbing with a warm, damp cloth. The subjects were then smelled by a blind judge (i.e., having no knowledge of whether any subject did or did not use the solution). The judge noted that each member of the control group smelled like "pool" or "chlorine," whereas the judge found that odor either "faint" or "not at all" for the members of the Swim Spray group.

[00136] The experiment was repeated, and consistent results were obtained.

WHAT IS CLAIMED IS:

1. A method of mitigating the adverse effects of exposure to chlorinating and/or brominating agents on body fibers and/or materials, comprising applying to said body fibers and/or materials an effective amount of ascorbic acid, salts, and/or derivatives thereof.

2. The method according to claim 1, wherein the ascorbic acid is present in an amount sufficient to reduce the number of N-Cl and/or N-Br bonds in body fibers and/or materials by at least 50%.

3. The method according to claim 2, wherein the ascorbic acid is present in an amount sufficient to reduce the number of N-Cl and/or N-Br bonds in body fibers and/or materials by at least 70%.

4. The method according to claim 3, wherein the ascorbic acid is present in an amount sufficient to reduce the number of N-Cl and/or N-Br bonds in body fibers and/or materials by at least 90%.

5. The method according to claim 4, wherein the ascorbic acid is present in an amount sufficient to reduce the number of N-Cl and/or N-Br bonds in body fibers and/or materials by at least 99%.

6. The method according to claim 1, comprising applying an aqueous solution comprising an effective amount of ascorbic acid, salts, and/or derivatives thereof, onto said body fibers and/or materials.

7. A method according to claim 6, wherein the body fibers are chosen from human hair, skin, mucous membranes, and/or nails.

8. A composition for treating body fibers and/or materials comprising from 5 to 25 wt% of ascorbic acid, salts, and/or derivatives thereof.

9. The composition according to claim 8, wherein the composition is in the form of an aqueous solution.

10. The composition according to claim 9, wherein the aqueous solution is substantially free of other components.

11. The composition according to claim 9, consisting essentially of water and at least one of ascorbic acid, salts of ascorbic acid, and derivatives of ascorbic acid.

12. The composition according to claim 9, wherein the aqueous solution has an ascorbic acid concentration ranging from about 0.5 to about 2 Molar.

13. The composition according to claim 12, wherein the said ascorbic acid concentration ranges from about 1 to about 2 Molar.

14. The composition according to claim 10, wherein the aqueous solution has an ascorbic acid concentration ranging from about 0.5 to about 2 Molar.

15. The composition according to claim 14, wherein the said ascorbic acid concentration ranges from about 1 to about 2 Molar.

16. The composition of claim 10, wherein said aqueous solution is a saturated solution of ascorbic acid.

17. The method of claim 1, wherein the step of applying an effective amount of ascorbic acid, salts, and/or derivatives thereof comprises spraying a solution of ascorbic acid onto said body fibers and/or materials.

18. The method of claim 1, wherein said effective amount of ascorbic acid, salts, and/or derivatives thereof ranges from about 0.2 to about 10 grams of ascorbic acid.

19. The method of claim 18, wherein said effective amount ranges from about 1 to about 3 grams of ascorbic acid.

20. The method of claim 17, wherein said effective amount of ascorbic acid, salts, and/or derivatives thereof ranges from about 0.2 to about 10 grams of ascorbic acid.

21. The method of claim 17, wherein said body fibers comprise hair.

22. The method of claim 17, wherein said body fibers comprise skin.

23. A method of mitigating adverse effects of exposure to chlorinating and/or brominating agents on body fibers, said method comprising applying to said body fibers an aqueous solution comprising ascorbic acid comprising from about 0.01 to about 99.99% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one, and dehydroascorbic acid in an amount ranging from about 0.01 to about 99.99%.

24. An aqueous solution for treating body fibers and/or materials, comprising water and ascorbic acid comprising from about 0.01 to about 99.99% (5*R*)-[(1*S*)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5*H*)-one, and from about 0.01 to about 99.99% dehydroascorbic acid.

- 25. The method of claim 6 wherein the body fibers comprise chicken skin.
- 26. The method of claim 6 wherein the body fibers comprise chicken meat.
- 27. The method of claim 22, wherein said body fibers comprise human skin.
- 28. The method of claim 22, wherein said body fibers comprise chicken skin.
- 29. The method of claim 22, wherein said body fibers comprise chicken meat.
- 30. The method of claim 6 wherein the said materials are selected from metal, glass, and organic polymers.

A. CLASSIFICATION OF SUBJECT MATTER*C11D 7/22(2006.01)i, C11D 7/26(2006.01)i, C11D 7/44(2006.01)i, C11D 7/10(2006.01)i*

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)

C11D 7/22; A61C 17/00; C11D 7/32; A45D 19/00; A61H 9/00; A61K 8/23; A61K 35/78; A61K 7/48; A61K 7/00; D06L 3/10; A61K 7/50; A61K 7/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords:"chlorine","skin","hair","ascorbic acid","meat"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 08-198738 A (KANSAI KOUSO KK) 06 August 1996 See claims 1,2, para.[0003],[0011],[0018]-[0020],[0036].	1-22,25-30 23-24
X A	US 04295985 A (PETROW HENRY G. et al.) 20 October 1981 See claims 3,4,9,10, col.1 lines 46-64, example 6.	1-16,25-26,30 17-24,27-29
A	JP 08-198743 A (KANSAI KOUSO KK) 06 August 1996 See claims 1,3, para.[0011],[0012],[0027],[0032].	1-30
A	JP 2010-126506 A (TOKYO MEDICAL & DENTAL UNIV et al.) 10 June 2010 See claims 1-3, para.[0033],[0039].	1-30
A	JP 2004-024786 A (RICOH ELEMEX CORP) 29 January 2004 See claim 3, para.[0003],[0035].	1-30
A	US 04547364 A (BROWN; ROBERT L.) 15 October 1985 See claims 1,9,10, col.1 lines 51-65.	1-30

 Further documents are listed in the continuation of Box C. See patent family annex.

* 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 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

Date of the actual completion of the international search

30 MARCH 2012 (30.03.2012)

Date of mailing of the international search report

10 APRIL 2012 (10.04.2012)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsa-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

CHOI, Chun Sic

Telephone No. 82-42-481-5563



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/062743

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 08-198738 A	06.08.1996	None	
US 04295985 A	20.10.1981	None	
JP 08-198743 A	06.08.1996	None	
JP 2010-126506 A	10.06.2010	None	
JP 2004-024786 A	29.01.2004	JP 3986902 B2	03.10.2007
US 04547364 A	15.10.1985	None	