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(54) **Title:** WOOD PRESERVATIVE COMPOSITION

(57) **Abstract:** The present invention provides wood preservative composition containing a dispersed and/or emulsified phase comprising a wood preservative component; and a stabilizer. The stabilizer is a cationic polymer, an enzyme, organic polymer, quaternary ammonium compound and/or a mixture thereof. Also provided is a method of preserving wood or other cellulosic material which comprises applying to the wood or other cellulosic material.



WOOD PRESERVATIVE COMPOSITION

[0001] FIELD OF THE INVENTION

[0002] The present invention relates to a wood preservative composition and a method of treating wood and other cellulosic material with the wood preservative composition.

[0003] BACKGROUND OF THE INVENTION

[0004] Many types of wood preservative treatments exist on the market today. These treatments can be surface applied by spray or dip, or impregnated into the wood by vacuum pressure immersion treatments. During industrial application of preservatives, the wood is typically impregnated with the treatment composition containing the wood preservative composition to achieve either shell or full cell type penetration into the wood substrate. Depending on the wood species being treated and the end use, the depth of penetration of the treatment composition into the wood can have a significant bearing on the useful service life of the treated wood.

[0005] A typical industrial treatment plant will consist of a storage tank to hold the treatment composition and an autoclave. Wood or other cellulosic material is charged into the autoclave and the autoclave is then flooded with treatment composition. Combinations of vacuum and pressure are applied to achieve the required penetration of treatment composition into the wood or other cellulosic material. During the treatment process, an amount of treatment composition is consumed by way of being absorbed into the wood or other cellulosic material. The amount of the treatment composition absorbed typically represents a relatively small amount of the total volume of treatment composition used to flood the autoclave. This generates a scenario whereby treatment composition is repeatedly exposed to wood or cellulosic material and becomes "aged" due to repeated use. The average age of a treatment composition increases as a function of solution refresh rates. This can extend from several days to many months. As a result, the treatment composition is repeatedly exposed to wood being treated increasing the average age of the composition.

[0006] It has been observed that the ability of the preservative to penetrate into the wood substrate or cellulosic substrate, as the treatment solution is repeatedly exposed to wood or cellulosic material, can deteriorate very significantly with each and every treatment. This can have significant consequences to the useful service life of the treated wood or cellulosic article. Although not wishing to be bound to theory, it is believed that disruptive substances from wood or cellulosic extractives increase in the preservative composition after each and every treatment. This reduces the ability of the preservative to penetrate the wood or cellulosic substrate in subsequent treatments and over time as the composition is repeatedly used. One remedy to this problem is taught in WO 2013/064798, assigned to Arch Timber Protection. However, the method described in WO 2013/064798 does not address dispersed and/or emulsified phases, which typically contain anionic, nonionic or anionic/nonionic blends of dispersants and emulsifiers.

[0007] The stability of systems with dispersants and emulsifiers is a delicate balance of steric and electrostatic mechanisms. Any significant changes in pH and/or solution charge can irreversibly disrupt this stability. Addition of acidic compounds to anionic dispersions, for example, can destabilize the composition and cause agglomeration and settling of dispersed compounds or creaming of emulsified material. This is commonly observed in wood preservatives systems containing dispersed biocides, emulsified water repellents, dispersed pigments, etc. In the present invention, various stabilizing compounds are disclosed which protect dispersed and/or emulsified phases from the disruptive substances generated during the wood treatment. Unexpectedly, cationic polymers, enzymes, organic polymers and quaternary ammonium compounds have been found that are not only compatible with anionic dispersion and/or emulsion phases but are also very effective at stabilizing these phases against charge fluctuations during subsequent treatment cycles and improving penetration of the dispersed and/or emulsified phase.

[0008] Accordingly, there is a need in the art for improving both stability and penetration of dispersed and/or emulsified phases in biocidal formulations into wood. The present invention provides an answer to that need.

[0009] SUMMARY OF THE INVENTION

[0010] In one aspect, the present invention provides wood preservative compositions containing a dispersed and/or emulsified phase comprising a wood preservative component; and a stabilizer. The stabilizer is a cationic polymer, an enzyme, an organic polymer, a quaternary ammonium compound and/or a mixture thereof. The stabilizer is present in an amount effective to stabilize the dispersed and/or emulsified phase of the preservative composition which will allow the wood preservative component to effectively penetrate a wood substrate intended to be protected by the wood preservative composition.

[0011] In further aspect of the present invention, the dispersed and/or emulsified phase contains a biocidal agent, colorant, water repellent, fire retardant, binder, emulsifier, co-solvent, dispersant, UV inhibitor, antioxidant, or a combination thereof. The biocidal component contains a biocidal metal compounds; boron containing biocides, organic fungicides such as of amides; anilides; anilinopyrimidine; aromatic compounds; fungicidal heterocyclic compounds; strobilurins; azoles; isothiazolones; cyclohexylhydroxydiazene 1 -oxide, potassium salt, pyrion compounds; quaternary ammonium compounds or mixtures thereof.

[0012] In a particular embodiment, the biocidal agent is dispersed zinc and/or dispersed copper. The dispersed zinc or copper may be micronized zinc or micronized copper dispersed in a solvent.

[0013] In another embodiment, the cationic polymer is chitosan, cationic derivative of natural polymers selected from guar gum, starch, cellulose or hydroxycellulose, a polymer or copolymer having one or more of the following repeating units of formula (I), (II) or (III) described below or mixtures of the cationic polymers. The cation copolymer may have a molecular weight between 1,000 and 100,000. The composition may contain between about 0.001 and 10% by weight of the cationic polymer, more specifically between 0.01% and 4% by weight of the cationic polymer.

[0014] In yet a further embodiment of the present invention, the wood preservative composition contains a quaternary ammonium compound wherein the quaternary ammonium compound is trimethyl alkyl quaternary ammonium compounds; dialkyldimethyl quaternary ammonium compounds; alkyl dimethyl or alkyl diethyl benzyl ammonium compounds; polyethoxylated quaternary ammonium; N-substituted

pyridinium compounds, monoalkyl methyl bisalkoxylated quaternary ammonium compounds, dialkyl bisalkoxylated quaternary ammonium compounds, a protonated amine, a protonated dialkylamine or a protonated trialkylamine, protonated monoalkyl bisalkoxylated amine, a complex of one or more of the foregoing quaternary ammonium compounds with a complexing agent, or mixtures thereof.

[0015] In another embodiment of the present invention, the quaternary ammonium compound is dialkyldimethyl quaternary ammonium compound selected from the group consisting of didecyl dimethyl ammonium chloride, didecyl dimethyl ammonium carbonate, didecyl dimethyl ammonium bicarbonate, dioctyl dimethyl ammonium chloride and octyl decyl dimethyl ammonium chloride, or a mixtures thereof.

[0016] In a further embodiment, the stabilizer may be an enzyme, wherein the enzyme comprises a lipase, lipoxygenase, esterase, laccase, peroxidase, pectinase, protease, amylase, cellulase and/or xylanase.

[0017] In yet a further embodiment, the stabilizer may be an organic polymer, wherein the organic polymer is an acrylamide polymer or copolymer, a polyethylene oxide or copolymer, an alkyl polyglucoside, or a mixture thereof.

[0018] In another aspect of the present invention, provided is a method of preserving wood or other cellulosic material which contains applying to the wood or other cellulosic material a wood preservative composition of any of the previous embodiments of the present invention.

[0019] In a further aspect of the present invention provided is a wood treatment system containing a storage tank adapted to receive the wood to be treated and in said tank a volume of treatment solution comprising a wood preservative composition of any of the previous embodiments of the present invention.

[0020] These and other aspects will become apparent when reading the detailed description of the invention.

[0021] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] It has now been surprisingly found that the wood preservative compositions described herein are effective in treating wood and other cellulosic substrates, even after multiple applications of the wood treatment composition on to different wood or

cellulosic substrates. As used herein, the term "preservative" as used herein means a composition that renders the material to which it is applied more resistant to insect, fungal and microbial attack than the same material without having the composition applied.

[0023] The wood preservative contains a dispersed and/or emulsified phase and a stabilizer. The dispersed and/or emulsified phase is selected from the group consisting of biocidal agents, colorants, water repellents, fire retardants, binders, emulsifiers, co-solvents, dispersants, UV inhibitors, or mixtures or combinations thereof. The stabilizer is selected from the group consisting of cationic polymers, enzymes, organic polymers, quaternary ammonium compounds and mixtures thereof.

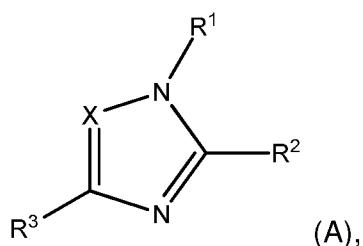
[0024] It has been discovered that such stabilizing agents allow the wood preservative composition containing dispersed and/or emulsified phases to be used to treat wood or cellulosic substrates, while maintaining the stability of the dispersed and/or emulsified phases. The biocidal agent is able to effectively penetrate the wood or cellulosic substrate even after the preservative composition is used to treat several batches of wood or cellulosic substrates. That is, the preservative composition of the present invention does not agglomerate, settle or separate over time and retains its ability to penetrate wood or cellulosic substrates even after the wood preservative has been used to treat multiple batches of wood or cellulosic substrates.

[0025] The wood preservative composition contains a biocidal agent and a stabilizer. The stabilizer allows the wood preservative composition to be used to treat multiple wood or cellulosic substrates, while allowing the biocidal agent to effectively penetrate the wood or cellulosic substrate even after the preservative composition is used to treat several wood or cellulosic substrates. That is, the preservative composition of the present invention does not appreciably lose its ability to penetrate wood or cellulosic substrates even after the wood preservative has been used to treat multiple batches of wood or cellulosic substrates.

[0026] The wood preservative composition may comprise as a biocidal agent, inter alia, one or more of the following active agents; biocidal metal compounds (in which the metal ion is the active biocidal agent); boron containing biocides such as boric acid, oxides and salts thereof and organic fungicides including fungicidal amides such as prochloraz, penthiopyrad, dichlofluanid and tolylfluanid; anilide fungicides such as

sedaxane and penflufen; anilinopyrimidine fungicides such as pyrimethanil, cyprodinil or mepanipyrim; fungicidal aromatic compounds such as chlorthalonil, cresol, dicloran, pentachlorophenol, sodium pentachlorophenol, 2-(thiocyanatomethylthio)-1,3-benzothiazole (TCMBC), dichlorophen, fludioxonil and 8-hydroxyquinoline; fungicidal heterocyclic compounds such as dazomet, fenpropimorph, bethoxazin and dehydroacetic acid; strobilurins such as azoxystrobin; azoles; isothiazolones; Potassium HDO (cyclohexylhydroxydiazene 1 -oxide, potassium salt), pyrion compounds such as sodium pyrithione, zinc pyrithione, copper pyrithione, 1-hydroxy-2-pyridinone and pyrion disulfide; quaternary ammonium compounds, and mixtures thereof.

[0027] The azole compound, i.e. a compound comprising an azole group, may be an imidazole or a 1,2,4-triazole and is preferably represented by the general formula (A)



wherein

X denotes CR⁴ or N;

R¹ denotes hydrogen or a linear, branched, cyclic, aromatic or any combination thereof, saturated or unsaturated, substituted or unsubstituted C₁ to C₄₀ group; wherein any of the carbon atoms other than those bound to the nitrogen atom shown in formula (A) may be replaced with an optionally substituted hetero atom;

R² denotes hydrogen, C₁-C₈ alkyl, C₂-C₈ alkenyl, C₆-C₁₀ aromatic, C₅-C₁₀ heteroaromatic or C₁-C₄ alkyl carbamate; and

R³ and R⁴ denote hydrogen; or together R³ and R⁴ may provide a benzimidazole group (i.e. R³ and R⁴ may combine to form -(CH)₄- linkage).

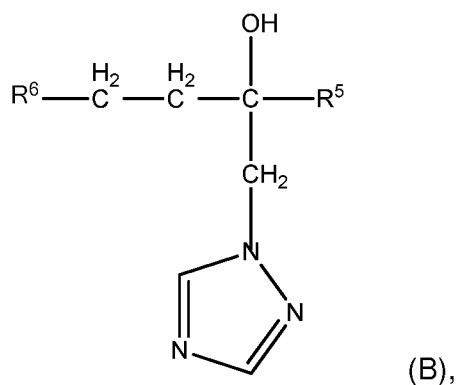
[0028] The formulations of the invention may contain one or more azole compounds, such as mixtures of an imidazole and a 1,2,4-triazole, or mixtures of two

or more 1,2,4-triazoles. However, the use 1,2,4-triazoles in the formulations of the invention is of particular interest.

[0029] An imidazole compound incorporates a five-membered di-unsaturated ring composed of three carbon atoms and two nitrogen atoms at non-adjacent positions. The imidazole compound may be a benzimidazole. Preferred compounds include thiabendazole, imazalil, carbendazim and prochloraz.

[0030] A 1,2,4-triazole compound incorporates a five-membered di-unsaturated ring composed of three nitrogen atoms and two carbon atoms at non-adjacent positions.

[0031] An exemplary triazole compounds include a triazole compound selected from compounds of formula (B):

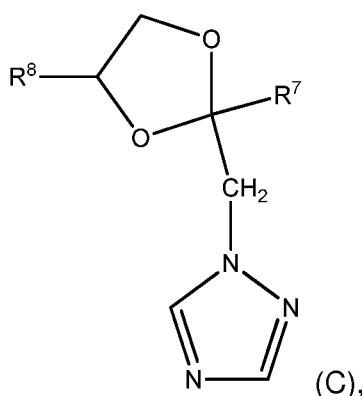


wherein

R⁵ represents a branched or straight chain C₁₋₅ alkyl group (e.g. t- butyl), and

R⁶ represents a phenyl group optionally substituted by one or more substituents selected from halogen (e.g. chlorine, fluorine or bromine) atoms or C₁₋₃ alkyl (e.g. methyl), C₁₋₃ alkoxy (e.g. methoxy), phenyl or nitro groups.

[0032] Alternatively, the triazole compound is advantageously selected from compounds of formula (C):



wherein

R⁷ is as defined for R⁶ above, and

R⁸ represents a hydrogen atom or a branched or straight chain C₁₋₅ alkyl group (e.g. methyl, ethyl, propyl, etc).

[0033] Particular triazoles include, but are not limited to, triadimefon, triadimenol, triazbutil, propiconazole, cyproconazole, difenoconazole, fluquinconazole, tebuconazole, flusilazole, uniconazole, diniconazole, bitertanol, hexaconazole, azaconazole, flutriafol, epoxyconazole, tetraconazole, penconazole, ipconazole, prothioconazole and mixtures thereof.

[0034] In one particular embodiment, the biocidal metal is a copper or a zinc metal. The biocidal metal may be a dispersed or an insoluble metal material. Examples of insoluble copper, such as in the form of submicron or micronized particles are illustratively, U.S. Patent Application Nos. 2006/0062926 and 2005/0255251 and US Patent No. 8,409,627, the disclosures of which are incorporated herein by reference in their entireties. These applications describe methodologies for making submicron-sized biocidal particulate slurries, such as particulate copper slurries, and their use as wood preservatives. The micronized copper based composition is suitably prepared by using conventional grinding methodology, or other means known in the small particle production industry. The composition comprises one or more of micronized elemental copper or copper-containing compounds and a liquid carrier medium, such as water or an organic solvent in which the micronized copper is insoluble. The exemplary copper containing compounds include copper carbonates, copper oxides, copper hydroxides, copper chlorides, copper aromatic or aliphatic carboxylates, copper aminocarboxylates, and combinations thereof. The copper containing

compound can also be any other suitable copper compounds known to those skilled in the art.

[0035] The term "micronized" as used herein means a particle size in the range of 0.001 to 25 microns. The term "particle size" refers to the largest axis of the particle, and in the case of a generally spherical particle, the largest axis is the diameter. Typically the insoluble micronized copper particles in the copper-based composition typically have a size such that wherein at least 95% of the particles have a particle diameter of from about 0.05 to about 1.5 microns, preferably from about 0.05 to about 1 micron, and most preferably from about 0.05 to about 0.7 microns. This type of insoluble metal material is referred to herein as dispersed metal.

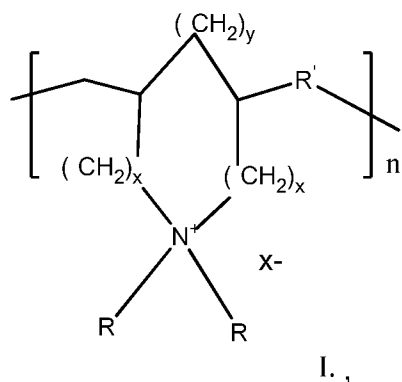
[0036] The biocidal metal ion may be a biocidal zinc ion. The biocidal zinc may advantageously be incorporated into the formulation in the form of inorganic zinc salts, such as carbonate, bicarbonate, chloride, hydroxide, borate, oxide or phosphate. Alternatively, the zinc may be in the form of an organozinc compound such as a simple organic salt, such as formate or acetate, or as a complex such as N-nitroso-N-cyclohexyl-hydroxylamine- zinc (zinc-HDO), zinc naphthenate or zinc pyrithione (bis(2-pyridylthio)zinc 1,1'- dioxide - CAS number 13463-41-7). Other exemplary zinc compounds include zinc oxide, zinc carbonate, zinc chloride, zinc borate and zinc pyrithione.

[0037] In another embodiment, the metal may be included in the formulation of the invention as a solubilized metal ion, in addition to the dispersed or emulsified metal ions. Suitable methods for solubilizing metal ions such as copper and zinc are known in the art, for example from WO93/02557. Suitable complexing agents for the copper or zinc ion include, for example, polyphosphoric acids such as tripolyphosphoric acid; ammonia; water soluble amines and alkanolamines capable of complexing with copper or zinc cations; aminocarboxylic acids such as glycine, glutamic acid, ethylenediaminetetraacetic acid (EDTA), hydroxyethyldiamine triacetic acid, nitrilotriacetic acid and N-dihydroxy ethylglycine. Where the complexing agents are acidic in nature they may be employed either as free acids or as their alkali metal or ammonium salts. These complexing agents may be used either alone or in combination with each other. Exemplary complexing agents are selected from alkanolamines, such as monoethanolamine, diethanolamine, triethanolamine,

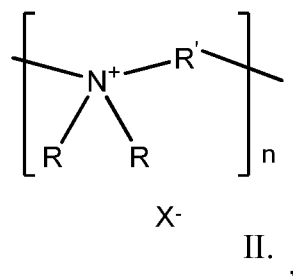
monopropanolamine, dipropanolamine, and tripropanolamine. Ethanolamines are generally used, with monoethanolamine being of particular interest.

[0038] The cationic polymer used in the preservative composition includes chitosan; cationic derivative of natural polymers such as guar gum, starch, cellulose and hydroxycellulose; a polymer or copolymer having one or more of the following repeating units of formula (I), (II), (III) or (IV):

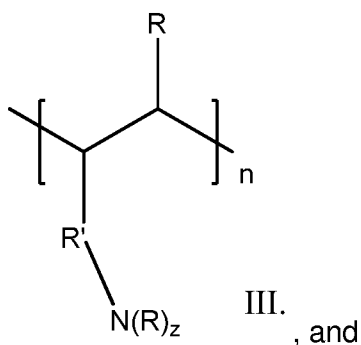
a. repeating units of formula (I)



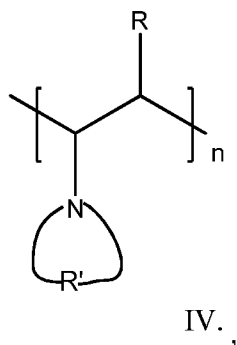
b. repeating units of formula (II)



c. repeating units of formula (III)



d. repeating units of formula (IV)



wherein

n is between 1 to 5000;

x is an integer equal to 0, 1 or 2;

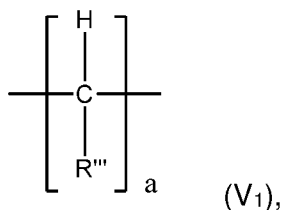
y is an integer equal to 0 or 1 ;

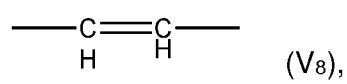
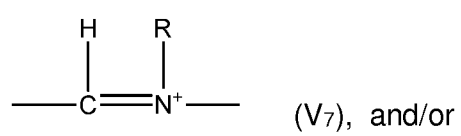
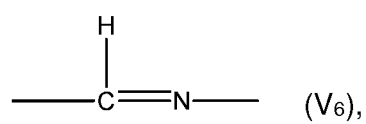
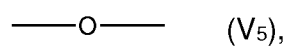
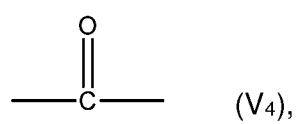
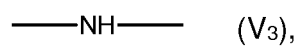
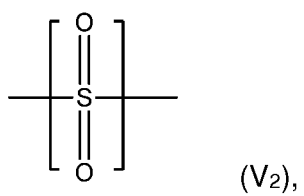
z is an integer equal to 2 or 3 and when z is 3, the nitrogen atom of formula III carries a positive charge and a counter ion X⁻ is present;

R groups, which can be identical or different, are each independently hydrogen or a straight chain, branched or cyclic alkyl, alkenyl, alkynyl, alkanoxyl, aryl, -(C=O)H, -(C=O)R^{''}, -CO₂H, -CO₂R^{''}, -CH₂CO₂H, -CH₂CO₂R^{''}, CH₂NR^{''}R^{''}, -CH₂CH(OH)CH₂Cl, -(C=O)NR^{''}R^{''}, -CN, -(CH₂)_w-O-R^{''}, in which; R^{''} groups, which can be identical or different, are hydrogen or a straight chain, branched or cyclic alkyl, alkenyl, alkynyl, alkanoxyl or aryl;

w is 2 or 3;

R' is a divalent group having one or more of the following groups V₁- V₈:





in which;

R''' is H, OH, or $N(R)_x$;

a is 0 to 20; and

X^- is any anion selected from chloride, bromide, iodide, fluoride, sulphate, phosphate, carboxylate especially propionate and lactate, carbonate, bicarbonate, nitrate, nitrite, hydroxide, cyanide;

or mixtures of the cationic polymers.

[0039] Exemplary cationic polymers for use in the formulations of the invention include: chitosan, cationic derivatives of natural polymers including guar gum, starch, cellulose and hydroxyl cellulose; Polydiallyldimethylammonium chlorides (polyDADMAC), including polyDADMAC-co-sulphones (DADMAC-co-SO₂), polyDADMAC-co-hydroxyethylcellulose (DADMAC-co-HEC), polyDADMAC-co-acrylamide (DADMAC-co-AM), polyDADMAC-co-acrylic acid (DADMAC-co-AA), and acrylic acid -DADMAC-acrylamide terpolymers (AA-co-DADMAC-AM); Polydiallylmethylamine chlorides (polyDAMAmC), including epichlorohydrin derivatives; Polydiallylamine chlorides (polyDAAmC), including polyDAAmC-co-sulphones (DAAmC-co-SO₂), polyDAAmC-co-maleic acid (DAAmC-co-MA); polyallylamines (polyAAm) including polyDAAmC-co-AAm; polyamines, including branched and linear epihalohydrin derivatives of polyamines or polyamidoamines, branched and linear polyethyleneimines (PEI), and polyionenes; polyvinyl amines (PVAm) including vinyl amine/ vinyl formamide copolymers, polyvinyl imidazole, and quaternized polyvinyl imidazole; polyamides; polyvinyl amides, including polyvinyl pyrrolidone and polyvinyl caprolactam; polyvinyl formamides; poly(acryloyloxy trimethyl ammonium (polyAcETA) or poly(methacryloyloxyethyl trimethyl ammonium) (polyMacETA) salts including polyMacETA-co-acrylamide (MacETA-co-Am), and polyMacETA-co-vinyl pyrrolidone (MacETA-co-VP); poly(acrylamidopropyl trimethyl ammonium) (polyAmPTA) or poly(methacrylamidopropyl trimethyl ammonium) (polyMamPTA) salts, including polyMamPTA-co-vinyl pyrrolidone (MamPTA-co-VP) and poly(acrylic acid-co-MamPTA-co-methyl acrylate) (AA-co-MamPTA-co-Mac).

[0040] Of particular interest are polyvinylamines, polyDADMACs, polyamines (both high and low MW polyamines), and polyionenes.

[0041] Generally the cationic polymer will have a molecular weight of about 1,000 to about 10,000, and typically will be in the range of about 2,000 to about 5,000. The preservative composition will generally contain between about 0.001% to about 10% by weight of the cationic polymer; typically between about 0.01% to about 4.0% by weight. A particularly useful range of the cationic polymer is in the 0.01 and 1.0%.

[0042] Exemplary cationic natural polymers include, for example, Guar Hydroxypropyltrimonium Chloride (Guar gum 2-hydroxy-3-(trimethylammonio) propyl ether chloride CAS# 65497-29-2); Hydroxypropyl Guar Hydroxypropyltrimonium Chloride (Guar gum, 2-hydroxypropyl 2-hydroxy-3-(trimethylammonio)propyl ether, chloride CAS# 71329-50-5); Starch Hydroxypropyltrimonium chloride (Starch, 2-hydroxy-3-(trimethylammonio)propyl ether, chloride CAS# 56780-58-6); Cellulose, omega-ether with alpha-2-hydroxy-3-(trimethylammonio) propyl-omega-hydroxypoly(oxy-1,2-ethanediyl) chloride (Polyquaternium-10, CAS# 68610-92-4); Hydroxyethyl cellulose dimethyl diallylammonium chloride copolymer (Polyquaternium-4 CAS# 92183-41-0); and chitosan (CAS# 9012-76-4).

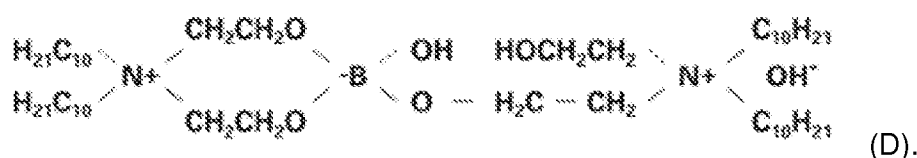
[0043] Exemplary polyionenes include, for example, Poly[(dimethyliminio)-1,3-propanediyl(dimethyliminio)-1,6-hexanediylbromide (1:2)] (Hexadimethrine Bromide, Ionene-6,3 Bromide; CAS# 28728-55-4), Poly[(dimethyliminio)-1,3-propanediyl(dimethyliminio)-1,6-hexanediylchloride (1:2)] (Hexadimethrine Chloride, Ionene-6,3 Chloride; CAS# 68393-49-7), Poly[oxyethylene (dimethyliminio) ethylene (dimethyliminio) ethylene dichloride] (Polixetonium chloride, Polyquaternium 42; CAS# 31512-74-0), Poly[(dimethyliminio)-1,3-propanediyl bromide(1:1)] (Ionene-3,3; CAS# 31622-87-4), Poly[(dimethyliminio)-1,6-hexanediylbromide (1:1)] (Ionene-6,6; CAS# 31622-88-5), Poly[(dimethyliminio)-1,6-hexanediyl(dimethyliminio)-1,10-decanediyl dibromide(1:2)] (Ionene-6,10; CAS# 28728-57-6), Poly[(dimethyliminio)-1,2-ethanediyl(dimethyliminio)-1,5-pentanediylbromide(1:2)] (Ionene-2,5; CAS# 51325-19-0), α -[4-[Tris(2-hydroxyethyl)ammonio]-2-buten-1-yl]- ω -[tris(2-hydroxyethyl)ammonio]poly[(dimethyliminio)-2-butene-1,4-diyl Chloride] Chloride; (Polidronium Chloride; Polyquaternium 1; CAS# 75345-27-6), and Poly[bis(2-chloroethyl)ether 1,3-bis[3-(dimethylamino)propyl]urea] quaternized (Polyquaternium 2; CAS# 68555-36-2).

[0044] Other stabilizers may be used either in place of or in combination with the cationic polymer and/or the quaternary ammonium compound. Such stabilizers include enzymes, organic polymers and mixtures thereof, wherein the stabilizer is present in an amount which will allow the preservative composition to effectively penetrate the wood being protected.

[0045] Particular enzymes include for example a lipase, lipoxygenase, esterase, laccase, peroxidase, pectinase, protease, amylase, cellulase, and/or xylanase.

[0046] Particular organic polymers include for example an acrylamide polymer or copolymers, and/or polyethylene oxide or copolymer. Further examples of organic polymers include alkyl polyglucosides, for example C₆-C₁₀ alkyl polyglucosides.

[0047] Particular quaternary ammonium compounds include trimethylalkyl quaternary ammonium compounds such as cocotrimethyl ammonium chloride; dialkyldimethyl quaternary ammonium compounds such as didecyl dimethyl ammonium chloride, didecyl dimethyl ammonium carbonate, didecyl dimethyl ammonium bicarbonate, dioctyl dimethyl ammonium chloride and octyl decyl dimethyl ammonium chloride, or mixtures thereof; alkyl dimethyl or diethyl benzyl ammonium salts such as benzalkonium chloride and benzalkonium hydroxide; polyethoxylated quaternary ammonium compounds such as N,N-didecyl-N-methyl- poly(oxyethyl) ammonium propionate (Bardap 26) or N,N-didecyl-N-methyl-poly(oxyethyl) ammonium lactate; and N-substituted pyridinium compounds such as cetyl pyridinium chloride. Further examples of quaternary ammonium compounds may include monoalkylmethyl bisalkoxylated quaternary ammonium salts such as cocoalkylmethyl bis(hydroxyethyl) ammonium chloride, ethoxylated; dialkyl bisalkoxylated quaternary ammonium salts such as didecyl bis(hydroxyethyl) ammonium hydroxide, ethoxylated. Other quaternary ammonium compounds may include quaternary ammonium compounds described herein which are complexed with an additional compound, such as a boron containing compound, for example, boric acid. An example of such a quaternary ammonium complex is didecyl bis(hydroxyethyl) ammonium borate, also referred to as a polymeric betaine, having the general formula D



[0048] This particular compound has a CAS# 21470-34-6. In this case, the complex is a complex of a dialkyl bisalkoxylated quaternary ammonium salts with boric acid. Other quaternary ammonium compound may also include quaternary amine salts formed by the protonation of monoalkylamines, dialkylamines, trialkylamines, and mono bisalkoxylated amines at pH values below their pKa.

[0049] Of these quaternary ammonium compounds of particular interest are benzalkonium chloride, didecyl dimethyl ammonium chloride and didecyl dimethyl ammonium carbonate. Of these quaternary ammonium compounds, didecyl dimethyl ammonium carbonate has been found to be particularly effective.

[0050] Types of wood which can benefit from treatment with the formulations of the invention include sawn timber, logs, glulam (glued laminated lumber), plywood, laminated veneer lumber (LVL), wood based composite products such as oriented strand board (OSB), medium density fiberboard (MDF), fiberboard, hardboard and particle board. It will be understood that "wood" in the context of this invention does not encompass living trees or other plants. Other cellulosic materials which can benefit from treatment with the formulations of the invention are lignocellulosic substrates, wood plastic composites, cardboard and cardboard faced building products such as plasterboard, and cellulosic material such as cotton. Also, leather, textile materials and even synthetic fibers, hessian, rope and cordage as well as composite wood materials. For convenience, the invention is described with reference to the treatment of wood but it will be appreciated that other cellulosic materials may be treated analogously. Generally, though not exclusively, the formulations are applied to sawn timber, logs or laminated veneer lumber, OSB or MDF.

[0051] For convenience, the preservative compositions of the present invention are applied as a liquid composition. They may also be applied as a solid implant or paste. The application of these formulations may be by one or more of dipping, deluging, spraying, brushing or other surface coating means or by impregnation methods, e.g. high pressure or double vacuum impregnation into the body of the wood or other material, all being techniques well known to the man skilled in the art. Impregnation under pressure is particularly advantageous when the substrate is wood or a wood composite material which is made to become wet during its life, for example, wood for

window frames, timber used above ground in exposed environments such as decking and timber used in ground contact or fresh water or salt water environments.

[0052] The preservative compositions of the invention are preferably used in immersion treatments of wood, in particular immersion treatments which utilize a vacuum and/or pressure. Thus, in a further aspect, the present invention provides a wood treatment system comprising a storage tank adapted to receive the wood to be treated and in said tank a volume of treatment solution comprising a dispersed and/or emulsified phase and a stabilizer as defined herein. Optionally the system further comprises an autoclave. Optionally the system comprises means to apply a vacuum or pressure, e.g. 25-95% of a full vacuum and 8-12 bar pressure.

[0053] Substrates made of wood or cellulosic material which have been treated with a formulation or product or by a method according to the invention as described herein, comprise further aspects of the present invention. Additionally, substrates made of wood or other cellulosic material containing a dispersed and/or emulsified phase and a stabilizer (e.g. a formulation) according to the invention comprise a further aspect of the present invention.

[0054] The present invention is further described in detail by means of the following Examples. All parts and percentages are by weight and all temperatures are degrees Celsius unless explicitly stated otherwise.

[0055] EXAMPLES

[0056] The micronized copper-based dispersion was prepared by micronizing basic copper carbonate (BCC) from a single source using a commercial grinding apparatus, and adding dispersing agents to prevent agglomeration of the micronized particles.

[0057] A micronized copper concentrate containing about 60% solids was prepared by mixing basic copper carbonate with water, a polycarboxylate dispersant, and a lignosulfonate dispersant wherein the dispersants were used in a 10:1 mixture, respectively. The mixture was mechanically stirred using a high speed mixer for 30 minutes. The mixture was then transferred into a LabStar bead mill, supplied by Netzsch Laboratories, and milled for 90 minutes at 1200 rpm.

[0058] An emulsifiable azole concentrate was prepared at 10 weight percent azoles and 1:1 wt. ratio of Tebuconazole and Propiconazole in a surfactant and/or solvent.

Emulsifiable azole/imidacloprid concentrates were prepared at 10.5 wt. percent actives with a 1:1:0.1 wt. ratio of Tebuconazole, Propiconazole and Imidacloprid in a surfactant and/or solvent.

[0059] The copper/azole composition was prepared by adding 272.7 grams of the micronized copper concentrate and 36.6 gram of the azole concentrate to water. The final weight of the wood treating solution was brought up to 100 pounds. The composition was calculated to be 0.2 weight percent copper and 0.008 weight percent azoles.

[0060] The azole/imidacloprid emulsion control was prepared by adding 217.7 grams of the azole/imidacloprid concentrate to water. The final weight of the wood treating solution was brought up to 100 pounds. The emulsion was calculated to be 0.005 weight percent azoles and 0.0025 weight percent imidacloprid. The emulsion was made 4 times and mixed together and then separated into 4 equal samples.

[0061] Where indicated in the following examples, preservative treatment solutions were aged to replicate commercial treatment plant solutions by the addition of Southern pine sawdust at 3.5% w/w and stirring for 1 hour. Solutions were then filtered to remove sawdust prior to wood treatment.

[0062] The following treatment solutions were made for Example 1.

[0063] Example 1

[0064] Control (fresh) - Copper/azole composition without additives.

[0065] Control (aged) - Copper/azole composition without additives.

[0066] Sample 1 (aged) – Copper/azole composition with 500 ppm didecyl dimethyl ammonium carbonate.

[0067] Sample 2 (aged) – Copper/azole composition with 500 ppm didecyl dimethyl ammonium carbonate and 250 ppm of the cationic polymer, polydimethylamine-co-epichlorohydrin.

[0068] Each of the treatment solutions were used to treat six southern yellow pine boards (2 inch x 6 inch x 24 inches). The boards were placed in an autoclave and were subjected to a vacuum of 24 inches of Hg for 5 minutes. Then the treatment solution was added to the autoclave and subjected to a pressure of 150 psi for a period of 20

minutes. The treatment solution was removed from the autoclave and then the boards were subject to 24 inches of Hg vacuum for 30 minutes. The boards were removed from the autoclave. The solution uptake for each of the solutions was determined and is reported in Table 1. As can be seen, gains in preservative solution uptake of 1.8 to 8.3% were seen with the presence of stabilizing additives.

[0069] TABLE 1

Sample	Uptake (lbs/cu ft.)	% Increase vs. Control (aged)
Control (fresh)	30.5	---
Control (aged)	27.6	---
Sample 1 (aged)	28.1	1.8
Sample 2 (aged)	29.9	8.3

[0070] Example 2

[0071] Control (fresh) - Copper/azole composition without additives.

[0072] Control (aged) - Aged copper composition without additives.

[0073] Sample 1 (aged) – Copper/azole composition with 500 ppm didecyl dimethyl ammonium carbonate.

[0074] Sample 2 (aged) – Copper/azole composition with 250 ppm of the cationic polymer, polydimethylamine-co-epichlorohydrin.

[0075] Sample 3 (aged) - Copper/azole composition with 500 ppm didecyl dimethyl ammonium carbonate and 250 ppm of the cationic polymer, polydimethylamine-co-epichlorohydrin.

[0076] Each of the treatment solutions were used to treat six southern yellow pine boards (2 inch x 6 inch x 24 inches). The boards were placed in an autoclave and were subjected to a vacuum of 24 inches of Hg for 5 minutes. Then the treatment solution

was added to the autoclave and subjected to a pressure of 150 psi for a period of 10 minutes. The treatment solution was removed from the autoclave and then the boards were subject to 24 inches of Hg vacuum for 30 minutes. The boards were removed from the autoclave. The solution uptake for each of the solutions was determined and is reported in Table 2. Stabilizing additives resulted in a 23-36% increase in solution uptakes.

[0077] TABLE 2

Sample	Uptake (lbs/cu ft.)	% Increase vs. Control (aged)
Control (fresh)	27.7	---
Control (aged)	17.5	---
Sample 1 (aged)	21.6	23.4
Sample 2 (aged)	23.8	36.0
Sample 3(aged)	23.9	36.6

[0078] Example 3

[0079] Control (aged) - Copper/azole composition without additives.

[0080] Sample 1 (aged) - Copper/azole composition with 200 ppm polyvinylamine.

[0081] Sample 2 (aged) - Copper/azole composition with 200 ppm polyamine low MW.

[0082] Sample 3 (aged) - Copper/azole composition with 200 ppm polyamine high MW.

[0083] Sample 4 (aged) - Copper/azole composition with 200 ppm poly(diallyldimethyl ammonium chloride).

[0084] Sample 5 (aged) - Copper/azole composition with 200 ppm of polyionene.

[0085] Each of the treatment solutions were used to treat a southern yellow pine board (2 inch x 6 inch x 24 inches). The boards were placed in an autoclave and were subjected to a vacuum of 24 inches of Hg for 5 minutes. Then the treatment solution was added to the autoclave and subjected to a pressure of 150 psi for a period of 25 minutes. The treatment solution was removed from the autoclave and then the boards were subject to 24 inches of Hg vacuum for 30 minutes. The boards were removed from the autoclave. The solution uptake for each of the solutions was determined and is reported in Table 3. Gains of up to 50% in solution uptake were seen when stabilizing additives when included in the treatments.

[0086] TABLE 3

Sample	Uptake (lbs/cu ft.)	% Increase vs. Control (aged)
Control (aged)	22	---
Sample 1	26	18
Sample 2	30	39
Sample 3	31	43
Sample 4	31	44
Sample 5	33	52

[0087] Example 4

[0088] Control - copper/azole (25/1 w/w) composition without additives.

[0089] Sample 1 - copper/azole/C₈ alkyl glucoside (44 ppm) composition.

[0090] Sample 2 - copper/azole/ C₈ alkyl glucoside (88 ppm) composition.

[0091] Sample 3 - copper/azole/ C₈ alkyl glucoside (176 ppm) composition.

[0092] Sample 4 - copper/azole/C₆ alkyl glucoside (44 ppm) composition.

[0093] Sample 5 - copper/azole/C₆ alkyl glucoside (88 ppm) composition.

[0094] Sample 6 - copper/azole/C₆ alkyl glucoside (176 ppm) composition.

[0095] Each of the treatment solutions were used to treat six end-sealed southern yellow pine boards (2 inch x 6 inch x 8 inches). The boards were placed in an autoclave and were subjected to a vacuum of 24 inches of Hg for 5 minutes. Then the treatment solution was added to the autoclave and subjected to a pressure of 150 psi for a period of 10 minutes. The treatment solution was removed from the autoclave and then the boards were subject to 24 inches of Hg vacuum for 30 minutes. The boards were removed from the autoclave. The solution uptake for each of the solutions was determined and is reported in Table 4. All samples had increased solution uptakes vs. the control.

[0096] TABLE 4

Sample	Uptake (lbs/cu ft.)	% Increase vs. Control
Control	28.2	---
Sample 1	28.8	2.3
Sample 2	28.8	2.0
Sample 3	29.7	5.3
Sample 4	29.1	3.0
Sample 5	30.0	6.2
Sample 6	31.2	10.5

[0097] Wafers (2 inch x 6 inch x 0.5 inches) were taken from each board and cut into 3 zones: Zone 1 (exterior 1/4"), Zone 2 (second 1/4"), and Zone 3 (core). Each zone was ground into sawdust and analyzed for copper and azoles. The relative wt. %

copper and azoles in each zone are shown in Tables 5 and 6. Improved penetration gradients for copper and azole preservatives were observed for all samples in Zone 2 and/or Zone 3.

[0098] TABLE 5

Sample	Cu, as % of Zone 1			Zone 2 % Change vs. Control	Zone 3 % Change vs. Control
	Zone 1	Zone 2	Zone 3		
Control	100	76.7	69.9	---	---
Sample 1	100	82.1	81.1	7.1	16.0
Sample 2	100	74.0	71.0	-3.5	1.6
Sample 3	100	84.2	88.4	9.8	26.5
Sample 4	100	85.2	89.1	11.0	27.5
Sample 5	100	76.8	77.8	0.2	11.3
Sample 6	100	73.9	76.6	-3.7	9.6

[0099] TABLE 6

Sample	Azole, as % of Zone 1			Zone 2 % Change vs. Control	Zone 3 % Change vs. Control
	Zone 1	Zone 2	Zone 3		
Control	100	43.6	29.0	---	---
Sample 1	100	45.6	33.3	4.7	14.8
Sample 2	100	43.9	31.6	0.7	8.8

Sample 3	100	45.8	37.3	5.1	28.4
Sample 4	100	50.8	41.0	16.7	41.2
Sample 5	100	46.2	33.8	6.0	16.6
Sample 6	100	45.4	31.8	4.4	9.6

[00100] Example 5

[00101] Control - Azole/Imidacloprid emulsion without additives.

[00102] Sample 1 - Azole/Imidacloprid/polyamine low MW (50 ppm) emulsion.

[00103] Sample 2 - Azole/Imidacloprid/polyamine low MW (100 ppm) emulsion.

[00104] Sample 3 - Azole/Imidacloprid/polyamine low MW (150 ppm) emulsion.

[00105] Sample 4 - Azole/Imidacloprid/polyamine low MW (200 ppm) emulsion.

[00106] Each of the treatment solutions were used to treat six southern yellow pine boards (2 inch x 6 inch x 24 inches). The boards were placed in an autoclave and were subjected to a vacuum of 24 inches of Hg for 5 minutes. Then the treatment solution was added to the autoclave and subjected to a pressure of 150 psi for a period of 10 minutes. The treatment solution was removed from the autoclave and then the boards were subject to 24 inches of Hg vacuum for 30 minutes. The boards were removed from the autoclave. The solution uptake for each of the solutions was determined and is reported in Table 7.

[00107] TABLE 7

Sample	Uptake (lbs/cu ft.)	% Increase vs. Control
Control	26.0	---
Sample 1	35.5	36.7

Sample 2	36.4	40.0
Sample 3	34.4	32.2
Sample 4	35.5	36.7

[00108] Wafers (2 inch x 6 inch x 0.5 inches) were taken from each board and cut into 3 zones: Zone 1 (exterior 1/4"), Zone 2 (second 1/4"), and Zone 3 (core). Each zone was ground into sawdust and analyzed for azole and imidacloprid concentration. The relative azole and imidacloprid concentrations in each zone are shown in Tables 8 and 9. Improved penetration gradients for azole and imidacloprid preservatives were observed for all samples vs. control in Zone 2 and/or Zone 3.

[00109] TABLE 8

Sample	Azoles, as % of Zone 1			Zone 2 % Change vs. Control	Zone 3 % Change vs. Control
	Zone 1	Zone 2	Zone 3		
Control	100	33.9	16.6	---	---
Sample 1	100	48.4	29.5	0.0	0.0
Sample 2	100	48.0	30.6	-0.8	3.7
Sample 3	100	55.0	35.1	13.6	18.8
Sample 4	100	53.9	34.6	11.4	17.0

[00110] TABLE 9

Sample	Imidacloprid, as % of Zone 1			Zone 2 % Change vs. Control	Zone 3 % Change vs. Control
	Zone 1	Zone 2	Zone 3		

Control	100	43.8	31.3	---	---
Sample 1	100	61.1	50.0	39.7	60.0
Sample 2	100	55.6	50.0	27.0	60.0
Sample 3	100	61.1	55.6	39.7	77.8
Sample 4	100	68.8	56.3	57.1	80.0

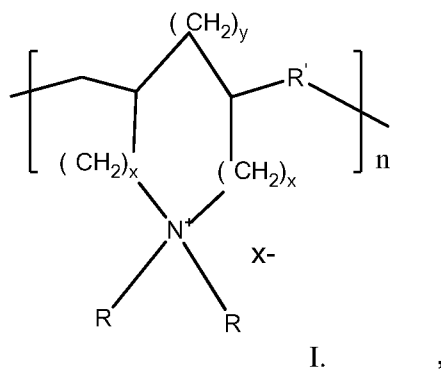
[00111] While the invention has been described above with references to specific embodiments thereof, it is apparent that many changes, modifications and variations can be made without departing from the invention concept disclosed herein. Accordingly, it is intended to embrace all such changes, modifications, and variations that fall within the spirit and broad scope of the appended claims.

What is claimed is:

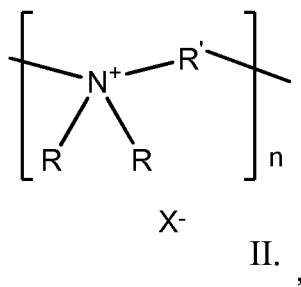
1. A wood preservative composition comprising
 - a) a dispersed and/or emulsified phase including a wood preservative component;
and
 - b) a stabilizer, the stabilizer selected from the group consisting of cationic polymers, enzymes, organic polymers, quaternary ammonium compounds, and mixtures thereof;wherein the stabilizer is present in an amount effective to stabilize the dispersed and/or emulsified phase of the preservative composition which will allow the wood preservative component to effectively penetrate a wood substrate intended to be protected by the wood preservative composition.
2. The wood preservative composition according to claim 1, wherein the dispersed and/or emulsified phase comprises a biocidal agent, colorant, water repellent, fire retardant, binder, emulsifier, co-solvent, dispersant, UV inhibitor, antioxidant, or a combination thereof.
3. The wood preservative composition according to any of the preceding claims, wherein the dispersed and/or emulsified phase comprises a biocidal component and the biocidal component comprises biocidal metal compounds; boron containing biocides organic fungicides selected from the group consisting of amides; anilides; anilinopyrimidine; aromatic compounds; fungicidal heterocyclic compounds; strobilurins; azoles; isothiazolones; cyclohexylhydroxydiazene 1 - oxide, potassium salt, pyron compounds; quaternary ammonium compounds and mixtures thereof.
4. The wood preservative composition according to any of the preceding claims, wherein the biocidal agent comprises dispersed zinc and/or dispersed copper.

5. The wood preservative composition according to any of the preceding claims, wherein the dispersed zinc or copper comprises micronized zinc or micronized copper dispersed in a solvent.
6. The wood preservative composition according to any of the preceding claims, wherein the cationic polymer comprises chitosan, cationic derivative of natural polymers selected from guar gum, starch, cellulose or hydroxycellulose, a polymer or copolymer having one or more of the following repeating units of formula (I), (II) or (III):

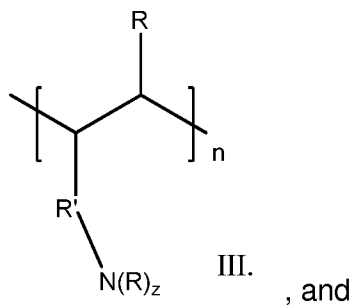
a. repeating units of formula (I)



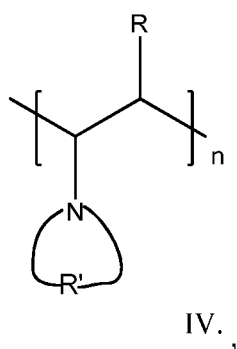
b. repeating units of formula (II)



c. repeating units of formula (III)



d. repeating units of formula (IV)



wherein

n is between 1 to 5000;

x is an integer equal to 0, 1 or 2;

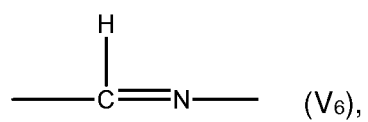
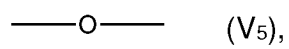
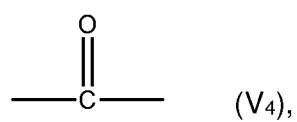
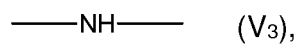
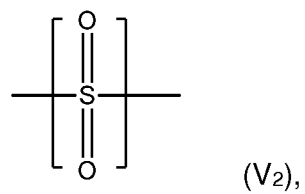
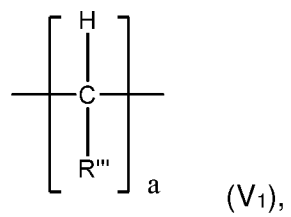
y is an integer equal to 0 or 1 ;

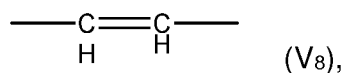
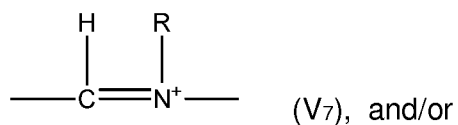
z is an integer equal to 2 or 3 and when z is 3, the nitrogen atom of formula III carries a positive charge and a counter ion X^- is present;

R groups, which can be identical or different, are each independently hydrogen or a straight chain, branched or cyclic alkyl, alkenyl, alkynyl, alkanoxyl, aryl, $-(C=O)H$, $-(C=O)R''$, $-CO_2H$, $-CO_2R''$, $-CH_2CO_2H$, $-CH_2CO_2R''$, $CH_2NR''R''$, $-CH_2CH(OH)CH_2Cl$, $-(C=O)NR''R''$, $-CN$, $-(CH_2)_w-O-R''$, in which; R'' groups, which can be identical or different, are hydrogen or a straight chain, branched or cyclic alkyl, alkenyl, alkynyl, alkanoxyl or aryl;

w is 2 or 3;

R' is a divalent group having one or more of the following groups V₁ - V₈:





in which;

R^m is H, OH, or N(R)_x;

a is 0 to 20; and

X⁻ is any anion selected from chloride, bromide, iodide, fluoride, sulphate, phosphate, carboxylate especially propionate and lactate, carbonate, bicarbonate, nitrate, nitrite, hydroxide, and cyanide;

or mixtures of the cationic polymers.

7. The wood preservative composition according to any of the preceding claims, wherein the cationic polymer has a molecular weight between 1,000 and 100,000.
8. The wood preservative composition according to any of the preceding claims, wherein the cationic polymer has a molecular weight between 1,000 and 100,000.
9. The wood preservative composition according to any of the preceding claims, wherein the composition contains between about 0.001 and 10% by weight of the cationic polymer.

10. The wood preservation composition according to any of the preceding claims, wherein the composition contains between 0.01% and 4% by weight of the cationic polymer.
11. The wood preservative composition according to any of the preceding claims, wherein the quaternary ammonium compound is selected from the group consisting of trimethyl alkyl quaternary ammonium compounds; dialkyldimethyl quaternary ammonium compounds; alkyl dimethyl or alkyl diethyl benzyl ammonium compounds; polyethoxylated quaternary ammonium; N-substituted pyridinium compounds, monoalkyl methyl bisalkoxylated quaternary ammonium compounds, dialkyl bisalkoxylated quaternary ammonium compounds, a protonated amine, a protonated dialkylamine or a protonated trialkylamine, protonated monoalkyl bisalkoxylated amine, a complex of one or more of the forgoing quaternary ammonium compounds with a complexing agent, or mixtures thereof.
12. The wood preservative composition according to any of the preceding claims, wherein the quaternary ammonium compound is dialkyldimethyl quaternary ammonium compound selected from the group consisting of didecyl dimethyl ammonium chloride, didecyl dimethyl ammonium carbonate, didecyl dimethyl ammonium bicarbonate, dioctyl dimethyl ammonium chloride and octyl decyl dimethyl ammonium chloride, or mixtures thereof.
13. The wood preservative composition according to any of the preceding claims, wherein the quaternary ammonium compound comprises didecyl dimethyl ammonium carbonate.
14. The wood preservative composition according to any of the preceding claims, wherein the quaternary ammonium compound is selected from the group consisting of trimethyl alkyl quaternary ammonium compounds; dialkyldimethyl quaternary ammonium compounds; alkyl dimethyl or alkyl diethyl benzyl ammonium compounds; polyethoxylated quaternary ammonium; N-substituted

pyridinium compounds, monoalkyl methyl bisalkoxylated quaternary ammonium compounds, dialkyl bisalkoxylated quaternary ammonium compounds, a protonated amine, a protonated dialkylamine or a protonated trialkylamine, protonated monoalkyl bisalkoxylated amine, a complex of one or more of the foregoing quaternary ammonium compounds with a complexing agent, or mixtures thereof.

15. The wood preservative composition according to any of the preceding claims, wherein the quaternary ammonium compound is dialkyldimethyl quaternary ammonium compound selected from the group consisting of didecyl dimethyl ammonium chloride, didecyl dimethyl ammonium carbonate, didecyl dimethyl ammonium bicarbonate, dioctyl dimethyl ammonium chloride and octyl decyl dimethyl ammonium chloride, or mixtures thereof.
16. The wood preservative composition according to any of the preceding claims, wherein the quaternary ammonium compound comprises didecyl dimethyl ammonium carbonate.
17. The wood preservative composition according to any of the preceding claims, wherein the enzyme comprises a lipase, lipoxygenase, esterase, laccase, peroxidase, pectinase, protease, amylase, cellulase and/or xylanase.
18. The wood preservative composition according to any of the preceding claims, wherein the organic polymer comprises an acrylamide polymer or copolymer, a polyethylene oxide or copolymer, an alkyl polyglucoside, or a mixture thereof.
19. The wood preservative composition according to any of the preceding claims, wherein the dispersed and/or emulsified phase comprises dispersed zinc or copper, and the composition further comprises a copper or zinc complex with an amino compound.

20. A method of preserving wood or other cellulosic material which comprises applying to the wood or other cellulosic material a wood preservative composition of any of the preceding claims.
21. A method of preserving wood or other cellulosic material which comprises applying to the wood or other cellulosic material a wood preservative composition of any of the preceding claims.
22. A wood treatment system comprising a storage tank adapted to receive the wood to be treated and in said tank a volume of treatment solution comprising a wood preservative composition as defined in any of the preceding claims.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/028616

A. CLASSIFICATION OF SUBJECT MATTER
INV. B27K3/22 C08L79/02
ADD.

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)
B27K C08L

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

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

EPO-Internal, BIOSIS, COMPENDEX, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2013/064798 A1 (ARCH TIMBER PROTECTION LTD [GB]) 10 May 2013 (2013-05-10) cited in the application claims; examples -----	1-6, 18-22
X	US 5 186 947 A (GOETTSCHKE REIMER [DE] ET AL) 16 February 1993 (1993-02-16) claims; examples -----	1-16, 18-22
X	US 2004/016909 A1 (ZHANG JUN [US] ET AL) 29 January 2004 (2004-01-29) claims; examples -----	1-10, 18-22
X	WO 2006/118980 A2 (CHEMICAL SPECIALTIES INC [US]; JIN LEHONG [US]; PRESTON ALAN F [US]; A) 9 November 2006 (2006-11-09) claims; examples ----- -/--	1-5, 11-16, 18-22



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"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

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"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

21 July 2015

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2015/028616

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SCHUBERT ET AL: "Protection of Wood from microorganisms by laccase-catalysed iodination", APPLIED AND ENVIRONMENTAL MICROBIOLOGY, AMERICAN SOCIETY FOR MICROBIOLOGY, US, vol. 78, no. 20, 1 October 2012 (2012-10-01), pages 7267-7275, XP009163868, ISSN: 0099-2240 the whole document -----	17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/028616

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013064798	A1	10-05-2013	
		AU 2012330920 A1	15-05-2014
		CA 2854445 A1	10-05-2013
		CL 2014001115 A1	21-11-2014
		CN 104066333 A	24-09-2014
		EA 201490898 A1	30-10-2014
		EP 2775846 A1	17-09-2014
		JP 2014532689 A	08-12-2014
		KR 20140098076 A	07-08-2014
		US 2014242404 A1	28-08-2014
		WO 2013064798 A1	10-05-2013

US 5186947	A	16-02-1993	
		AT 117618 T	15-02-1995
		AU 638873 B2	08-07-1993
		CA 2053698 A1	21-04-1992
		CS 9103165 A3	13-05-1992
		DE 4033419 A1	23-04-1992
		DE 59104396 D1	09-03-1995
		DK 0482433 T3	10-04-1995
		EP 0482433 A1	29-04-1992
		ES 2067827 T3	01-04-1995
		FI 914834 A	21-04-1992
		JP 3115376 B2	04-12-2000
		JP H04339602 A	26-11-1992
		NO 914101 A	21-04-1992
		NZ 240048 A	25-11-1992
		PL 292098 A1	01-06-1992
		US 5186947 A	16-02-1993

US 2004016909	A1	29-01-2004	
		AU 2003256832 A1	16-02-2004
		CA 2493922 A1	05-02-2004
		EP 1545205 A2	29-06-2005
		JP 2006502126 A	19-01-2006
		NZ 538153 A	31-05-2007
		US 2004016909 A1	29-01-2004
		WO 2004011215 A2	05-02-2004

WO 2006118980	A2	09-11-2006	
		AU 2006242478 A1	09-11-2006
		BR PI0611129 A2	09-11-2010
		CA 2605735 A1	09-11-2006
		DE 112006001077 T5	27-03-2008
		JP 2008540412 A	20-11-2008
		NZ 562592 A	25-02-2011
		SE 0702536 A	19-11-2007
		US 2006251915 A1	09-11-2006
		WO 2006118980 A2	09-11-2006
