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(54) Title: A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM

(57) Abstract: A wood preservative composition comprising 4,5-dichloro-2-octylisothiazol-3(2H)-one, a method of treating a wood substrate therewith, and a wood product produced therefrom are provided. The wood preservative composition comprises at least 0.5 % by weight of DCOI based on the total weight of the composition and a retaining additive comprising a solvent-borne polymeric resin, a wax, or a combination thereof. A weight ratio of the DCOI to the retaining additive in the composition is in a range of 1:5 to 5:1.

TITLE

A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM

CROSS-REFERENCE

[0001] The present application claims priority to U.S. Provisional Application No. 63/229,817, filed August 5, 2021, the entire contents of which is hereby incorporated by reference in its entirety.

FIELD

[0002] The present disclosure relates to a wood preservative composition comprising 4,5-dichloro-2-octylisothiazol-3(2H)-one, a method of treating a wood substrate therewith, and a wood product produced therefrom.

BACKGROUND

[0003] Oil-borne preservatives, such as, for example, pentachlorophenol (Penta) in hydrocarbon solvent carriers have been used as heavy-duty industrial wood preservative to treat, for example, utility poles for many decades. Oil-borne preservatives comprising Penta may impart treated wood with excellent resistance to wood decay fungi and termites as well as potentially desirable climbability, electrical resistance, and inhibition of corrosion of hardware. However, in 2015, the Stockholm Convention classified Penta as a persistent organic pollutant (POP) and proposed to discontinue its use. In 2019, the only North American producer of Penta made an announcement that they will close its manufacturing plant and a blending facility at the end of 2021. In March 2021, the EPA made a proposal to cancel all uses of pentachlorophenol through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) registration review process. Therefore, an alternative oil-borne preservative to oil-borne preservatives comprising Penta is desired.

SUMMARY

[0004] The present disclosure provides a wood preservative composition comprising at least 0.5 % by weight of 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on the total weight of the

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composition and a retaining additive comprising a solvent-borne polymeric resin, a wax, or a combination thereof. A weight ratio of the DCOI to the retaining additive in the composition is in a range of 1:5 to 5:1.

[0005] The present disclosure also provides a method of treating a wood substrate. The method comprises contacting the wood substrate with a wood preservative composition for a period of time suitable to inhibit fungal decay of the wood substrate. The wood preservative composition comprises at least 0.5 % by weight of 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on the total weight of the composition and a retaining additive comprising a solvent-borne polymeric resin, a wax, or a combination thereof. A weight ratio of the DCOI to the retaining additive in the composition is in a range of 1:5 to 5:1.

[0006] The present disclosure also provides a wood product produced by treating a wood substrate with a wood preservative composition. The wood preservative composition comprises at least 0.5 % by weight of 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on the total weight of the composition and a retaining additive comprising a solvent-borne polymeric resin, a wax, or a combination thereof. A weight ratio of the DCOI to the retaining additive in the composition is in a range of 1:5 to 5:1.

[0007] The present disclosure also provides a wood product comprising a wood preservative composition. The wood preservative composition comprises at least 0.5 % by weight of 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on the total weight of the composition and a retaining additive comprising a solvent-borne polymeric resin, a wax, or a combination thereof. A weight ratio of the DCOI to the retaining additive in the composition is in a range of 1:5 to 5:1.

[0008] It is understood that the inventions described in this specification are not limited to the examples summarized in this Summary. Various other aspects are described and exemplified herein.

DETAILED DESCRIPTION

[0009] Certain exemplary aspects of the present disclosure will now be described to provide an overall understanding of the principles of the structure, function, manufacture, and use of the compositions, methods, and products disclosed herein. One or more examples of these aspects are illustrated in the accompanying drawings. Those of ordinary skill in the art will understand

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that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary aspects and that the scope of the various examples of the present disclosure is defined solely by the claims. The features illustrated or described in connection with one exemplary aspect may be combined with the features of other aspects. Such modifications and variations are intended to be included within the scope of the present disclosure.

[0010] Any references herein to "various examples," "some examples," "one example," "an example," similar references to "aspects," or the like, means that a particular feature, structure, or characteristic described in connection with the example is included in at least one example. Thus, appearances of the phrases "in various examples," "in some examples," "in one example," "in an example," similar references to "aspects," or the like, in places throughout the specification are not necessarily all referring to the same example. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more examples. Thus, the particular features, structures, or characteristics illustrated or described in connection with one example may be combined, in whole or in part, with the features, structures, or characteristics of one or more other examples without limitation. Such modifications and variations are intended to be included within the scope of the present examples.

[0011] 4,5-dichloro-2-octylisothiazol-3(2H)-one (DCOI) has been used in wood preservative compositions for mold control and antibacterial activity. DCOI dissolved in hydrocarbon solvents has also been proposed to treat wood for heavy duty applications. The present disclosure provides a wood preservative composition comprising DCOI, an organic solvent, and a retaining additive that the present inventors surprisingly discovered that can enhance resistance to fungal and/or insect attack.

[0012] DCOI ($C_{10}H_{15}Cl_2NOS$) is an organic compound biocide that can inhibit fungal decay and/or insect attack of a wood product. Thus, the concentration of the DCOI in the wood preservative composition according to the present disclosure can be selected based on the desired level of inhibition of the fungal decay and/or insect attack, and/or based on the method used to treat the wood product. For example, the wood preservation composition according to the present disclosure can comprise a concentration of DCOI of at least 0.5 % by weight based on the total weight of the composition, such as, for example, at least 1.0 % by weight, at least 2.0 % by weight, at least 2.5 % by weight, or at least 3.0 % by weight, all based on the total weight of the composition. The wood preservation composition according to the present

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disclosure can comprise a concentration of DCOI no greater than 10 % by weight based on the total weight of the composition, such as, for example, no greater than 9 % by weight, no greater than 8 % by weight, no greater than 5 % by weight, no greater than 4 % by weight, or no greater than 3 % by weight, , all based on the total weight of the composition. In various examples, the wood preservative composition according to the present disclosure can comprise a concentration of DCOI in a range of 0.5 % by weight to 10 % by weight based on the total weight of the composition, such as, for example, 1.0 % by weight to 5.0 % by weight, 1.5 % by weight to 5.0 % by weight, 1.5 % by weight to 3.0 % by weight, 2.0 % by weight to 3.0% by weight, 2.0 % by weight to 2.5 % by weight, 1.5 % by weight to 2.0 % by weight, all based on the total weight of the composition. For example, the wood preservative composition according to the present disclosure can comprise 2 % by weight DCOI based on the total weight of the composition.

[0013] The organic solvent can facilitate solubilization of the DCOI and/or the retaining additive and/or the penetration of the DCOI into a wood product. For example, DCOI can comprise a solubility of 2% in the organic solvent, such as, for example, at least 5% in the organic solvent. The organic solvent can comprise one solvent, or a mixture of two or more solvents based on the application and/or desired properties of the organic solvent. The organic solvent can comprise a hydrocarbon solvent (e.g., diesel #2, diesel #4, diesel #6, an aliphatic solvent), an amine solvent, a glycol solvent, a ketone solvent, an ester solvent, an alcohol solvent, a halogenated solvent, a terpene solvent, an aromatic solvent, a biodegradable organic solvent, or a combination thereof.

[0014] When employed in wood preservative composition according to the present disclosure the hydrocarbon solvent can comprise various hydrocarbon classes and chain lengths. For example, the hydrocarbon solvent can be a hydrocarbon solvent as defined in American Wood Protection Association (AWPA) 2021 Book of Standards HSA-18, HSC-17, HSF-17, HSG-18, HSH-18, or a combination thereof. The chain length and hydrocarbon classes of the hydrocarbon solvents suitable for use with the present disclosure can be selected to achieve a desired flash point of the composition and/or solubility of the DCOI and/or retaining additive. For example, the organic solvent can comprise a hydrocarbon solvent, such as, for example, diesel. The organic solvent can comprise a flash point of at least 20 degrees Celsius, such as, for example, at least 50 degrees Celsius or at least 60 degrees Celsius, at least 70 degrees Celsius, at least 80 degrees Celsius, at least 90 degrees Celsius, at least 100 degrees Celsius, at least 110

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degrees Celsius, at least 120 degrees Celsius, at least 150 degrees Celsius, or at least 200 degrees Celsius. The hydrocarbon solvent can be derived from petroleum based products.

[0015] The aliphatic solvent can comprise, Heptane, Hexane, Kerosene, Lacquer Diluent, Mineral Seal Oil, #2 fuel oil, Mineral Spirits, n-Pentane, OMS-Odorless Mineral Spirits, Rubber Solvent, 140 Solvent, 360 Solvent, Textile Spirits.RTM., VM&P, or a combination thereof.

[0016] The amine solvent can comprise Diamylamine, Diethylamine, Diisopropylamine, Dimethylethylamine, Di-n-Butylamine, Mono-2-Ethylhexyamine, Monoamylamine, Monoethylamine 70%, Monoisopropylamine, Anhy., Mono-n-Butylamine, Triamylamine, Triethylamine, Tri-n-Butylamine, Dibutylaminoethanol, Diethylaminoethanol, Diethylaminoethoxyethanol, Diisopropylaminoethanol, Dimethylamino-2P, 77% Mixed, Dimethylamino-2-P, Anhy., Dimethylaminoethanol, Dimethylaminoethoxyethanol, Ethylaminoethanol, Ethylaminoethanol, Mixed, Isopropylaminoethanol, Isopropylaminoethanol, Mixed, Methyldiethanolamine, Monomethylaminoethanol, Mono-n-Propylaminoethanol, n-Butylaminoethanol, n-Butyldiethanolamine, n-Butyldiethanolamine, Photo, t-Butylaminoethanol, t-butyldiethanolamine, Diethanolamine, Monoethanolamine, Triethanolamine, Triethanolamine 85%/99%, Diisopropanolamine, Monoisopropanolamine, Triisopropanolamine, Aminoethylethanolamine, Aminoethylpiperazine, Diethylenetriamine, Ethylenediamine, Piperazine 65%/Anhy., Piperazine, Tetraethylenepentamine, Triethylenetetramine, 3-Methoxypropylamine, AMP.RTM. Regular/95, Cyclohexylamine, Morpholine, Neutrol TE.RTM, or a combinations thereof.

[0017] The glycol solvent can comprise Diethylene Glycol, Dipropylene Glycol, Ethylene Glycol, Glycerine 96%, 99%, U.S.P., Glycerine, Hexylene Glycol, Neol.RTM. Neopentyiglycol, Polyethylene Glycol, Polypropylene Glycol, Propylene Glycol Ind., U.S.P., Tetraethylene Glycol, Triethylene Glycol, Tripropylene Glycol, or a combination thereof.

[0018] The ketone solvent can comprise Acetone, Cyclohexanone, Diacetone, DIBK--Diisobutyl Ketone, Isophorone, MAK--Methyl Amyl Ketone, MEK--Methyl Ethyl Ketone, MIAK--Methyl Isoamyl Ketone, MIBK--Methyl Isobutyl Ketone, MPK--Methyl Propyl Ketone, or a combination thereof.

[0019] The ester solvent can comprise Amyl Acetate, Dibasic Ester, Ethyl Acetate, 2 Ethyl Hexyl Acetate, Ethyl Propionate, Exxate.RTM. Acetate Esters, Isobutyl Acetate, Isobutyl

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Isobuterate, Isopropyl Acetate, n-Butyl Acetate, n-Butyl Propionate, n-Pentyl Propionate, n-Propyl Acetate, or a combination thereof.

[0020] The alcohol solvent can comprise Amyl Alcohol, Benzyl Alcohol, Cyclohexanol, Ethyl Alcohol-Denatured, 2-Ethyl Hexanol, Exxal 8.RTM. Isooctyl Alcohol, Exxal 10.RTM. Isodecyl Alcohol, Exxal 13.RTM. Tridecyl Alcohol, Furfuryl Alcohol, Isobutyl Alcohol, Isopropyl Alcohol 99% Anhy, Methanol, Methyl Amyl Alcohol (MIBC), n-Butyl Alcohol, n-Propyl Alcohol, Neodol.RTM. Linear Alcohol, Secondary Butyl Alcohol, Tertiary Butyl Alcohol, Tetrahydrofurfuryl Alcohol, Texanol Ester Alcohol.RTM., UCAR Filmer IBT.RTM, or a combination thereof.

[0021] The halogenated solvent can comprise Methylene Chloride, Monochlorobenzene, Orthodichlorobenzene, Perchloroethylene, Trichloroethylene, Vertrel.RTM. Hydrofluorocarbon, or a combination thereof.

[0022] The terpene solvent can comprise Alpha-Pinene, Wood, Dipentene 122.RTM., D-Limonene, Herco.RTM. Pine Oil, Solvenol.RTM., Steam Distilled Turpentine, Terpineol.RTM., Yarmor.RTM. 302,302-W Pine Oil, or a combination thereof.

[0023] The aromatic solvent can comprise Aromatic 100, Aromatic 150, Aromatic 200, Aromatic 200ND, Heavy Aromatic Solvent, Panasol.RTM., Toluene, Xylene, or a combination thereof.

[0024] The biodegradable organic solvent can comprise vegetable oil (e.g., renewable resource oil), biodiesel, or a combination thereof. Vegetable oil refers to compounds extracted from plants. For example, the compounds extracted from plants are primarily triglyceride-based, and present as liquid, fatty waxy, or solid state at room temperature. Vegetable oils that are waxy or solid at room temperature are also called vegetable fats. In Addition, vegetable oil contains both saturated and unsaturated carbon-carbon double bonds.

[0025] Unsaturated vegetable oils can be transformed through partial or complete hydrogenation into oils of higher melting point. The hydrogenation process involves sparging the oil at a high temperature and a high pressure with hydrogen in the presence of a catalyst, typically a nickel based compound. As each carbon–carbon double-bond is chemically reduced to a single bond, two hydrogen atoms each form single bonds with the two carbon atoms to increase its degree of saturation. An oil may be hydrogenated to increase resistance to rancidity (oxidation) or to

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change its physical characteristics. As the degree of saturation increases, the oil's viscosity and melting point increase.

[0026] The vegetable oil can comprise linseed oil, coconut oil, corn oil, cottonseed oil, palm oil, canola oil, palm kernel oil, olive oil, peanut oil, rapeseed oil, safflower oil, sesame oil, soybean oil, sunflower oil, castor oil, tung oil, poppyseed oil, vernonia oil, almond oil, beech nut oil, Brazil nut oil, virgin oil, cashew oil, hazelnut oil, macadamia oil, mongongo nut oil (manketti oil), pecan oil, pine nut oil, pistachio oil, walnut oil, pumpkin seed oil, pracaxi oil, grape seed oil, rice bran oil, carapa oil, hempseed oil, or a combination thereof.

[0027] Renewable resource oil is derived from sustainable and renewable sources of fatty acids and resins, such as tall oil. Tall oil, also called "liquid rosin" or tallol, is a yellow-black liquid obtained as a by-product of wood pulping process. Tall oil is the third largest chemical by-product in a Kraft mill after lignin and hemicellulose; the yield of crude tall oil from the process is in the range of 30 – 50 kg / ton pulp, and it has been produced commercially since the 1930s. Biodiesel refers to a vegetable oil- or animal fat-based diesel fuel comprising long-chain alkyl (methyl, ethyl, or propyl) esters. Biodiesel is typically made by chemically reacting lipids (e.g., vegetable oil, soybean oil,[1] animal fat (tallow[2][3])) with an alcohol producing fatty acid esters.

[0028] The organic solvent can comprise a flash point of at least 20 degrees Celsius, such as, for example, at least 30 degrees Celsius, at least 40 degrees Celsius, at least 50 degrees Celsius, at least 60 degrees Celsius, at least 70 degrees Celsius, at least 80 degrees Celsius, at least 100 degrees Celsius, at least 150 degrees Celsius, or at least 200 degrees Celsius.

[0029] The wood preservative composition can comprise a concentration of the organic solvent of at least 50 % by weight based on the total weight of the composition, such as, for example, at least 60 % by weight, at least 70 % by weight, at least 80 % by weight, or at least 90 % by weight, all based on the total weight of the composition. The wood preservative composition can comprise a concentration of organic solvent in a range of 50 % by weight to 99 % by weight based on the total weight of the composition, such as, for example, 50 % by weight to 98 % by weight, 60 % by weight to 98 % by weight, 70 % by weight to 98 % by weight, or 80 % by weight to 96 % by weight, all based on the total weight of the composition. The organic solvent can be polar, non-polar, a combination of polar and non-polar solvents.

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[0030] The retaining additive comprises a solvent-borne polymeric resin, a wax, or a combination thereof. Without being bound to any particular theory, the retaining additive can bind the DCOI to the wood product, entrap the DCOI within the wood , physically fix the DCOI to the wood product, and/or otherwise inhibit movement of the DCOI in the wood product (e.g., from inside of the wood product to a surface of the wood product). The concentration of the retaining additive in the wood preservative composition can be balanced with the concentration of the DCOI used in the wood preservative composition according to the present disclosure to achieve a desired retention of the DCOI in a wood product treated with the wood preservative composition according to the present disclosure. For example, a weight ratio of the DCOI to the retaining additive can be in a range of 1:5 to 5:1, such as, for example, 1:4 to 4:1, 1:3 to 3:1, 1:2 to 2:1, 1.5:1 to 1:1.5, or 1.1:1 to 1:1.1. In various examples, a weight ratio of the DCOI to the retaining additive can be 1:1.

[0031] The wood preservation composition according to the present disclosure can comprise a concentration of the retaining additive of at least 0.05 % by weight based on the total weight of the composition, such as, for example, at least 0.2 % by weight, at least 0.5 % by weight, at least 1.0 % by weight, at least 1.2 % by weight, at least 1.5 % by weight, at least 2 % by weight, at least 3 % by weight, or at least 4 % by weight, all based on the total weight of the composition. The wood preservation composition according to the present disclosure can comprise a concentration of the retaining additive of no greater than 20 % by weight based on the total weight of the composition, such as, for example, no greater than 15 % by weight, no greater than 10 % by weight, no greater than 9 % by weight, no greater than 8 % by weight, no greater than 5 % by weight, no greater than 4 % by weight, no greater than 3 % by weight, or no greater than 2.5 % by weight, all based on the total weight of the composition. For example, the wood preservative composition can comprises a concentration of the retaining additive in a range of 0.05 % by weight to 20 % by weight based on the total weight of the composition, such as, for example, 0.2 % by weight to 20 % by weight, 0.5 % by weight to 20 % by weight, 1 % by weight to 15 % by weight, 1 % by weight to 10 % by weight, 1 % by weight to 5 % by weight, 1.5 % by weight to 10 % by weight, 2 % by weight to 5 % by weight, 1.5 % by weight to 3 % by weight, or 1.5 % by weight to 2.5 % by weight, all based on the total weight of the composition. For example, the wood preservative composition according to the present disclosure can comprise 2.5 % by weight of the retaining additive based on the total weight of the composition.

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[0032] The solvent borne polymeric resin can comprise an epoxy, an acrylic, an acrylate, a polyurethane, a polyurea resin, a vinyl resin, a cellulose resin, a polyester resin, a polyether resin, a phenolic resin, an alkyd resin (e.g., short oil alkyd, long chain alkyd resin), a hydrocarbon resin, or a combination thereof. For example, the solvent borne polymeric resin can comprise a hydrocarbon resin, an alkyd resin, or a combination thereof. The solvent borne polymeric resin can comprise an alkyd resin (e.g., a long chain alkyd resin, such as, for example, a polymeric resin based on linseed oil). The solvent borne polymeric resin can comprise a long chain alkyd resin and the organic solvent is non-polar character (e.g., odorless mineral spirits). The long chain alkyd resin can comprise greater than 55% oil length.

[0033] The wax can comprise a paraffin wax, an olefin wax, a petroleum wax, a carnauba wax, a polyethylene wax, a slack wax, a silicone wax, a polypropylene wax, a polytetrafluoroethylene (PTFE) synthetic wax, or a combination thereof.

[0034] The wax can comprise a melting point suitable for handling and/or for a desirable treatment application. For example, the wax can comprise a melting point of at least 30 degrees Celsius, such as, for example, at least 35 degrees Celsius, at least 40 degrees Celsius, at least 45 degrees Celsius, at least 50 degrees Celsius, at least 55 degrees Celsius, at least 60 degrees Celsius, or at least 75 degrees Celsius. The wax can comprise a melting point of no greater than 100 degrees Celsius, such as, for example, no greater than 90 degrees Celsius, no greater than 80 degrees Celsius, no greater than 70 degrees Celsius, or no greater than 60 degrees Celsius. For example, the wax can comprise a melting point in a range of 30 degrees Celsius to 100 degrees Celsius, such as, for example, 35 degrees Celsius to 70 degrees Celsius.

[0035] The retaining additive can have a solubility in the organic solvent of at least 0.5% by weight, such as, for example, at least 1% by weight, at least 1.5% by weight, or at least 2% by weight.

[0036] Water may be present in the wood preservative composition according to the present disclosure, which can lead to the formation of stable emulsions that can affect the treatment of a wood product. The wood preservative composition according to the present disclosure can be formulated to inhibit emulsion formation and/or can comprise a de-emulsifier. The de-emulsifier can comprise an alkylphenol formaldehyde resin alkoxylate (AFRA), a polyalkylene glycol (PAG), an organic sulfonate, or a combination thereof. For example, the de-emulsifier can comprise a Stepan series de-emulsifiers (e.g., Agent NE-3A, NE-3B, Toximul 8244); Dow

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Chemicals DM series de-emulsifiers (e.g., DM3, DM5, DM6); Munzing Foamban series de-emulsifiers (e.g., 1550, TK-150, TK-75, WP-35); Evonik Tego Foamex series de-emulsifiers (e.g., 843, 844, 883, Surfynol 420); Demtrol series de-emulsifiers (e.g., 1030, 1040, 1130, 1135E, 2030,2045, 4026, 6055, 6237); Reziflow series de-emulsifiers (e.g., 2110,2215, 2130,2140, 2205, 2210, 2300, 2305, 2600, 2605, 2720, 2740); or a combination thereof.

[0037] The wood preservative composition may not phase separate when stored at ambient temperature (i.e., a temperature in a range of 20 degrees Celsius to 24 degrees Celsius) for at least 60 minutes, such as, for example, at least 120 minutes, at least 240 minutes, 24 hours, 48 hours, or 72 hours.

[0038] The wood preservative composition according to the present disclosure can also optionally comprise a colorant, an ultraviolet (UV) stabilizer, a UV absorber, de-foamer, a water repellent, an additional biocide, a fungicide, a termiticide, a fire retardant, or a combination thereof. The UV stabilizer can comprise copper oxide, a copper salt, iron oxide, iron complexes, transparent iron oxide, iron salts, nanoparticle iron oxide, titanium dioxide, benzophenone, substituted benzophenones, cinnamic acid, esters of cinnamic acid, amides of cinnamic acid, substituted triazines (e.g., triphenyl triazaine, substituted phenyl triazine), or combinations thereof. The UV absorber can comprise benzotriazole, substituted benzotriazole, hindered amine light stabilizers, or combinations thereof. The water repellent can comprise a wax water repellent (e.g., paraffin wax, polyethylene wax, carnauba wax, slack wax), a silicone, or combinations thereof.

[0039] The fire retardant can be one or more compounds selected from the group consisting of inorganic metal oxides, hydroxides, salts and expandable graphite phosphate compounds, nitrogen-containing compounds, dipentaerythritol, pentaerythritol, dextrin and boron-containing compounds.

[0040] The additional biocide can comprise a creosote, a triazole, an imidazole, a pyrazole, a boron compound, a quaternary ammonium, an isothiazolone, a pyrethroid, copper metal, a copper compound (e.g., copper napthenate), pentachlorophenol, bethoxazin, or a combination thereof.

[0041] Triazole and imidazole can comprise: 1-[[2-(2,4-dichlorophenyl)-1,3-dioxolan-2-yl]methyl]-1H-1,2,4-triazole (azaconazole), 1-[(2RS,4RS:2RS,4SR)-4-bromo-2-(2,4-dichlorophenyl)tetrahydrofurfuryl]-1H-1,2,4-triazole (bromuconazole), (2RS,3RS;2RS,3SR)-2-

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(4-chlorophenyl)-3-cyclopropyl-1-(1H-1,2,4-triazol-1-yl)butan-2-ol (Cyproconazole), (2RS,3RS)-1-(2,4-dichlorophenyl)-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl)pentan-3-ol (diclobutrazol), cis-trans-3-chloro-4-[4-methyl-2-(1H-1,2,4-triazol-1-ylmethyl)-1,3-dioxolan-2-yl]phenyl 4-chlorophenyl ether (difenoconazole), (E)-(RS)-1-(2,4-dichlorophenyl)-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl)pent-1-en-3-ol (diniconazole), (E)-(R)-1-(2,4-dichlorophenyl)-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl)pent-1-en-3-ol (diniconazole-M), (2RS,3SR)-1-[3-(2-chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)propyl]-1H-1,2,4-triazole (epoxiconazole), (RS)-1-[2-(2,4-dichlorophenyl)-4-ethyl-1,3-dioxolan-2-ylmethyl]-1H-1,2,4-triazole (etaconazole), (RS)-4-(4-chlorophenyl)-2-phenyl-2-(1H-1,2,4-triazol-1-ylmethyl)butyronitrile (fenbuconazole), 3-(2,4-dichlorophenyl)-6-fluoro-2-(1H-1,2,4-triazol-1-yl)quinazolin-4(3H)-one (fluquinconazole), bis(4-fluorophenyl)(methyl)(1H-1,2,4-triazol-1-ylmethyl)silane (flusilazole), (RS)-2,4′-difluoro-α-(1H-1,2,4-triazol-1-ylmethyl)benzhydryl alcohol (flutriafol), (2RS,5RS;2RS,5SR)-5-(2,4-dichlorophenyl)tetrahydro-5-(1H-1,2,4-triazol-1-ylmethyl)-2-furyl 2,2,2-trifluoroethyl ether (furconazole), (2RS,5RS)-5-(2,4-dichlorophenyl)tetrahydro-5-(1H-1,2,4-triazol-1-ylmethyl)-2-furyl 2,2,2-trifluoroethyl ether (furconazole-cis), (RS)-2-(2,4-dichlorophenyl)-1-(1H-1,2,4-triazol-1-yl)hexan-2-ol (hexaconazole), 4-chlorobenzyl (EZ)-N-(2,4-dichlorophenyl)-2-(1H-1,2,4-triazol-1-yl)thioacetamidate (imibenconazole), (1RS,2SR,5RS;1RS,2SR,5SR)-2-(4-chlorobenzyl)-5-isopropyl-1-(1H-1,2,4-triazol-1-ylmethyl)cyclopentanol (ipconazole), (1RS,5RS;1RS,5SR)-5-(4-chlorobenzyl)-2,2-dimethyl-1-(1H-1,2,4-triazol-1-ylmethyl)cyclopentanol (metconazole), (RS)-2-(4-chlorophenyl)-2-(1H-1,2,4-triazol-1-ylmethyl)hexanenitrile (myclobutanil), (RS)-1-(2,4-dichloro-β-propylphenethyl)-1H-1,2,4-triazole(penconazole), cis-trans-1-[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-ylmethyl]-1H-1,2,4-triazole (propiconazole), (RS)-2-[2-(1-chlorocyclopropyl)-3-(2-chlorophenyl)-2-hydroxypropyl]-2,4-dihydro-1,2,4-triazole-3-thione (prothioconazole), 3-(2,4-dichlorophenyl)-2-(1H-1,2,4-triazol-1-yl)-quinazolin-4(3H)-one (quinconazole), (RS)-2-(4-fluorophenyl)-1-(1H-1,2,4-triazol-1-yl)-3-(trimethylsilyl)propan-2-ol (simeconazole), (RS)-1-p-chlorophenyl-4,4-dimethyl-3-(1H-1,2,4-triazol-1-ylmethyl)pentan-3-ol (tebuconazole), propiconazole, (RS)-2-(2,4-dichlorophenyl)-3-(1H-1,2,4-triazol-1-yl)propyl 1,1,2,2-tetrafluoroethyl ether (tetraconazole), (RS)-1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)butan-2-one (triadimefon), (1RS,2RS;1RS,2SR)-1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)butan-2-ol (triadimenol), (RS)-(E)-5-(4-chlorobenzylidene)-2,2-dimethyl-1-(1H-1,2,4-triazol-1-ylmethyl)cyclopentanol (triticonazole), (E)-(RS)-1-(4-chlorophenyl)-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl)pent-1-en-3-ol (uniconazole), (E)-(S)-1-(4-chlorophenyl)-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl)pent-1-en-3-ol (uniconazole-P), 2-(2,4-difluorophenyl)-1-(1H-1,2,4-triazole-1-

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yl)-3-trimethylsilyl-2-propanol, or a combination thereof. Other azole compounds suitable as an additional biocide can comprise amisulbrom, bitertanol, fluotrimazole, triazbutil, climbazole, clotrimazole, imazalil, oxpoconazole, prochloraz, triflumizole, azaconazole, simeconazole, hexaconazole, or a combination thereof.

[0042] The pyrazole can comprise: benzovindiflupyr, bixafen, fenpyrazamine, fluxapyroxad, furametpyr, isopyrazam, oxathiapiprolin, penflufen, penthiopyrad, pydiflumetofen, pyraclostrobin, pyrametostrobin, pyraoxystrobin, rabenzazole, sedaxane, or a combination thereof.

[0043] The boron compound can comprise water-insoluble boron compounds, such as, for example, metal borate compounds (*e.g.*, calcium borate, borate silicate, aluminum silicate borate hydroxide, silicate borate hydroxide fluoride, hydroxide silicate borate, sodium silicate borate, calcium silicate borate, aluminum borate, boron oxide, magnesium borate, iron borate, copper borate, and zinc borate (borax)).

[0044] The quaternary ammonium can comprise didecyldimethylammonium chloride; didecyldimethylammonium carbonate/bicarbonate; alkyldimethylbenzylammonium chloride; alkyldimethylbenzylammonium carbonate/bicarbonate; didodecyldimethylammonium chloride; didodecyldimethylammonium carbonate/bicarbonate; didodecyldimethylammonium propionate; N,N-didecyl-N-methyl-poly(oxyethyl)ammonium propionate, or a combination thereof.

[0045] The isothiazolone can comprise methylisothiazolinone; 5-chloro-2-methyl-4-isothiazoline-3-one, 2-methyl-4-isothiazoline-3-one, 2-n-octyl-4-isothiazoline-3-one, 4,5-dichloro-2-n-octyl-4-isothiazoline-3-one, 2-ethyl-4-isothiazoline-3-one, 4,5-dichloro-2-cyclohexyl-4-isothiazoline-3-one, 5-chloro-2-ethyl-4-isothiazoline-3-one, 2-octyl-3-isothiazolone, 5-chloro-2-t-octyl-4-isothiazoline-3-one, 1,2-benzisothiazoline-3-one, preferably 5-chloro-2-methyl-4-isothiazoline-3-one, 2-methyl-4-isothiazoline-3-one, 2-n-octyl-4-isothiazoline-3-one, 4,5-dichloro-2-n-octyl-4-isothiazoline-3-one, 1,2-benzisothiazoline-3-one, etc., more preferably 5-chloro-2-methyl-4-isothiazoline-3-one, 2-n-octyl-4-isothiazoline-3-one, 4,5-dichloro-2-n-octyl-4-isothiazoline-3-one, 1,2-benzisothiazoline-3-one, chloromethylisothiazolinone, 4,5-Dichloro-2-n-octyl-3(2H)-isothiazolone, 1,2-benzisothiazolin-3-one, or a combination thereof.

[0046] The pyrethroid can comprise: acrinathrin, allethrin, bioallethrin, barthrin, bifenthrin, bioethanomethrin, cyclethrin, cycloprothrin, cyfluthrin, beta-cyfluthrin, cyhalothrin, gamma-

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cyhalothrin, lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, beta-cypermethrin, theta-cypermethrin, zeta-cypermethrin, cyphenothrin, deltamethrin, dimefluthrin, dimethrin, empenthrin, fenfluthrin, fenpirithrin, fenpropathrin, fenvalerate, esfenvalerate, flucythrinate, fluvalinate, tau-fluvalinate, furethrin, imiprothrin, metofluthrin, permethrin, biopermethrin, transpermethrin, phenothrin, prallethrin, profluthrin, pyresmethrin, resmethrin, bioresmethrin, cismethrin, tefluthrin, terallethrin, tetramethrin, tralomethrin, transfluthrin, etofenprox, flufenprox, halfenprox, protrifenbute, silafluofen, or a combination thereof.

[0047] The additional biocide can comprise imidachloprid, fipronil, cyfluthrin, bifenthrin, permethrin, cypermethrin, chlorpyrifos, iodopropynyl butylcarbamate (IPBC), chlorothalonil, 2-(thiocyanatomethylthio) benzothiazole, alkoxylated diamines, carbendazim, or a combination thereof. The additional biocide can comprise a bactericide, a moldicide, or a combination thereof.

[0048] The wood preservative composition can comprise a flash point suitable for handling and/or a desirable treatment application. For example, the wood preservative composition can comprise a flash point of at least 20 degrees Celsius, such as, for example, at least 30 degrees Celsius, at least 40 degrees Celsius, at least 50 degrees Celsius, at least 60 degrees Celsius, at least 70 degrees Celsius, at least 80 degrees Celsius, at least 100 degrees Celsius, at least 110 degrees Celsius, at least 120 degrees Celsius, at least 130 degrees Celsius, or at least 140 degrees Celsius.

[0049] The present disclosure also provides a method for making the wood preservative composition. The method can comprise dissolving the DCOI and the polymeric resin in the organic solvent, thereby forming the wood preservative composition. In various examples, a de-emulsifier may be added to the organic solvent and/or other component (e.g., a colorant, an ultraviolet stabilizer, a de-foamer, a water repellent, an additional biocide, a fungicide, a termiticide, a fire retardant or a combination thereof). In various examples, the wood preservative composition according to the present disclosure is made by dissolving the DCOI in the organic solvent, thereby forming an intermediate mixture followed by mixing the intermediate mixture with the polymeric resin and the de-emulsifier.

[0050] The wood preservative composition according to the present disclosure can be formulated as a concentrated composition (e.g., greater than 5 % by weight DCOI based on the total weight of the composition) or a diluted composition (e.g., ready to treat formulation, 0.5 %

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by weight to 5 % by weight DCOI based on the total weight of the composition). For example, if the wood preservative composition according to the present disclosure is formulated as a concentration composition, the concentration composition can be diluted with another organic solvent, which may be the same or different than the organic solvent used to formulate the concentrated composition, prior to treating a wood substrate with the wood preservative composition. In certain examples, the concentrated formulation may be formed by mixing the DCOI with a retaining additive (with or without the presence of an organic solvent) at a temperature above the melting point of DCOI. The resulting concentrate can be in a liquid form or a solid form. In addition, the resulting concentrate can be further diluted in an organic solvent to make the final wood preservative treating composition. In certain examples, the concentrated formulation may be used to treat a wood substrate to form a wood product.

[0051] The concentrated composition can comprise at least 5% by weight DCOI based on the total weight of the composition, such as, for example, at least 10% by weight DCOI, at least 15% by weight DCOI, at least 20% by weight DCOI, at least 30% by weight DCOI, at least 40% by weight DCOI, or at least 50% by weight DCOI, all based on the total weight of the composition. The concentrated composition can comprise no greater than 80% by weight DCOI based on the total weight of the composition, such as, for example, no greater than 70% by weight DCOI, no greater than 60% by weight DCOI, or no greater than 50% by weight DCOI, all based on the total weight of the composition. In various examples, the concentration composition can comprise DCOI in a range of 5% to 80% by weight based on the total weight of the composition, such as, for example, 20% to 80% by weight, 30% to 70% by weight, 40% to 50% by weight, or 45% to 55% by weight.

[0052] The concentrated composition can comprise at least 5% by weight of the retaining additive based on the total weight of the composition, such as, for example, at least 10% by weight retaining additive, at least 20% by weight retaining additive, at least 30% by weight retaining additive, at least 40% by weight retaining additive, or at least 50% by weight retaining additive, all based on the total weight of the composition. The concentrated composition can comprise no greater than 80% by weight retaining additive based on the total weight of the composition, such as, for example, no greater than 70% by weight retaining additive, no greater than 60% by weight retaining additive, or no greater than 50% by weight retaining additive, all based on the total weight of the composition. In various examples, the concentration composition can comprise retaining additive in a range of 5% to 80% by weight based on the

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total weight of the composition, such as, for example, 20% to 80% by weight, 30% to 70% by weight, 40% to 50% by weight, or 45% to 55% by weight, all based on the total weight of the composition. In certain examples where the retaining additive comprises a wax, the concentrated composition can be solid at 20 degrees Celsius. In various examples, the concentrated composition and/or the treating composition can be liquid at 20 degrees Celsius.

[0053] The present disclosure also provides a method of treating a wood substrate, thereby forming a wood product. The method comprises contacting a wood substrate with the wood preservative composition according to the present disclosure for a period of time suitable to inhibit fungal decay of the wood substrate. The method of treating the wood substrate can inhibit biological deterioration (e.g., fungal decay) and insect attack of the wood product (e.g., termite attack). The contacting can be performed until the wood product retains at least 0.05 pounds of DCOI per cubic foot (pcf) of the wood product, such as, for example, at least 0.10 pounds of DCOI pcf of the wood product or at least 0.15 pounds of DCOI pcf of the wood product.

[0054] Contacting the wood substrate can comprise dipping, soaking, spraying, brushing, a vacuum process, a pressure process, or a microwave process. For example, the contacting can comprise a modified full-cell process, an empty-cell process, or a combination thereof. In various examples, contacting comprises the empty-cell process and the empty-cell process comprises a Rueping process and a Lowry process. For example, in the empty-cell process, prior to the introduction of wood preservative composition according to the present disclosure, the wood substrate is subjected to atmospheric air pressure (Lowry) or to higher air pressures than atmospheric (Rueping) of the necessary intensity and duration. Various example contacting processes that can be used with the present disclosure are defined in the American Wood Protection Association (AWPA) Book of Standards T1-21: Processing and Treatment Standard, which is hereby incorporated by reference.

[0055] The present disclosure also provides a wood product produced by treating a wood substrate with the wood preservative composition according to the present disclosure. The wood product can comprise timber, plywood, laminated veneer lumber (LVL), cross laminated timber (CTL), parallel strand lumber (PSL), structural glued laminated timber, particle board, dimensional lumber, or a combination thereof. In various examples, the wood product

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comprises a deck, a rail, a fence, a utility pole, a pile, a railway tie, a railroad bridge, cladding, siding, or a combination thereof. For example, the wood product can comprise a utility pole.

[0056] The wood product can comprise various species of wood. For example, the wood product can comprise southern pine, Douglas fir, Jack pine, red pine, Lodgepole pine, radiata pine, Alaska yellow cedar, Hem-fir, Nordic pine, Scotts pine, white spruce, Spruce-Pine-Fir, redwood, white oak, red oak, maple, black and red gum, Norway spruce, Sitka spruce, western red cedar, western larch, ponderosa pine, or a combination thereof.

[0057] In various examples, by treating the wood product with the wood preservative composition according to the present disclosure, the wood product may leach less DCOI into deionized water after 24 hours than a comparative wood product treated with a comparative composition without the retaining additive (i.e., the same components except the retaining additive is replaced with addition organic solvent). For example, the wood product can leach at least 5% less DCOI into deionized water after 24 hours than a comparative wood product treated with a comparative composition without the retaining additive, such as, for example, at least 10% less, at least 15% less, at least 20% less, at least 25% less, at least 30% less, at least 40% less, at least 50% less, at least 60% less, at least 75% less, at least 80% less, or at least 90% less DCOI into deionized water after 24 hours than a comparative wood product treated with a comparative composition without the retaining additive. In certain examples, the wood preservation composition can be adjusted to have enhanced DCOI leach resistance without the use of the retaining additive.

[0058] In various examples, by treating the wood product with the wood preservative composition according to the present disclosure, less DCOI may be dislodged from a surface of the wood product after 72 hours as measured by wiping with a polyester wipe 9 times across the surface of the wood product than a comparative wood product treated with a comparative composition without the retaining additive. For example, the wood product can dislodge at least 5% less DCOI from a surface of the wood product after 72 hours as measured by wiping with a polyester wipe 9 times across the surface of the wood product than a comparative wood product treated with a comparative composition without the retaining additive, such as, for example, at least 10% less, at least 15% less, at least 20% less, at least 25% less, at least 30% less, at least 40% less, at least 50% less, at least 60% less, at least 75% less, at least 80% less, or at least 90% less DCOI into deionized water after 24 hours than a comparative wood product treated with a

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comparative composition without the retaining additive. In certain examples, the wood preservation composition can be adjusted to have enhanced DCOI dislodgeability resistance without the use of the retaining additive.

[0059] EXAMPLES

[0060] The present disclosure will be more fully understood by reference to the following examples, which provide illustrative non-limiting aspects of the invention. It is understood that the invention described in this specification is not necessarily limited to the examples described in this section.

[0061] Retaining additive and Organic Solvent Compatibility Testing

[0062] For testing the compatibility of the organic solvent and the retaining additive at a 1 % by weight concentration, 0.1 gram of the retaining additive and 9.9 grams of the organic solvent can be added to a 20 mL clear glass vial and mixed together. Thereafter, the vial is stored at a selected temperature (i.e., ambient temperature or 40 degrees Fahrenheit in a refrigerator). The vial is monitored for up to 7 days for phase separation and precipitation which may indicate incompatibility between the organic solvent and the retaining additive.

[0063] By way of example, various retaining additives were tested for compatibility with #2 diesel at 1 % by weight according to the method described above and the results are shown in Table 1 below. A retaining additive was determine to be compatible if there was no observable phase separation or precipitation after 7 days of storage at ambient temperature and 40 degrees Fahrenheit.

[0064] Table 1. Retaining additive Compatibility with #2 Diesel

Trade Name of Retaining additive	General Composition	Supplier	Compatibility (wt. 1%)
Chempol 801-2164	Alkyd Resin	Arkema	Yes
Chempol 801-6005	Alkyd Resin	Arkema	Yes
Chempol 801-7961	Alkyd Resin	Arkema	Yes
Paraffin Wax	Wax	Aldrich	Yes
Slack Wax	Wax	Aldrich	Yes
Piccotac™ 8095	Hydrocarbon Resin	Eastman	Yes
Piccotac™ 1095	Hydrocarbon Resin	Eastman	Yes
CAB 381-0.1	Cellulose Ester Resin	Eastman	No

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CAB 551-0.2	Cellulose Ester Resin	Eastman	No
Desmodur XP2675	Polyisocyanate Resin	Covestro	No
Desmodur N3900	Polyisocyanate Resin	Covestro	No
Desmodur N3400	Polyisocyanate Resin	Covestro	No
Pearlstick 5714	Polyurethane Resin	Lubrizol	No
Pearlstick 5703	Polyurethane Resin	Lubrizol	No
Pearlstick 5701	Polyurethane Resin	Lubrizol	No
Setalux 27-1550	Acrylic Resin	Allnex	No
Setalux 1190 SS-61	Acrylic Resin	Allnex	No
Duroxyn EF900/60X	Epoxy Resin	Allnex	No
Duroxyn EF935/60X	Epoxy Resin	Allnex	No
Sancure™ 1511	Polyester Resin	Lubrizol	No

[0065] During the testing it was observed that Chempol 801 alkyd resin, Paraffin wax, Slack wax and Piccotac hydrocarbon resin were compatible with #2 diesel at 1 % by weight. Without being bound by any particular theory, it is believed that the compatibility of the retaining additive with #2 diesel is based on the solubility of the respective retaining additive in #2 diesel. Therefore, various combinations of retaining additives and organic solvents can be selected for use with the wood preservative composition according to the present disclosure by utilizing the compatibility test described herein.

[0066] Organic Solvent Solvency with DCOI and Retaining additive Testing

[0067] For testing the solvency (i.e., ability to dissolve) of the organic solvent for DCOI and the retaining additive, 4.7 gram of DCOI and 5.0 g of retaining additive were dissolved in 10.3 gram of organic solvent to make a 23.5% of DCOI and 25.0% resin solution in a clear 20 ml glass vial. Thereafter, the vial is stored at a selected temperature (i.e., ambient temperature, 40 degrees Fahrenheit, or 120 degree Fahrenheit or whenever a crosslinking may occur). The vial is monitored for up to 7 days for phase separation, precipitation, and turbidity, which may indicate incompatibility between the organic solvent and the retaining additive and/or DCOI. The as prepared solution is maintained at room temperature and 40 degrees Fahrenheit for up to 7 days or whenever a phase separation, precipitation or solution turbidity event happens to disqualify the solution.

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[0068] The results of the solvency test of various organic solvents with DCOI and Chempol 801-2164 are shown in Table 2 below. The solvents were tested at 40 degrees Fahrenheit and rated low solvency, medium solvency, or high solvency based on the amount, if any, of separation, precipitation, and turbidity observed in each solution.

[0069] Table 2. Solvency of DCOI/retaining additive in Organic Solvents

Solvent	CAS#	Flash Point (°C)	DCOI/Resin Solvency
Exxsol D 40	64742-47-8	44	Medium
Exxsol D 60	64742-47-8	64	Medium
Exxsol D 80	64742-47-8	83	Medium
Exxsol D 95	64742-47-8	96	Medium
Exxsol D 110	64742-47-8	115	Medium
Exxsol D 130	64742-46-7	137	Low
Varsol 1	8052-41-3	45	Medium
Varsol 18	8052-41-3	44	Medium
Varsol 60	64742-82-1	65	Medium
Varsol 80	64742-81-0	80	Medium
Varsol 110	64742-81-0	116	Medium
Varsol 120	64742-81-0	120	Medium
Varsol 140	64742-80-9	66	Low
Varsol 140 naphtha	64742-47-8	65	Medium
Aromatic 100	64742-95-6	46	High
Aromatic 150	64742-94-5	65	High
Aromatic 150 ND	64742-94-5	64	High
Aromatic 200	64742-94-5	107	High
Aromatic 200 ND	64742-94-5	111	High
Diesel # 2	68476-34-6	58-76	High
Benzyl Alcohol	100-51-6	93	High
Biodiesel	67762-38-3 67784-80-9 68937-84-8 61788-61-2 67762-26-9 73891-99-3 129828-16-6 67762-26-9	>= 93	High

[0070] Based on the results above, Aromatic 100, Aromatic 150, Aromatic 150 ND, Aromatic 200, Aromtic 200ND, diesel fuel # 2, and benzyl alcohol were determined to be good candidates for further performance testing. It is believed other solvents are also suitable and that the solvents that did not perform well in this test may be suitable with other retaining additives and/or additional components to improve the solubility of the retaining additive.

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[0071] Preparation of a Concentrated Wood Preservative Composition

[0072] To prepare a concentrated wood preservative composition, 200 grams of wood preservative concentrate is prepared by adding 103 grams of organic solvent, 47 grams of DCOI, and 50 gram of retaining additive under agitation to a 200 mL beaker until a homogenous solution is formed. The beaker can be placed in a 40°C water bath to speed up the dissolving process.

[0073] Preparation of a Diluted Wood Preservative Composition

[0074] 5 kilogram of a diluted wood preservative composition is prepared by adding 4500 grams of an additional organic solvent, #2 diesel, and 500 grams of the concentrated wood preservative composition under agitation to a 5-liter beaker until a homogenous solution is formed.

[0075] De-emulsifier Evaluation

[0076] To evaluate the effectiveness of a de-emulsifier, de-emulsifier was added to 20 ml of diluted wood preservative composition in a glass vial to achieve a concentration of 1000 ppm and mixed thoroughly. Thereafter, 5 ml of water is added into the glass vial and a line at the water/oil interface is marked with a marker. Then the vial is mix for 10 seconds using a vortex mixer. After mixing, the vial is placed on a countertop and observed over time to determine how long it takes the water to completely separate from the wood preservative composition based on the previously marked line.

[0077] Various de-emulsifiers were tested with a wood preservative composition comprising 2.3 % by weight DCOI, 2.5 % by weight of Chempol 801-2164, and Aromatic 200 ND according to the procedures described above. The results of the de-emulsifier testing is shown in Table 3 below:

[0078] Table 3. Evaluation of De-emulsifiers at 1000 ppm in the Wood Preservative Composition

De-emulsifier	Observations
Foam Ban HV-830G	Starts getting water separation at 2.5 minutes. Water is very hazy. No change at 5 minutes.
Foam Ban HV-810G	Starts getting water separation that is clear after 30s. Most of the water has separated out after 1 minute.
Foam Ban 1839	Starts getting water separation at 45s. Rapid separation but water is hazy. Water layer clears up over 2 days.

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Foam Ban 820-N	Starts getting some separation at 30s. About 90% of water has separated out after 1 minute. Water is clear.
Tego Foamex 843	No Separation
Tego Foamex 883	No Separation
Surfynol 420	Starts getting water separation after 1.5 minutes. Close to 70% of water has separated out by 5 minutes. 95% of water has separated out by 6.5 minutes.
Emulsogen EL 360A	Starts getting water separation after 2 minutes. Close to 50% of water has separated out by 5 minutes. 90% of water has separated out by 6.5 minutes.
Foam Ban WP-35	Has a good layer of separation by 15s. 90% has separated by 1 minute
Foam Ban MS-550	Does not mix with the Diesel phase. Most of the water has separated out by 30 seconds but is hazy. Water is still hazy after 5 minutes. Water layer is still hazy after sitting over 2 days.

[0079] As shown in Table 3, many de-emulsifiers are likely suitable for further performance testing in a wood preservative composition. It is believed other emulsifiers are also suitable for use with diesel #2 and that the performance of the de-emulsifier can change based on the organic solvent used.

[0080] Various diluted wood preservative compositions were prepared from concentrated wood preservative compositions as shown in Table 4 below. The organic solvent used in Table 4 is a mixture of Aromatic 200 and diesel #2.

[0081] Table 4- Various diluted wood preservative compositions

Sample	DCOI (% by weight)	Retaining additive Name	Retaining additive (% by weight)	Aromatic 200 (% by weight)	De-emulsifer Name	Demulsifer (% by weight)	Diesel #2 (% by weight)
#1	2.35	Chempol 801-2164	2.50	5.13	Surfynol 420	0.1	89.92
#2	2.35	Chempol 801-2164	2.50	5.13	Foam Ban WP35	0.1	89.92
#3	2.35	Chempol 801-2164	2.50	5.13	Foam Ban 820-N	0.1	89.92
#4	2.35	Chempol 801-7961	2.50	5.13	Foam Ban WP35	0.1	89.92
#5	2.35	Chempol 801-7961	2.50	5.13	Foam Ban 820-N	0.1	89.92

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#6	2.35	Piccotac™ 8095	2.50	5.13	Foam Ban WP35	0.1	89.92
#7	2.35	Piccotac™ 8095	2.50	5.13	Foam Ban 820-N	0.1	89.92
#8	2.35	Piccotac™ 1095	2.50	5.13	Foam Ban WP35	0.1	89.92
#9	2.35	Piccotac™ 1095	2.50	5.13	Foam Ban 820-N	0.1	89.92
#10	2.35	Slack Wax	2.50	0	Foam Ban WP35	0.1	95.05
#11	2.35	Slack Wax	2.50	5.13	Foam Ban 820-N	0.1	89.92
#12 (Comparative)	2.35	Not used	0	Not used	Not used	0	97.65

[0082] Evaluation of leaching of DCOI

[0083] To evaluate the leaching of DCOI from a wood substrate treated with samples #1-#12, SYP blocks were milled to cubes having dimensions of 0.75" X 0.75" X 0.75" with a ring count of 6-10 rings per inch were prepared. A set of cubes (minimum of 24) were used for test each sample #1-#12 and weighed individually before treating. To treat each set of cubes, the cubes were placed in a plastic container and weighed down with weights to prevent the cubes from floating. Then the container was placed in desiccator and subjected to a vacuum of -26"Hg for 20 minutes. The container was fill with one of the solution of one of samples #1-#12 under vacuum and the vacuum pump was turned off once all the cubes in the container were below the liquid level. The cubes were allowed to soak at atmospheric pressure for 30 minutes. After the 30 minutes had elapsed, the solution of the respective sample #1-#12 was removed and each cube in the container was weighed. This procedure was repeated until a set of cubes had been prepared for each of samples #1-#12.

[0084] The sets of cubes were then placed in oven at 120 degrees Fahrenheit and dried for 4 weeks. Once a week, four preselected cubes from each set of cubes were weighed. After the four weeks had passed, the sets of cubes were remove from the oven and allowed to sit at ambient temperature for 1 day.

[0085] From each set of cubes, 24 cubes with the most uniformed retention of the respective sample #1-#12 were selected for DCOI leach testing. Then, for each set, the 24 cubes were

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randomly divided into 4 groups of 6. Three of the groups were water impregnated while the fourth group was used to determine the unleached retention of DCOI.

[0086] For water impregnation of each group, the group was placed in a 16oz glass jar and weighed down to prevent floating. 300ml of deionized water was then added to the jars. The jars were placed into a cylinder without lids and subjected to a -26"Hg vacuum for 20 minutes. The vacuum was removed and the jars were sealed for the leaching testing.

[0087] For the leaching testing, each jar was placed on a shake table. The shake table was turned on and set to 100 RPMs. 300 mL aliquots of the water solution from each jar were taken at selected intervals and replaced with an additional 300ml of deionized water. Each aliquot taken was analyzed for DCOI content. The jars were observed for a minimum of 14 days. A summary of the results of the leaching testing are provided in Table 5 below:

[0088] Table 5 - DCOI Leaching Results

DCOI in water (ppm)							
Sample	6h	1d	2d	4d	7d	14d	In total
#2	0.066	0.026	0.018	0.012	0.008	0	0.130
#10	0.089	0.033	0.031	0.016	0.009	0	0.178
#12	0.159	0.039	0.032	0.013	0.008	0.002	0.253

[0089] As shown in Table 5 above, Samples #2 and #10 had an improved leach rate of DCOI into the deionized water than comparative sample #12 indicating the respective retaining additive inhibited the release of DCOI into the deionized water.

[0090] Wood treatment

[0091] Samples #1-#12 were used to treat wood substrates. The wood substrates were 3" x 10" prepared from select 1 SYP 5/4" thick deck board with no defects. To treat each wood substrate to create a wood product, a cylinder was filled with 5 kg with one of samples #1-12#. Thereafter, the wood substrate was added and subjected to a treatment cycle of 15 minutes at -26"Hg initial vacuum, 30 minutes at 100psi pressure, and 15 minutes at -26"Hg final vacuum.

[0092] Evaluation of Surface Dislodgeability of DCOI

[0093] After treatment, boards were placed in a 120°F oven and dried for 41 days, and after removal were left at ambient temperature for 11 additional days.

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[0094] After conditioning, the boards were cut into 3 pieces with dimensions of 3" x 35/16" x 1". Polyester wipes were cut to a dimension of 3" X 4" and attached to a 27/8" x 27/8" x 1" steel block using tape. A piece of parafilm was placed between the wipe and the block and was changed every wipe to prevent cross contamination. Each sample board was placed in a holder and wiped 9 times across a surface of the sample board using only gravity for down pressure. Thereafter, the wipe was placed in a large centrifuge tube and 30g of Methanol was added and analyzed for DCOI content.

[0095] An initial wipe was performed on each board. Then each sample board was placed in a QUV chamber and wiped at day 3 and then every 7 days after that. In the QUV chamber, each board was subjected to a repeating cycle of 2.5hrs of UV exposure followed by a 0.5 hr water spray. This cycle repeated until the testing was completed.

[0096] Table 6. Dislodgeability of DCOI

	DCOI dislodged from the surface (ppm)					
Sample	0d	3d	9d	23d	33d	In total
#2	0.131	0.042	0.033	0.01	0.009	0.225
#12	0.198	0.079	0.012	0.004	0.021	0.314

[0097] As observed from Table 6 above, a wood substrate treated with sample #2 showed less DCOI surface dislodging after 33 days compared to DCOI alone.

[0098] It is believed that other wood preservative compositions according to the present disclosure can also retain more DCOI in the wood product than comparative wood preservative compositions.

[0099] DCOI concentrate Example 1

[0100] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Chempol 801-2164 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 1 had a suitable viscosity of 132.4 cP at 25°C.

[0101] DCOI concentrate Example 2

[0102] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Chempol 801-6005 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker

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under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 2 had a suitable viscosity of 156.3 cP at 25°C.

[0103] DCOI concentrate Example 3

[0104] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Chempol 801-7961 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 3 had a suitable viscosity of 156.3 cP at 25°C.

[0105] DCOI concentrate Example 4

[0106] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Piccotac™ 8095 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 4 had a suitable viscosity of 187.3 cP at 25°C.

[0107] DCOI concentrate Example 5

[0108] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Piccotac™ 8015 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 5 had a suitable viscosity of 230.6 cP at 25°C.

[0109] DCOI concentrate Example 6

[0110] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Setal 21-3464 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 6 had a suitable viscosity of 36.4 cP at 25°C.

[0111] DCOI concentrate Example 7

[0112] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Setal 11-3610 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 7 had a suitable viscosity of 28.3 cP at 25°C.

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[0113] DCOI concentrate Example 8

[0114] DCOI concentrate was made by dissolving 46.70 g of DCOI and 71.0 g of Setal 11-3466 in a mixture of 46.14 g of Benzyl alcohol and 46.16 g of #2 diesel in a 200 mL beaker under agitation. The mixture was agitated for 20 minutes or until a homogenous solution was formed. DCOI concentrate Example 8 had a suitable viscosity of 12.5 cP at 25°C.

[0115] DCOI concentrate Example 9

[0116] A DCOI concentrate was made by heating 98.48 g of a slack wax (melting point 30-68 degrees Celsius) at 40 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 45 degrees Celsius. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 9 had a suitable initial viscosity of less than 10 cP at 40°C.

[0117] DCOI concentrate Example 10

[0118] A DCOI concentrate was made by heating 98.48 g of a slack wax (melting point 42 degrees Celsius) at 45 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 45 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 10 had a suitable initial viscosity of less than 10 cP at 45°C.

[0119] DCOI concentrate Example 11

[0120] A DCOI concentrate was made by heating 98.48 g of a slack wax (melting point 48-52 degrees Celsius) at 55 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 55 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 11 had a suitable initial viscosity of less than 10 cP at 55°C.

[0121] DCOI concentrate Example 12

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[0122] A DCOI concentrate was made by heating 98.48 g of a slack wax (melting point 47-49 degrees Celsius) at 55 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 55 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 12 had a suitable initial viscosity of less than 10 cP at 55°C.

[0123] DCOI Concentrate Example 13

[0124] A DCOI concentrate was made by heating 98.48 g of a slack wax (melting point 53 degrees Celsius) at 58 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 58 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 13 had a suitable initial viscosity of less than 10 cP at 58°C.

[0125] DCOI Concentrate Example 14

[0126] A DCOI concentrate was made by heating 98.48 g of a paraffin wax (melting point 54 degrees Celsius) at 59 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 59 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 14 had a suitable initial viscosity of less than 10 cP at 59°C.

[0127] DCOI Concentrate Example 15

[0128] A DCOI concentrate was made by heating 98.48 g of a paraffin wax (melting point 51 degrees Celsius) at 56 degrees Celsius in the a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 56 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was naturally cool

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down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 15 had a suitable initial viscosity of less than 10 cP at 56°C.

[0129] DCOI Concentrate 16

[0130] A DCOI concentrate was made by heating 98.48 g of a paraffin wax (melting point 59 degrees Celsius) at 64 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 64 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 16 had a suitable initial viscosity of less than 10 cP at 64°C.

[0131] DCOI concentrate Example 17

[0132] DCOI concentrate was made by heating 98.48 g of a paraffin wax (melting point 61 degrees Celsius) at 66 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 66 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 17 had a suitable initial viscosity of less than 10 cP at 66°C.

[0133] DCOI concentrate Example 18

[0134] DCOI concentrate was made by heating 98.48 g of a paraffin wax (melting point 66 degrees Celsius) at 71 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI (98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 71 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 18 had a suitable initial viscosity of less than 10 cP at 71°C.

[0135] DCOI concentrate Example 19

[0136] DCOI concentrate block was made by heating 98.48 g of a microcrystalline wax (melting point 90 degrees Celsius) at 100 degrees Celsius in a 200 mL beaker. Then, 101.52 g of DCOI

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(98.5% purity) was added into the beaker to form an intermediate mixture while continuously mixing and heating the intermediate mixture to 100 degrees Celsius. The mixture was agitated for 20 minutes or until a homogenous solution was formed. The as prepared solution was allowed to naturally cool down to below 35 degrees Celsius to form a solid block. DCOI concentrate Example 19 had a suitable initial viscosity of less than 10 cP at 100°C.

[0137] DCOI Treating Solution Example 20

[0138] A treating solution of 2.3% of DCOI was made by adding 4500 g of #2 diesel to 500 g of DCOI concentrate Example 1 solution in a 5 liter plastic beaker under agitation until a homogeneous solution was formed. DCOI Treating Solution Example 20 had a viscosity of less than 3 cP at 25°C

[0139] DCOI Treating Solution Example 21

[0140] A treating solution of 2.3% of DCOI was made by adding 4500 g of #2 diesel to 500 g of DCOI concentrate Example 6 solution in a 5 liter plastic beaker under agitation until a homogeneous solution was formed. DCOI Treatin Solution Example 21 had a viscosity of less than 3 cP at 25°C

[0141] DCOI Treating Solution Example 22

[0142] A treating solution of 2.3% of DCOI was made by adding 4500 g of #2 diesel to 500 g of DCOI concentrate Example 9 solution in a 5 liter plastic beaker under agitation until a homogeneous solution was formed. DCOI Treating Solution Example 22 had a viscosity of less than 3 cp at 25°C

[0143] DCOI Treating Solution Example 23

[0144] A treating solution of 2.3% of DCOI was made by adding 4500 g of #2 diesel to 500 g of DCOI concentrate Example 14 solution in a 5 liter plastic beaker under agitation until a homogeneous solution is formed. DCOI Treating Solution Example 23 had a viscosity of less than 3 cp at 25°C

[0145] DCOI Treating Solution Example 24

[0146] A treating solution of 2.3% of DCOI was made by adding 1295 g of biodiesel and 3205 g of #2 diesel to 500 g of DCOI concentrate Example 1 solution in a 5 liter plastic beaker under

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agitation until a homogeneous solution was formed. DCOI Treating Solution Example 24 had a viscosity of less than 3 cP at 25°C

[0147] DCOI Treating Solution Example 25

[0148] A treating solution of 2.3% of DCOI was made by adding 1295 g of biodiesel and 3205 g of #2 diesel to 500 g of DCOI concentrate Example 6 solution in a 5 liter plastic beaker under agitation until a homogeneous solution was formed. DCOI Treating Solution Example 25 had a viscosity of less than 3 cP at 25°C

[0149] DCOI Treating Solution Example 26

[0150] A treating solution of 2.3% of DCOI was made by adding 1295 g of biodiesel and 3205 g of #2 diesel to 500 g of DCOI concentrate Example 9 solution in a 5 liter plastic beaker under agitation until a homogeneous solution was formed. DCOI Treating Solution Example 26 had a viscosity of less than 3 cP at 25°C

[0151] DCOI Treating Solution Example 27

[0152] A treating solution of 2.3% of DCOI was made by adding 1295 g of biodiesel and 3205 g of #2 diesel to 500 g of DCOI concentrate Example 14 solution in a 5 liter plastic beaker under agitation until a homogeneous solution was formed. DCOI Treating Solution Example 27 had a viscosity of less than 3 cP at 25°C

[0153] In this specification, unless otherwise indicated, all numerical parameters are to be understood as being prefaced and modified in all instances by the term "about", in which the numerical parameters possess the inherent variability characteristic of the underlying measurement techniques used to determine the numerical value of the parameter. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of the claims, each numerical parameter described herein should at least be construed in light of the number of reported significant digits and by applying ordinary rounding techniques.

[0154] Also, any numerical range recited herein includes all sub-ranges subsumed within the recited range. For example, a range of "1 to 10" includes all sub-ranges between (and including) the recited minimum value of 1 and the recited maximum value of 10, that is, having a minimum value equal to or greater than 1 and a maximum value equal to or less than 10. Any maximum numerical limitation recited in this specification is intended to include all lower numerical

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limitations subsumed therein, and any minimum numerical limitation recited in this specification is intended to include all higher numerical limitations subsumed therein. Accordingly, Applicant reserves the right to amend this specification, including the claims, to expressly recite any sub-range subsumed within the ranges expressly recited.

[0155] The grammatical articles "a," "an," and "the," as used herein, are intended to include "at least one" or "one or more," unless otherwise indicated, even if "at least one" or "one or more" is expressly used in certain instances. Thus, the articles are used herein to refer to one or more than one (*i.e.*, to "at least one") of the grammatical objects of the article. Further, the use of a singular noun includes the plural, and the use of a plural noun includes the singular, unless the context of the usage requires otherwise.

[0156] Any patent, publication, or other disclosure material identified herein is incorporated by reference into this specification in its entirety unless otherwise indicated, but only to the extent that the incorporated material does not conflict with existing descriptions, definitions, statements, or other disclosure material expressly set forth in this specification. As such, and to the extent necessary, the express disclosure as set forth in this specification supersedes any conflicting material incorporated by reference. Any material, or portion thereof, that is said to be incorporated by reference into this specification, but which conflicts with existing definitions, statements, or other disclosure material set forth herein, is only incorporated to the extent that no conflict arises between that incorporated material and the existing disclosure material. Applicants reserve the right to amend this specification to expressly recite any subject matter, or portion thereof, incorporated by reference herein.

[0157] One skilled in the art will recognize that the herein described components (*e.g.*, operations), devices, objects, and the discussion accompanying them are used as examples for the sake of conceptual clarity and that various configuration modifications are contemplated. Consequently, as used herein, the specific exemplars set forth and the accompanying discussion are intended to be representative of their more general classes. In general, use of any specific exemplar is intended to be representative of its class, and the non-inclusion of specific components (*e.g.*, operations), devices, and objects should not be taken limiting.

[0158] With respect to the appended claims, those skilled in the art will appreciate that recited operations therein may generally be performed in any order. Also, although various operational flows are presented in a sequence(s), it should be understood that the various operations may be

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performed in other orders than those which are illustrated, or may be performed concurrently. Examples of such alternate orderings may include overlapping, interleaved, interrupted, reordered, incremental, preparatory, supplemental, simultaneous, reverse, or other variant orderings, unless context dictates otherwise. Furthermore, terms like "responsive to," "related to," or other past-tense adjectives are generally not intended to exclude such variants, unless context dictates otherwise.

[0159] One skilled in the art will recognize that the herein-described components, devices, operations/actions, and objects, and the discussion accompanying them, are used as examples for the sake of conceptual clarity and that various configuration modifications are contemplated. Consequently, as used herein, the specific examples/embodiments set forth and the accompanying discussion are intended to be representative of their more general classes. In general, use of any specific exemplar is intended to be representative of its class, and the non-inclusion of specific components, devices, operations/actions, and objects should not be taken limiting. While the present disclosure provides descriptions of various specific aspects for the purpose of illustrating various aspects of the present disclosure and/or its potential applications, it is understood that variations and modifications will occur to those skilled in the art. Accordingly, the invention or inventions described herein should be understood to be at least as broad as they are claimed and not as more narrowly defined by particular illustrative aspects provided herein.

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CLAIMS

WHAT IS CLAIMED IS:

1. A wood preservative composition comprising:

at least 0.5 % by weight of 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on the total weight of the composition; and

a retaining additive comprising a solvent-borne polymeric resin, a wax, or a combination thereof,

wherein a weight ratio of the DCOI to the retaining additive is in a range of 1:5 to 5:1.

2. The wood preservative composition of claim 1, wherein the composition further comprises:

an organic solvent, wherein the retaining additive has a solubility in the organic solvent of at least 0.5% by weight.

3. The wood preservative composition of claim 2, wherein the composition comprises 0.5 % by weight to 10.0 % by weight of the DCOI based on the total weight of the composition.

4. The wood preservative composition of claim 2, wherein the composition comprises 1.0 % by weight to 5.0 % by weight of the DCOI based on the total weight of the composition.

5. The wood preservative composition of claim 2, wherein the composition comprises 1.5 % by weight to 3.0 % by weight of the DCOI based on the total weight of the composition.

6. The wood preservative composition of any of claims 2-5, wherein the composition comprises 0.05 % by weight to 20 % by weight of the retaining additive based on the total weight of the composition.

7. The wood preservative composition of any of claims 2-5, wherein the composition comprises 1 % by weight to 10 % by weight of the retaining additive based on the total weight of the composition.

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8. The wood preservative composition of any of claims 1-7, wherein the weight ratio of the DCOI to the retaining additive is in a range of 1:5 to 5:1.

9. The wood preservative composition of any of claims 1-7, wherein the weight ratio of the DCOI to the retaining additive is in a range of 1:2 to 2:1.

10. The wood preservative composition of any of claims 1-7, wherein the weight ratio of the DCOI to the retaining additive is in a range of 1:1.5 to 1.5:1.

11. The wood preservative composition of any of claims 1-10, wherein the retaining additive comprises the solvent-borne polymeric resin and the solvent-borne polymeric resin comprises an epoxy, an acrylic, an acrylate, a polyurethane, a polyurea, a vinyl resin, a cellulose resin, a polyester resin, a polyether resin, a phenolic resin, an alkyd resin, a hydrocarbon resin, or a combination thereof.

12. The wood preservative composition of claim 11, wherein the solvent-borne polymeric resin comprises a hydrocarbon resin, an alkyd resin, or a combination thereof.

13. The wood preservative composition of any of claims 11-12, wherein the solvent-borne polymeric resin comprises an alkyd resin.

14. The wood preservative composition of claim 13, wherein the solvent-borne polymeric resin comprises a long chain alkyd resin.

15. The wood preservative composition of any of claims 13-14, wherein the solvent-borne polymeric resin is based on linseed oil.

16. The wood preservative composition of any of claims 1-14, wherein the wood preservative composition is a liquid at 20 degrees Celsius.

17. The wood preservative composition of any of claims 1 and 16, wherein the retaining additive comprises the wax and the wax comprises a paraffin wax, an olefin wax, a petroleum

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wax, a carnauba wax, a polyethylene wax, a slack wax, a silicone wax, a polypropylene wax, a polytetrafluoroethylene (PTFE) synthetic wax, or a combination thereof.

18. The wood preservative composition of claim 17, wherein the wood preservative composition is a solid at 20 degrees Celsius.

19. The wood preservative composition of any one of claims 17-18, wherein the composition comprises 40% by weight to 60% % by weight of the DCOI based on the total weight of the composition.

20. The wood preservative composition of any of claims 17-19, wherein the composition comprises 40% by weight to 60% by weight of the retaining additive based on the total weight of the composition.

21. The wood preservative composition of any of claims 1-20, wherein the composition further comprises an organic solvent and wherein the organic solvent comprises a hydrocarbon solvent, an amine solvent, a glycol solvent, a ketone solvent, an ester solvent, an alcohol solvent, a halogenated solvent, an aliphatic solvent, an aromatic solvent, a terpene solvent, a biodegradable organic solvent, or combinations thereof.

22. The wood preservative composition of claim 21, wherein the organic solvent comprises a hydrocarbon solvent.

23. The wood preservative composition of claim 22, wherein the hydrocarbon solvent comprises diesel.

24. The wood preservative composition of claim 23, wherein the diesel comprises a flash point of at least 50 degrees Celsius.

25. The wood preservative composition of any of claims 1-24, wherein the organic solvent comprises a flash point of at least 20 degrees Celsius.

26. The wood preservative composition of any of claims 1-25, wherein the wood preservative composition comprises a flash point of at least 20 degrees Celsius.

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27. The wood preservative composition of any of claims 1-26, wherein the wood preservative composition comprises a flash point of at least 50 degrees Celsius.

28. The wood preservative composition of any of claims 1-27, further comprising a de-emulsifier.

29. The wood preservative of claim 28, wherein the de-emulsifier comprises an alkylphenol formaldehyde resin alkoxylate (AFRA), a polyalkylene glycol (PAG), an organic sulfonate, or a combination thereof.

30. The wood preservative composition of any of claims 28-29, wherein the wood preservative composition does not phase separate when stored at ambient temperature for at least 60 minutes.

31. The wood preservative composition of any of claims 1-30, wherein the wood preservative composition further comprises a colorant, an ultraviolet stabilizer, a de-foamer, a water repellent, an additional biocide, a fungicide, a termiticide, a fire retardant, or a combination thereof.

32. The wood preservative composition of claim 2, wherein the retaining additive has a solubility in the organic solvent of at least 1%.

33. A method of treating a wood substrate, the method comprising contacting the wood substrate with the wood preservative composition of any of claims 1-32 for a period of time suitable to inhibit fungal decay of the wood substrate.

34. The method of claim 33, wherein the contacting comprises a modified full-cell process, an empty-cell process, or a combination thereof.

35. The method of claim 34, wherein the contacting comprises the empty-cell process and the empty-cell process comprises a Rueping process and a Lowry process.

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36. A wood product produced by treating a wood substrate with the wood preservative composition of any of claims 1-32.

37. A wood product comprising the wood preservative composition of any of claims 1-32.

38. The wood product of claims 36-37, wherein the wood product retains at least 0.05 pounds of DCOI per cubic foot of the wood product.

39. The wood product of any of claims 36-38, wherein the wood product comprises timber, plywood, laminated veneer lumber (LVL), cross laminated timber (CTL), parallel strand lumber (PSL), structural glued laminated timber, particle board, dimensional lumber, or a combination thereof.

40. The wood product of any of claims 36-39, wherein the wood product comprises a deck, a rail, a fence, a utility pole, a pile, a railway tie, a railroad bridge, cladding, siding, or a combination thereof.

41. The wood product of any of claims 36-40, wherein the wood product comprises a utility pole.

42. The wood product of any of claims 36-41, wherein the wood product comprises southern pine, Douglas fir, Jack pine, red pine, Lodgepole pine, radiata pine, Alaska yellow cedar, Hem-fir, Nordic pine, Scotts pine, white spruce, Spruce-Pine-Fir, redwood, white oak, red oak, maple, black and red gum, Norway spruce, Sitka spruce, , western red cedar, western larch, ponderosa pine, or a combination thereof.

Viance Exhibit 1004, Part 1 of 2
Viance v. Koppers Performance Chemicals
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COPY FROM PARENT

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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 18/294,852 filed on February 2, 2024.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than **five** (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Min Kuang Date (Optional) :

Signature: Min Kuang

Note: An application data sheet (PTO/**AIA**/14 or equivalent), including naming the entire inventive entity, must accompany this form **or must have been previously filed**. Use an additional PTO/A**IA/01** form for each additional inventor.

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0032. Public burden for this form is estimated to average 1 minute per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. If filing this completed form by mail, send to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/01 (06-12)
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 18/294,852

filed on February 2, 2024.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Jun Zhang Date (Optional): _____

Signature: Jun Zhang

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0032. Public burden for this form is estimated to average 1 minute per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.** If filing this completed form by mail, send to: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
	Application Number	
Title of Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Min		Kuang	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Peachtree City	State/Province	GA	Country of Residence	US

Mailing Address of Inventor:

Address 1	222 Lenox Drive		
Address 2			
City	Peachtree City	State/Province	GA
Postal Code	30269	Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jun		Zhang	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Peachtree City	State/Province	GA	Country of Residence	US

Mailing Address of Inventor:

Address 1	234 Independence Lane		
Address 2			
City	Peachtree City	State/Province	GA
Postal Code	30269	Country	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
	Application Number	
Title of Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM	

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	26285		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM		
Attorney Docket Number	210189PCTUSCON	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)		**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	26285		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
	Application Number	
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Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	18/294852	2024-02-02
Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
18/294852	a 371 of international	PCT/US2022/074619	2022-08-05
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2022/074619	Claims benefit of provisional	63/229817	2021-08-05

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
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☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
	Application Number	
Title of Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
	Application Number	
Title of Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	KOPPERS PERFORMANCE CHEMICALS, INC.		
Mailing Address Information For Applicant:			
Address 1	436 Seventh Avenue		
Address 2			
City	Pittsburgh	**State/Province**	PA
Country	US	Postal Code	15219
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
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Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/William E. Kuss/			Date (YYYY-MM-DD)	2025-03-06
First Name	William	Last Name	Kuss	Registration Number	41919

Additional Signature may be generated within this form by selecting the Add button. Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	210189PCTUSCON
	Application Number	
Title of Invention	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/15 (10-17)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	210189PCTUSCON
First Named Inventor	Min Kuang
Title	A WOOD PRESERVATIVE COMPOSITION COMPRISING..
Priority Mail Express® Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✓] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✓] **Specification** [*Total Pages* 38] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [ ] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* ____]
6. **Inventor's Oath or Declaration** [*Total Pages* 2] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [ ] Newly executed (original or copy)
   b. [✓] A copy from a prior application (37 CFR 1.63(d))
7. [✓] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**

ACCOMPANYING APPLICATION PAPERS

10. [ ] **Assignment Papers** (cover sheet & document(s))
    Name of Assignee _____
11. [ ] **37 CFR 3.73(c) Statement** (*when there is an assignee*) [✓] **Power of Attorney**
12. [ ] **English Translation Document** (*if applicable*)
13. [ ] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
14. [✓] **Preliminary Amendment**
15. [ ] **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. [ ] **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. [ ] **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. [✓] **Other:** Certification and Request for Prioritized Examination

***Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS

[✓] The address associated with Customer Number: 26285 **OR** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/William E. Kuss/	Date	March 6, 2025
Name (Print/Type)	William E. Kuss	Registration No. (Attorney/Agent)	41,919

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0032. Public burden for this form is estimated to average 12 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **If filing this completed form by mail, send to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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FEE TRANSMITTAL

(page 1 of 2)

Complete if known	
Application Number	
Filing Date	
First Named Inventor	Min Kuang
Examiner Name	
Art Unit	
Practitioner Docket No.	210189PCTUSCON

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

TOTAL AMOUNT OF PAYMENT ($) 8,665.00

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 02-1818 Deposit Account Name: K&L Gates LLP For the above-identified deposit account, the Director is hereby authorized to (check all that apply):

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☒ Charge any additional fee(s) or underpayment of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayment of fee(s)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES (U = undiscounted fee; S = small entity fee; M = micro entity fee)

	FILING FEES			SEARCH FEES			EXAMINATION FEES			
Application Type	U ($)	S ($)	M ($)	U ($)	S ($)	M ($)	U ($)	S ($)	M ($)	Fees Paid ($)
Utility	350	140*	70	770	308	154	880	352	176	$2,000.00
Design	300	120	60	300	120	60	700	280	140	
Plant	240	96	48	485	194	97	725	290	145	
Reissue	350	140	70	770	308	154	2,550	1,020	510	
Provisional	325	130	65	0	0	0	0	0	0	

* The $140 small entity filing fee for a utility application is further reduced to $70 for a small entity applicant who files the application via Patent Center.

2. EXCESS CLAIM FEES

Fee Description	Undiscounted Fee ($)	Small Entity Fee ($)	Micro Entity Fee ($)
Each claim over 20 (including Reissues)	200	80	40
Each independent claim over 3 (including Reissues)	600	240	120
Multiple dependent claims	925	370	185

Total Claims		Extra Claims		Fee ($)		Fee Paid ($)
30	-20 or HP =	10	x	$200.00	=	$2,000.00

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		Extra Claims		Fee ($)		Fee Paid ($)
3	-3 or HP =	0	x	0	=	0

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	
Fee ($)	Fee Paid ($)
0	0

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $450 ($180 for small entity) ($90 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof		Fee ($)		Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____ (round **up** to a whole number)	x	_____	=	_____

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0032. Public burden for this form is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email informationCollection@uspto.gov. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.** If filing this completed form by mail, send to: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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FEE TRANSMITTAL

(page 2 of 2)

4. CONTINUING APPLICATION FEE

If the actual filing date of the application is more than six years after the earliest benefit date, a continuing application fee is due. The earliest benefit date is the earliest filing date for which benefit is claimed under 35 U.S.C. 120, 121, 365(c), or 386(c) and § 1.78(d).

Choose only one of the following:

If the actual filing date is more than six years, and is less than or equal to nine years, after the earliest benefit date, the continuing application fee is $2,700 ($1,080 for small entity or $540 for micro entity). See 37 CFR 1.17(w)(1).

or

If the actual filing date is more than nine years after the earliest benefit date, the continuing application fee is $4,000 ($1,600 for small entity or $800 for micro entity), less any amount previously paid under 37 CFR 1.17(w)(1). See 37 CFR 1.17(w)(2).

Fees Paid ($)

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5. OTHER FEE(S) **Fees Paid ($)**

Non-English specification, $150 fee ($60 for small entity) ($30 for micro entity) ---

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, $400 fee ($200 small or micro entity) ---

Other (e.g., late filing surcharge): Request for Prioritized Examination ($4,515.00) and Processing Fee ($150.00) $4,665.00

SUBMITTED BY

Signature	/William E. Kuss/	Registration No. (Attorney/Agent) 41,919	Telephone 412-355-6323
Name (Print/Type)	William E. Kuss		Date March 6, 2025

PTO/AIA/82A (07-13)
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	
Filing Date	
First Named Inventor	Min Kuang
Title	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM
Art Unit	
Examiner Name	
Attorney Docket Number	210189PCTUSCON

SIGNATURE of Applicant or Patent Practitioner

Signature	/William E. Kuss/	Date (Optional)	March 6, 2025
Name	William E. Kuss	Registration Number	41,919
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 2 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 26285

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☐ The address associated with the above-mentioned Customer Number

OR

☑ The address associated with Customer Number: 26285

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

KOPPERS PERFORMANCE CHEMICALS INC.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	[signature]	Date (Optional)	8/7/2020
Name	Stephanie D. Apostolou		
Title	Secretary		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of forms are submitted.

This collection of information is required by 37 CFR 1.191, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Doc Code: TRACK1.REQ
Document Description: TrackOne Request

PTO/AIA/424 (11-23)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	Min Kuang	Nonprovisional Application Number (if known):	
Title of Invention:	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

I. ☑ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via USPTO patent electronic filing system.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via USPTO patent electronic filing system.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /William E. Kuss/	Date March 6, 2025
Name (Print/Typed) William E. Kuss	Practitioner Registration Number 41,919

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☑ *Total of 1 forms are submitted.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
19/072,608	**03/06/2025 05:05:53 PM Z ET**	**210189PCTUSCON**

Title of Invention

A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	6883	FILED BY	Jessica Brandenburg
PATENT CENTER #	69471451	FILING DATE	-
CUSTOMER #	26285	FIRST NAMED INVENTOR	Min Kuang
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	William Kuss

Documents

TOTAL DOCUMENTS: 12

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
ADS_3-6-25.pdf		9	Application Data Sheet	2174 KB
Preliminary_Amendment_3-6-25.pdf		7	-	128 KB
Preliminary_Amendment_3-6-25-A.PE.pdf	(1-1)	1	Preliminary Amendment	113 KB
Preliminary_Amendment_3-6-25-SPEC.pdf	(2-2)	1	Specification	113 KB
Preliminary_Amendment_3-6-25-CLM.pdf	(3-6)	4	Claims	120 KB
Preliminary_Amendment_3-6-25-REM.pdf	(7-7)	1	Applicant Arguments/Remarks Made in an Amendment	113 KB

Track1Request_3-6-25.pdf		1	Track One Request	161 KB
Declarations_3-6-25.pdf		2	Oath or Declaration filed	1185 KB
POA_Transmittal_3-6-25.pdf		2	Power of Attorney	1809 KB
Application_3-6-25.pdf		38	-	1935 KB
Application_3-6-25-ABST.pdf	(1-1)	1	Abstract	54 KB
Application_3-6-25-SPEC.pdf	(2-33)	32	Specification	1702 KB
Application_3-6-25-CLM.pdf	(34-38)	5	Claims	176 KB
Utility_Transmittal_3-6-25.pdf		3	Transmittal of New Application	335 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
ADS_3-6-25.pdf	6B883881C9F4FDCC3583251349858311D47670951D5B30D52D7A9897546BF6B0DF16D7CC5885ED7FBE14A5DA646E380439D77171BCBCD3F331D779EB5526AF27
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Preliminary_Amendment_3-6-25-SPEC.pdf	F8C7B50FAE1EE0EA95021F9C36A9AB762F098B42C5630D17EF996AACA486F3D35E8F1428BB71DE10554D35D05A8EF5C5AC8858BA9E7529EBCBE91C22343AB52A
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Preliminary_Amendment_3-6-25-REM.pdf	669810A7FDFA7F4B6139611EC0A16F70934D9AFCDD7844C49069D02C0A83A1A9CE9AD056AE987F5C30751B890068AFF1EABC0AD86A9E4EC07ABEE30F7D1DD301
Track1Request_3-6-25.pdf	A10ECEC211AEF7EF8BF0C7E7B344D3F316A89BC44822DA3A946449885410DEFDC08EBA24749159B6D1667BB3F0EE075A027B28A2B5EC52E94496A87443D296A6
Declarations_3-6-25.pdf	D1E61857206003B139CAB3F586763F7BBBBCCBE7139DD89A5F0AB3E0244D85DF0E6AC91601D49A3F74063E65F9A65DDC

	EA026B021835AEADB4ACD537CA82E055
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Application_3-6-25.pdf	7A83176BED58D318DFF03645BF9DE1B7586050D4198BDAFB2 63099AAA764EF7DCBC0E7B52DF5176B1F3F600B50F4F9E045 68FA43A56456D3370763281B4398C8
Application_3-6-25-ABST.pdf	A43CFCA8953E129D8AE015362851DAA322C32809406B3E0AB C378B6A248B1D6A616D99384904DEA46B42BCD3541BBF5B2 265E3E73A0B1655CB216A20890F72F7
Application_3-6-25-SPEC.pdf	AEA5957D30A236FEEE14BDF6E1C0A39551007D000D62E7BB 1284982C557E38167A46E4503C5BC7C3423A6CC861841AC16 89855C298DD44F8FB4A6F7D1E501082
Application_3-6-25-CLM.pdf	A51F434C97977FF54C859E0582297A0454059D881155C6BC51 017AB050D236D14B6AD69BD83E4C750B00E7442FEE014348C CECE5F39FF8702E166CB9CC96DF44
Utility_Transmittal_3-6-25.pdf	7419CE9192E3D07B9D25106BCC28BFC25AD14B8E3C5AB832 3A1AE41B363D5EF4771C9F86994E12A66C13A92773856F77A1 6ECC49E3017C2F87625731ACA2D557

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
19/072,608	**03/06/2025 05:05:53 PM Z ET**	**210189PCTUSCON**

Title of Invention

A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	6883	FILED BY	Jessica Brandenburg
PATENT CENTER #	69471451	AUTHORIZED BY	William Kuss
CUSTOMER #	26285	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Min Kuang

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
DA / 021818	**E202536H06457032**	**Jessica Brandenburg**

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
021818	**37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees)**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1011	BASIC FILING FEE - UTILITY (PAPER FILING ALSO REQUIRES NON-ELECTRONIC FILING FEE UNDER 1.16(T))	350.00	1	350.00
1111	UTILITY PATENT APPL. SEARCH FEE	770.00	1	770.00
1311	PATENT APPL. EXAMINATION FEE	880.00	1	880.00
1817	REQUEST FOR PRIORITIZED	4515.00	1	4515.00

	EXAMINATION			
1830	PROCESSING FEE, EXCEPT IN PROVISIONAL APPLICATIONS	150.00	1	150.00
1202	EACH CLAIM IN EXCESS OF 20	200.00	10	2000.00
			TOTAL AMOUNT:	**$8,665.00**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Serial No. TBD	A WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM
Filing Date: TBD	
Application of: Kuang, *et al.*	
Art Unit TBD	
Examiner: TBD	
Confirmation No.: TBD	Attorney Docket No. 210189PCTUSCON

PRELIMINARY AMENDMENT

March 6, 2025

VIA EFS-Web

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Before examination, Applicant respectfully requests amendment of the above-identified patent application (the "*Subject Application*"). In this amendment:

Amendments to the Specification begin on page 2;

Amendments to the Claims begin on page 3; and

Remarks begin on page 7.

AMENDMENTS TO THE SPECIFICATION

Please amend paragraph [0001] following immediately after the sub-heading "CROSS-REFERENCE" on page 1 of the Specification of the *Subject Application* as follows:

[0001] The present application is continuation of U.S. Patent Application Serial No. 18/294,852, filed on February 2, 2024, which is a U.S. national stage application, filed under 35 U.S.C. § 371, of International Application No. PCT/US2022/074619, which was filed on August 5, 2022, and which claims priority to U.S. Provisional Application No. 63/229,817, filed August 5, 2021., ~~the~~ The entire contents of ~~which is~~ each are hereby incorporated by reference ~~in its entirety~~ into this specification.

AMENDMENTS TO THE CLAIMS

This listing of the claims replaces all prior versions and listings of the claims in the *Subject Application*:

Claims 1-42 (Canceled)

43. (New) A wood preservative composition comprising:

at least 0.5% by weight 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on a total weight of the composition; and

a retaining additive comprising a wax,

wherein a weight ratio of the DCOI to the retaining additive is in a range of 1:5 to 5:1.

44. (New) The wood preservative composition of claim 43, wherein the weight ratio of the DCOI to the retaining additive is in a range of 1:1.5 to 1.5:1.

45. (New) The wood preservative composition of claim 43, wherein the wax comprises a paraffin wax, an olefin wax, a petroleum wax, a carnauba wax, a polyethylene wax, a slack wax, a silicone wax, a polypropylene wax, a polytetrafluoroethylene (PTFE) synthetic wax, or a combination thereof.

46. (New) The wood preservative composition of claim 43, wherein the wax comprises a melting point in a range of 40 degrees Celsius to 100 degrees Celsius.

47. (New) The wood preservative composition of claim 43, wherein the wax comprises a melting point in a range of 75 degrees Celsius to 100 degrees Celsius.

48. (New) The wood preservative composition of claim 43, wherein the wax comprises a slack wax.

49. (New) The wood preservative composition of claim 43, wherein the wax comprises a

petroleum wax, a paraffin wax, or a combination thereof.

50. (New) The wood preservative composition of claim 43, wherein the wax comprises paraffin wax and a microcrystalline wax.

51. (New) The wood preservative composition of claim 43, wherein the composition comprises 40% by weight to 60% % by weight of the DCOI based on the total weight of the composition and 40% by weight to 60% by weight of the retaining additive based on the total weight of the composition.

52. (New) The wood preservative composition of claim 43, wherein the composition comprises 45% by weight to 55% % by weight of the DCOI based on the total weight of the composition and 45% by weight to 55% by weight of the retaining additive based on the total weight of the composition.

53. (New) The wood preservative composition of claim 43, wherein the composition consists essentially of the DCOI and the retaining additive.

54. (New) The wood preservative composition of claim 43, wherein the composition further comprises an organic solvent.

55. (New) The wood preservative composition of claim 54, wherein the organic solvent comprises a hydrocarbon solvent, an amine solvent, a glycol solvent, a ketone solvent, an ester solvent, an alcohol solvent, a halogenated solvent, an aliphatic solvent, an aromatic solvent, a terpene solvent, a biodegradable organic solvent, or combinations thereof.

56. (New) The wood preservative composition of claim 54, wherein the organic solvent comprises diesel, biodiesel, or a combination thereof.

57. (New) The wood preservative composition of claim 54, wherein the organic solvent comprises a flash point of at least 40 degrees Celsius.

58. (New) The wood preservative composition of claim 54, wherein the organic solvent comprises a flash point of at least 60 degrees Celsius.

59. (New) The wood preservative composition of claim 54, wherein the organic solvent comprises a flash point of at least 80 degrees Celsius.

60. (New) The wood preservative composition of claim 54, wherein the retaining additive has a solubility in the organic solvent of at least 0.5%.

61. (New) The wood preservative composition of claim 54, wherein the retaining additive has a solubility in the organic solvent of at least 1%.

62. (New) A method of treating a wood substrate, the method comprising contacting the wood substrate with the wood preservative composition of claim 54 for a period of time suitable to inhibit fungal decay of the wood substrate.

63. (New) A wood product produced by treating a wood substrate with the wood preservative composition of claim 54.

64. (New) A wood product comprising the wood preservative composition of claim 54.

65. (New) The wood product of claim 64, wherein the wood product retains at least 0.05 pounds of DCOI per cubic foot of the wood product.

66. (New) The wood product of claim 64, wherein the wood product comprises a deck, a rail, a fence, a utility pole, a pile, a railway tie, a railroad bridge, cladding, siding, or a combination thereof.

67. (New) A wood preservative composition consisting essentially of:

45% by weight to 55% by weight 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on

a total weight of the composition; and

45% by weight to 55% by weight of a retaining additive comprising petroleum wax and a paraffin wax, wherein the retaining additive comprises a melting point in a range of 75 degrees Celsius to 100 degrees Celsius.

68. (New) A wood preservative composition comprising:

at least 10% by weight of 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on a total weight of the composition;

at least 10% by weight of a retaining additive comprising a solvent borne polymeric resin, wherein a weight ratio of the DCOI to the retaining additive is in a range of 1:5 to 5:1; and

at least 50% by weight of an organic solvent, wherein the retaining additive has a solubility in the organic solvent of at least 0.5% by weight.

69. (New) The wood preservative composition of claim 68, wherein the organic solvent comprises a hydrocarbon solvent, an amine solvent, a glycol solvent, a ketone solvent, an ester solvent, an alcohol solvent, a halogenated solvent, an aliphatic solvent, an aromatic solvent, a terpene solvent, a biodegradable organic solvent, or combinations thereof.

70. (New) The wood preservative composition of claim 68, wherein the organic solvent comprises a diesel, biodiesel, or a combination thereof.

71. (New) The wood preservative composition of claim 68, wherein the organic solvent comprises soybean oil and 2-Ethyl Hexanol.

72. (New) The wood preservative composition of claim 68, wherein the solvent borne polymeric resin comprises a hydrocarbon resin, an alkyd resin, or a combination thereof.

REMARKS

This preliminary amendment accompanies the filing of the *Subject Application* under 35 U.S.C. §371, cancels claims 1-42, and adds new claims 43-72.

The amendments do not add new matter to the *Subject Application* and are compliant with 35 U.S.C. §§112 and 132(a). Applicant is not conceding that the claims of the *Subject Application* in their prior forms are not patentable, as the present claims are only to facilitate expeditious prosecution of the *Subject Application*. The amendments are made without prejudice or disclaimer and solely to expedite the allowance of the *Subject Application*. Applicant reserves the right to pursue the subject matter of the original or previously pending claims in future actions and continuing applications.

Respectfully submitted,

March 6, 2025

Date

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Document Code:WFEE

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Sale Accounting Date:03/13/2025

Sale Item Reference Number	Effective Date
19072608	03/06/2025

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I20253CD30087707	1054	Non-DOC-X Filing Surcharge	$430.00	Deposit Account

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
19/072,608	03/06/2025		4430	210189PCTUSCON	30	3

CONFIRMATION NO. 6883

26285
K&L GATES LLP-Pittsburgh
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

FILING RECEIPT



Date Mailed: 03/18/2025

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

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Applicant(s)

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Power of Attorney: The patent practitioners associated with Customer Number 26285

Domestic Applications for which benefit is claimed

This application is a CON of 18/294,852 02/02/2024
which is a 371 of PCT/US2022/074619 08/05/2022
which claims benefit of 63/229,817 08/05/2021

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) **- None.**
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 19/072,608**

Projected Publication Date: 06/19/2025

Non-Publication Request: No

Early Publication Request: No

Title

WOOD PRESERVATIVE COMPOSITION COMPRISING 4,5-DICHLORO-2-OCTYLISOTHIAZOL-3(2H)-ONE, A METHOD TREATING A WOOD SUBSTRATE THEREWITH, AND A WOOD PRODUCT PRODUCED THEREFROM

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 19/072,608

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	350
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	770
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	880
TOTAL CLAIMS (37 CFR 1.16(i))	30 minus 20 =	* 10			OR	x 200 =	2000
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x =	0
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	4000

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
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AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
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Application	Document	Mailroom Date	Attorney Docket No.
19072608	APP.FILE.REC	03/18/2025	210189PCTUSCON
19072608	WELCOME.LET	03/18/2025	210189PCTUSCON

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Sincerely,

The Patent Center Team

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
19/072,608	03/06/2025	Min Kuang	210189PCTUSCON	6883

26285 7590 04/04/2025

K&L GATES LLP-Pittsburgh
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

EXAMINER	
CENTRAL, DOCKET	

ART UNIT	PAPER NUMBER
OPAP	

NOTIFICATION DATE	DELIVERY MODE
04/04/2025	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USpatentmail@klgates.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 19/072,608	**Applicant(s)** Kuang et al.	
	Examiner FIKIRTE A GEREMEW	**Art Unit** OMBL	**AIA (FITF) Status** Yes

1. THE REQUEST FILED 06 March 2025 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to FIKIRTE GEREMEW at (703) 756-1930. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/FIKIRTE A GEREMEW/ PROGRAM SUPPORT SPECIALIST, OMBL	

TO: USpatentmail@klgates.com
FROM: noreply@uspto.gov
CC: patentcenter_eofficeaction@uspto.gov
SUBJECT: USPTO: Patent Electronic System - Correspondence Notification for Customer Number 26285

Sat Apr 05 05:00:06 EDT 2025

Dear Patent Center Customer:

Correspondence Address:

K&LGATES LLP-Pittsburgh
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PITTSBURGH,PENNSYLVANIA,15222-2613
UNITED STATES

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Application	Document	Mailroom Date	Attorney Docket No.
19072608	TRACK1.GRANT	04/04/2025	210189PCTUSCON

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
19/072,608	03/06/2025	Min Kuang	210189PCTUSCON	6883

26285 7590 04/23/2025

K&L GATES LLP-Pittsburgh
210 SIXTH AVENUE
PITTSBURGH, PA 15222-2613

EXAMINER	
GUINO-O UZZLE, MARITES A	

ART UNIT	PAPER NUMBER
1731	

NOTIFICATION DATE	DELIVERY MODE
04/23/2025	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

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Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USpatentmail@klgates.com

Office Action Summary	Application No. 19/072,608	Applicant(s) Kuang et al.	
	Examiner MARITES A GUINO-O UZZLE	Art Unit 1731	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 06 March 2025.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 43-72 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 43-50 and 53-72 is/are rejected.

8) ☑ Claim(s) 51-52 is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☑ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Specification

2. The disclosure is objected to because of the following informalities: specification at [0009] discloses one or more examples of these aspects are illustrated in the accompanying drawings… those of ordinary skill in the art will understand that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary aspects. However, there are no submitted "drawings" and there are no "devices" that are described in the specification. Examiner suggest amending specification at [0009] to remove the ambiguity with respect to the "drawings" and "devices" outlined above. Appropriate correction is required.

Claim Objections

3. **Claims 51-52** are objected to because of the following informalities:

- claim 51 line 2 recites "60% % by weight", wherein the second "%" appears to be a typographical error; and
- similarly, claim 52 line 2 recites "55% % by weight", wherein the second "%" appears to be a typographical error.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. **Claims 45, 49, 55, 67 and 69** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

6. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) may be considered indefinite if the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). In the present instance, claim 45 line 2 recites the broad/genus recitation "petroleum wax", and the claim at line 2 also recites "paraffin wax" and "slack wax" which are the narrower/specie statements of the range/limitation, as evidenced by IRM (Classification of Refined Petroleum Waxes) ("IRM" hereinafter) (see IRM at page 1 Title evidencing classification of refined petroleum waxes, bullet (1) evidencing paraffin wax group… softer paraffin waxes (e.g., slack waxes)). The claim(s) are considered indefinite because there is a question or doubt as to whether the feature introduced by such narrower language is (a) merely

exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims.

Examiner is treating claim 45 as requiring "petroleum wax" as claimed.

Examiner suggests amending the claim to either: i) remove the narrower "paraffin wax" and "slack wax" as desired; ii) remove the broader "petroleum wax" as desired; or iii) some other clarifying amendment so as to remove the ambiguity as set forth above.

7. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) may be considered indefinite if the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). In the present instance, claim 49 line 2 recites the broad/genus recitation "petroleum wax", and the claim at line 2 also recites "paraffin wax" which is the narrower/specie statement of the range/limitation. The claim(s) are considered indefinite because there is a question or doubt as to whether the feature introduced by such narrower language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims.

Examiner is treating claim 49 as requiring "petroleum wax" as claimed.

Examiner suggests amending the claim to either: i) remove the narrower "paraffin wax" as desired; ii) remove the broader "petroleum wax" as desired; or iii) some other clarifying amendment so as to remove the ambiguity as set forth above.

8. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) may be considered indefinite if the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP §

2173.05(c). In the present instance, claim 55 line 2 recites the broad/genus recitation "hydrocarbon solvent", and the claim at lines 3-4 also recites "aliphatic solvent", "aromatic solvent" and "terpene solvent" which are the narrower/specie statements of the range/limitation. The claim(s) are considered indefinite because there is a question or doubt as to whether the feature introduced by such narrower language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims.

Examiner is treating claim 55 as requiring "hydrocarbon solvent" as claimed.

Examiner suggests amending the claim to either: i) remove the narrower "aliphatic solvent", "aromatic solvent" and "terpene solvent", as desired; ii) remove the broader "hydrocarbon solvent" as desired; or iii) some other clarifying amendment so as to remove the ambiguity as set forth above.

9. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) may be considered indefinite if the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). In the present instance, claim 67 line 4 recites the broad/genus recitation "petroleum wax", and the claim at line 5 also recites "paraffin wax" which is the narrower/specie statement of the range/limitation. The claim(s) are considered indefinite because there is a question or doubt as to whether the feature introduced by such narrower language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims.

Examiner is treating claim 67 as requiring "petroleum wax" as claimed.

Examiner suggests amending the claim to either: i) remove the narrower "paraffin wax" as desired; ii) remove the broader "petroleum wax" as desired; or iii) some other clarifying amendment so as to remove the ambiguity as set forth above.

10. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) may be considered indefinite if the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). In the present instance, claim 69 line 2 recites the broad/genus recitation "hydrocarbon solvent", and the claim at lines 3-4 also recites "aliphatic solvent", "aromatic solvent" and "terpene solvent" which are the narrower/specie statements of the range/limitation. The claim(s) are considered indefinite because there is a question or doubt as to whether the feature introduced by such narrower language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims.

Examiner is treating claim 69 as requiring "hydrocarbon solvent" as claimed.

Examiner suggests amending the claim to either: i) remove the narrower "aliphatic solvent", "aromatic solvent" and "terpene solvent", as desired; ii) remove the broader "hydrocarbon solvent" as desired; or iii) some other clarifying amendment so as to remove the ambiguity as set forth above.

Claim Rejections - 35 USC § 103

11. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a

new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

12. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

13. The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

14. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

15. **Claims 43-50 and 53** are rejected under 35 U.S.C. 103 as being unpatentable over Cui et al. (US 2006/0057300 A1) ("Cui" hereinafter); as evidenced by PubChem (CID 91688) ("PubChem" hereinafter) with respect to claim 43 only, and IRM with respect to claim 50 only.

16. Regarding claim 1, Cui teaches wood preservative composition (see Cui at [0018] teaching the present disclosure provides wood preservative compositions) comprising:

at least 0.5% by weight 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on a total weight of the composition (see Cui at [0018] teaching containing an active organic preservative, see Cui at [0019] teaching exemplary organic preservatives of the disclosure include... isothiazolones such as 4,5-dichloro-2-n-octyl-4-isothiazol-3-one... exemplary concentrations of the active preservative are 0.1-30 weight %... based on the weight of the formulation) (see MPEP 2144.05(I)). 4,5-dichloro-2-n-octyl-4-isothiazol-3-one is a synonym of the claimed DCOI as evidenced by PubChem (see PubChem at page 7, section 2.4.2 Depositor-Supplied Synonyms); and

a retaining additive comprising a wax (see Cui at [0021] teaching the organic phase of the disclosure may comprise a hydrophobe... the hydrophobe is more preferably a strong hydrophobe... exemplary strong hydrophobes include waxes),

wherein a weight ratio of the DCOI to the retaining additive is in a range of 1:5 to 5:1 (Cui teaches this limitation, as outlined below).

As mentioned, Cui teaches exemplary concentrations of the active preservative are 0.1-30 weight %... based on the weight of the formulation (see Cui at [0019]). Cui also teaches exemplary concentrations of the hydrophobe component are 0-40 weight %... based on the weight of the total formulation (see Cui at [0021]). One of ordinary skill in the art would

appreciate that the wood preservative composition as taught by Cui may have 0.1 wt % organic preservative (or DCOI), and 0.5 wt% hydrophobe or wax (or retaining additive), which meets the claimed range of 1:5.

Additionally, MPEP states that "[w]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation", and "the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages" (see MPEP § 2144.05.II.A). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention, to have selected amounts of organic preservative (or DCOI) and hydrophobe/wax (or retaining additive) from within the ranges taught by Cui because there is a reasonable expectation of success that the disclosed amounts would be suitable.

17. Regarding claim 44, Cui teaches the limitations as applied to claim 43 above, and Cui further teaches wherein the weight ratio of the DCOI to the retaining additive is in a range of 1:1.5 to 1.5:1 (Cui teaches this limitation, as outlined below).

As mentioned, Cui teaches exemplary concentrations of the active preservative are 0.1-30 weight %... based on the weight of the formulation (see Cui at [0019]). Cui also teaches exemplary concentrations of the hydrophobe component are 0-40 weight %... based on the weight of the total formulation (see Cui at [0021]). One of ordinary skill in the art would appreciate that the wood preservative composition as taught by Cui may have 0.1 wt % organic preservative (or DCOI), and 0.15 wt% hydrophobe or wax (or retaining additive), which meets the claimed range of 1:1.5.

Additionally, MPEP states that "[w]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation", and "the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages" (see MPEP § 2144.05.II.A). It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention, to have selected amounts of organic preservative (or DCOI) and hydrophobe/wax (or retaining additive) from within the ranges taught by Cui because there is a reasonable expectation of success that the disclosed amounts would be suitable.

18. Regarding claims 45 and 49, Cui teaches the limitations as applied to claim 43 above, and Cui further teaches wherein the wax comprises a... petroleum wax (claims 45 and 49) (see 112 rejection for Examiner's interpretation, see Cui at [0021] teaching exemplary strong hydrophobes include waxes, such as... petroleum waxes).

19. Regarding claims 46-47, Cui teaches the limitations as applied to claim 43 above, and Cui further teaches wherein the wax comprises a melting point in a range of 40 degrees Celsius to 100 degrees Celsius (claim 46), and wherein the wax comprises a melting point in a range of 75 degrees Celsius to 100 degrees Celsius (claim 47) (see Cui at [0021] teaching preferred waxes have a melting point of 30-100° C) (see MPEP 2144.05(I)).

20. Regarding claim 48, Cui teaches the limitations as applied to claim 43 above, and Cui further teaches wherein the wax comprises a slack wax (see Cui at [0021] teaching exemplary petroleum waxes include slack wax).

21. Regarding claim 50, Cui teaches the limitations as applied to claim 43 above, and Cui further teaches wherein the wax comprises paraffin wax and microcrystalline wax (see Cui at [0021] teaching exemplary strong hydrophobes include waxes, such as… petroleum waxes… or a combination of these… exemplary petroleum waxes include slack wax or microcrystalline wax). Slack wax is taken to meet the claimed paraffin wax as evidenced by IRM (see IRM at page 1 Title evidencing classification of refined petroleum waxes, bullet (1) evidencing paraffin wax group… softer paraffin waxes (e.g., slack waxes)).

Additionally, MPEP states that "the selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination" (see MPEP § 2144.07). In this case, one of ordinary skill in the art would appreciate that slack waxes and microcrystalline wax are suitable waxes for the composition as taught by Cui.

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention, to use a combination of slack and microcrystalline waxes in the wood preservative compositions as taught by Cui because both waxes are suitable for its intended use.

22. Regarding claim 53, Cui teaches the limitations as applied to claim 43 above, and Cui further teaches wherein the composition consists essentially of the DCOI and the retaining additive (see Cui at [0018] teaching the present disclosure provides wood preservative

compositions containing an active organic preservative… containing an organic acid, and see Cui at [0020] teaching the organic acid may serve one or more of the following purposes in the compositions of the present disclosure… (3) reducing preservative leaching). MPEP states that the transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials or steps "and those that do not materially affect the basic and novel characteristic(s)" of the claimed invention (see MPEP 2111.03.III). In this instance, specification at [0057] discloses that in various examples, by treating the wood product with the wood preservative composition according to the present disclosure, the wood product may leach less DCOI into deionized water after 24 hours than a comparative wood product treated with a comparative composition without the retaining additive (i.e., the same components except the retaining additive is replaced with addition organic solvent). One of ordinary skill in the art would appreciate that the addition of organic acid as taught by Cui would do not materially affect the basic and novel characteristic(s) of the claimed invention because similar to Cui, the claimed invention aims to reduce the leaching of DCOI (or organic preservative). As such, the wood preservative composition as taught by Cui meets the claimed limitations.

23. **Claims 43-49, 54-55, 57-58 and 60-66** are rejected under 35 U.S.C. 103 as being unpatentable over Ashmore et al. (US 2007/0175360 A1) ("Ashmore" hereinafter); as evidenced by PubChem with respect to claim 43 only; as evidenced by IRM with respect to claims 45 and 49 only; and as evidenced by PubChem (CID 1030) ("CID" hereinafter) with respect to claim 59 only.

24. Regarding claim 43, Ashmore teaches a wood preservative composition (see Ashmore at [0005] teaching the present disclosure is directed to a method for preserving wood by contacting wood with an aqueous composition). The aqueous composition is taken to meet the claimed wood preservative composition, based on the structure as outlined below, comprising:

at least 0.5% by weight 4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on a total weight of the composition (see Ashmore at [0005] teaching an aqueous composition comprising… (c) an organic wood preservative, see Ashmore at [0006] teaching organic wood preservatives include, e.g., halogenated 3-isothiazolone biocides, see Ashmore at [0008] teaching organic wood preservatives are those not containing metals… most preferably 4,5-dichloro-2-n-octyl-4-isothiazol-3-one ("DCOIT"), see Ashmore at [0011] teaching the aqueous composition… contains from 300 ppm (or 0.3%) to 5,000 ppm (or 0.5%) halogenated isothiazolone biocide) (see MPEP 2144.05(I)). 4,5-dichloro-2-n-octyl-4-isothiazol-3-one ("DCOIT") is a synonym of the claimed DCOI as evidenced by PubChem (see PubChem at page 7, section 2.4.2 Depositor-Supplied Synonyms); and

a retaining additive comprising a wax (see Ashmore at [0005] teaching an aqueous composition comprising… (a) paraffin wax),

wherein a weight ratio of the DCOI to the retaining additive is in a range of 1:5 to 5:1 (see Ashmore at [0011] teaches the wax solids to biocide ratio is from 1:1 to 150:1 (see MPEP 2144.05(I)).

25. Regarding claim 44, Ashmore teaches the limitations as applied to claim 43 above, and Ashmore further teaches wherein the weight ratio of the DCOI to the retaining additive is in a

range of 1:1.5 to 1.5:1 (see Ashmore at [0011] teaches the wax solids to biocide ratio is from 1:1 to 150:1 (see MPEP 2144.05(I)).

26. Regarding claims 45 and 49, Ashmore teaches the limitations as applied to claim 43 above, and Ashmore further teaches wherein the wax comprises… a petroleum wax (see 112 rejection for Examiner interpretation, see Ashmore at [0005] teaching an aqueous composition comprising… (a) paraffin wax). Paraffin is taken to meet the claimed petroleum wax because it is a specie to the genus wax, as evidenced by IRM (see IRM at page 1 Title evidencing classification of refined petroleum waxes, bullet (1) evidencing paraffin wax group… softer paraffin waxes (e.g., slack waxes)).

27. Regarding claims 46 and 47, Ashmore teaches the limitations as applied to claim 43 above, and Ashmore further teaches wherein the wax comprises a melting point in a range of 40 degrees Celsius to 100 degrees Celsius (claim 46), and wherein the wax comprises a melting point in a range of 75 degrees Celsius to 100 degrees Celsius (claim 47) (see Ashmore at [0009] teaching waxes suitable for use… preferably have a melting point… from 45-160° C (see MPEP 2144.05(I))).

28. Regarding claim 48, Ashmore teaches the limitations as applied to claim 43 above, and Ashmore further teaches wherein the wax comprises a slack wax (see Ashmore at [0009] teaching paraffin, such as… slack wax).

29. Regarding claims 54-55, Ashmore teaches the limitations as applied to claim 43 above, and Ashmore further teaches wherein the composition further comprises an organic solvent (claim 54), and wherein the organic solvent comprises… a glycol solvent (claim 55) (see Ashmore at [0012] teaching the aqueous wood treatment composition optionally contains a non-aqueous solvent… examples of suitable solvents include glycols).

30. Regarding claims 57-58, Ashmore teaches the limitations as applied to claims 43 and 54 above, and Ashmore further teaches wherein the organic solvent comprises a flash point of at least 40 degrees Celsius (claim 57), and wherein the organic solvent comprises a flash point of at least 60 degrees Celsius (claim 58) (see Ashmore at [0012] teaching preferably a flash point of at least 60° C (see MPEP 2144.05(I))).

31. Regarding claim 59, Ashmore teaches the limitations as applied to claims 43 and 54 above, and Ashmore further teaches wherein the organic solvent comprises a flash point of at least 80 degrees Celsius (see Ashmore at [0012] teaching the aqueous wood treatment composition optionally contains a non-aqueous solvent… examples of suitable solvents include glycols… wherein propylene glycol (PG) is included in the list). Propylene glycol is taken to meet the claimed flash point, as evidenced by CID (see CID at page 1 Title evidencing propylene glycol, see CID at page 14, section 3.2.7 evidencing flash point 99° C), which is at least 80° C (see MPEP 2144.05(I)).

32. Regarding claims 60-61, Ashmore teaches the limitations as applied to claims 43 and 54 above, and Ashmore further teaches wherein the retaining additive has a solubility in the organic

solvent of at least 0.5% (claim 60), and wherein the retaining additive has a solubility in the organic solvent of at least 1% (claim 61) (since the wax (or retaining additive) and non-aqueous solvent (or organic solvent) as taught by Ashmore (see Ashmore at [0009] and [0012]) and the claimed retaining additive and organic solvent as recited in claims 43, 45 and 54-55) employ substantially similar materials, it is reasonable to believe that the claimed properties (i.e., wherein the retaining additive has a solubility in the organic solvent of at least 0.5% (claim 60), and wherein the retaining additive has a solubility in the organic solvent of at least 1% (claim 61)) would have naturally flowed following the teaching of Ashmore (see MPEP 2112.01).

33. Regarding claim 62, Ashmore teaches a method comprising contacting the wood substrate with the wood preservative composition of claim 54 for a period of time suitable to inhibit fungal decay of the wood substrate (see Ashmore at [0002] teaching the present disclosure relates to a method for treating wood to impart protection from wood-decaying organisms, see Ashmore at [0005] teaching the present disclosure is directed to a method for preserving wood by contacting wood with an aqueous composition, see Ashmore at [0020] teaching pieces of Southern Yellow Pine are loaded into a pressure vessel… sufficient treatment mixture is drawn into the vessel to completely cover the wood… when no more treatment mixture is taken up by the wood… the wood can be removed, and see claims 43 and 54 rejections above). Protection from wood decaying organisms is taken to meet the claimed inhibit fungal decay of the wood substrate. The claimed "period of time suitable" is being treated as being taught by Ashmore because one of ordinary skill in the art would appreciate that there is necessarily a period of time "when no more treatment mixture is taken up by the wood… the wood can be removed".

34. Regarding claim 63, Ashmore teaches a wood product produced by treating a wood substrate with wood preservative composition of claim 54 (see Ashmore at [0005] teaching the present disclosure is directed to a method for preserving wood by contacting wood with an aqueous composition, see Ashmore at [0020] teaching pieces of Southern Yellow Pine are loaded into a pressure vessel… sufficient treatment mixture is drawn into the vessel to completely cover the wood… when no more treatment mixture is taken up by the wood… the wood can be removed, and see claims 43 and 54 rejections above). The treated wood is taken to meet the claimed wood product.

35. Regarding claim 64, Ashmore teaches a wood product the wood preservative composition of claim 54 (see Ashmore at [0005] teaching the present disclosure is directed to a method for preserving wood by contacting wood with an aqueous composition, see Ashmore at [0020] teaching pieces of Southern Yellow Pine are loaded into a pressure vessel… sufficient treatment mixture is drawn into the vessel to completely cover the wood… when no more treatment mixture is taken up by the wood… the wood can be removed, and see claims 43 and 54 rejections above). The treated wood is taken to meet the claimed wood product.

36. Regarding claim 65, Ashmore teaches the limitations as applied to claims 43, 54 and 64 above, and Ashmore further teaches wherein the wood product retains at least 0.5 pounds of DCOI per cubic foot of the wood product (since the aqueous wood treatment formulation as taught by Ashmore and the claimed wood preservative composition recited in claims 43, 54 and 64 employ substantially similar materials and methods, it is reasonable to believe the claimed

properties (i.e., wherein the wood product retains at least 0.5 pounds of DCOI per cubic foot of the wood product) would have naturally flowed following the teaching of Ashmore (see MPEP 2112.01).

37. Regarding claim 66, Ashmore teaches the limitations as applied to claims 43, 54 and 64 above, and Ashmore further teaches wherein the wood product comprises a deck, a rail, a fence, a utility pole, a pile, a railway tie, a railroad bridge, cladding, siding, or a combination thereof (see Ashmore at [0002] teaching the present disclosure relates to a method for treating wood to impart protection from wood-decaying organisms). The claimed limitations is being treated as being taught by Ashmore because there is no evidence indicating that the claimed wood products are critical, absent new and unexpected results.

38. **Claim 56** is rejected under 35 U.S.C. 103 as being unpatentable over Ashmore as applied claims 43 and 54 above, and further in view of Arumugam et al. (US 2021/0112812 A1) ("Arumugam" hereinafter).

39. Regarding claim 56, Ashmore teaches the limitations as applied to claims 43 and 54 above, but Ashmore does not explicitly teach wherein the organic solvent comprised diesel, biodiesel, or a combination thereof.

Like Ashmore, Arumugam teaches a method for treating wood to impart protection from wood-decaying organisms comprising contacting wood with a wood treatment composition comprising DCOIT and organic solvent (see Arumugam at [0001] teaching the present disclosure relates to a method for treating wood to impart protection from wood-decaying organisms, see

Arumugam at [0004] teaching said method comprising contacting wood with a wood treatment composition comprising… b) at least one organic solvent… c) at least one wood preservative selected from among… halogenated isothiazolinone biocides, see Arumugam at [0010] teaching most preferably 4,5-dichloro-2-n-octyl-4-isothiazol-3-one ("DCOIT")).

Arumugam further teaches suitably, the organic solvent is diesel, however other organic solvents known to those of skill in the art may be used (see Arumugam at [0012]). Diesel is taken to meet the claimed wherein the organic solvent comprised… diesel.

Additionally, MPEP states that "the selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination" (see MPEP § 2144.07). In this case, one of ordinary skill in the art would appreciate that diesel is a suitable organic solvent for wood treatment compositions that impart protection from wood-decaying organisms.

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention, to use diesel as taught by Arumugam in the wood treatment formulation as taught by Ashmore because diesel is a suitable organic solvent for wood treatment compositions that impart protection from wood-decaying organisms.

40. **Claims 68-72** are rejected under 35 U.S.C. 103 as being unpatentable over Arumugam in view of Cui; as evidenced by PubChem with respect to claim 68 only.

41. Regarding claim 68, Arumugam teaches a wood preservative composition (see Arumugam at [0004] teaching the present disclosure is directed to a method of preserving wood, said method comprising contacting wood with a wood treatment composition), comprising:

4,5-dichloro-2-octylisothiazol-3-one (DCOI) based on a total weight of the composition (see Arumugam at [0004] teaching a wood treatment composition comprising… c) at least one wood preservative selected from among… halogenated isothiazolinone biocides… see Arumugam at [0010] teaching most preferably 4,5-dichloro-2-n-octyl-4-isothiazol-3-one ("DCOIT")). 4,5-dichloro-2-n-octyl-4-isothiazol-3-one ("DCOIT") is a synonym of the claimed DCOI as evidenced by PubChem (see PubChem at page 7, section 2.4.2 Depositor-Supplied Synonyms);

at least 10% by weight of a retaining additive comprising a solvent borne polymeric resin (see Arumugam at [0004] teaching a wood treatment composition comprising… a) a polyurethane polymer… in a non-aqueous solvent, see Arumugam at [0011] teaching preferably, the polymer solids content of the composition is from 10% to 40% (see MPEP 2144.05(I))). Polyurethane polymer solids is taken to meet the claimed retaining additive because it is a polymeric resin in a non-aqueous solvent,

wherein a weight ratio of the DCOI to the retaining additive is in a range of 1:5 to 5:1 (see Arumugam at [0011] teaching preferably, the polymer solids (or retaining additive) to biocide (or DCOIT) ratio is from 2:1 to 1:2 (see MPEP 2144.05(I))); and

at least 50% by weight of an organic solvent (see Arumugam at [0004] teaching a wood treatment composition comprising… b) at least one organic solvent, see Arumugam at [0012] teaching the polyurethane polymer is diluted with organic solvent… suitably, the organic solvent is diesel, see Arumugam at [0018]-[0019] teaching wood treatment solution preparation… in a 4 liter vessel, 3 kilograms of wood treatment solution is prepared by adding diesel fuel, polymer solution, and DCOIT… for polymers at 30% solids, this equates to 2675 grams diesel, 75 grams of DCOIT, and 250 grams of polymer solution). One of ordinary skill in the art would

appreciate that the % by weight solvent or diesel is 87% (or (2675 ÷ 3000) x 100), which is at least 50% (see MPEP 2144.05(I)),

wherein the retaining additive has a solubility in the organic solvent of at least 0.5% by weight (see Arumugam at [0018] teaching wood treatment solution preparation… in a 4 liter vessel, 3 kilograms of wood treatment solution is prepared by adding diesel fuel, polymer solution, and DCOIT technical to obtain a final concentration of… 2.5% polymer solids). 2.5% polymer solids is taken to meet the claimed range (see MPEP 2144.05(I)).

Arumugam does not explicitly teach that the concentration of DCOI is at least 10% by weight. However, Arumugam teaches the composition used to treat wood preferably contains 100 ppm (or 0.01%) to 40,000 ppm (or 4%) wood preservative (see Arumugam at [0011]).

Like Arumugam, Cui teaches wood treatment compositions comprising DCOI (see Cui at [0016] teaching the present disclosure provides compositions for the preservation of wood… the wood preservation compositions… contain an organic preservative agent, see Cui at [0019] teaching exemplary organic preservatives… include isothiazolones such as 4,5-dichloro-2-n-octyl-4-isothiazol-3-one… exemplary concentrations of the active preservative are 0.1-30 weight %... based on the weight of the formulation). The DCOI concentration as taught by Cui overlaps with the DCOI concentration as taught by Arumugam, and the claimed at least 10% by weight (see MPEP 2144.05(I)).

Additionally, MPEP states that "[w]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation", and “the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages” (see MPEP § 2144.05.II.A). It

would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention, to have selected the DCOI concentration as taught by Cui in the wood treatment composition as taught by Arumugam because there is a reasonable expectation of success that the disclosed concentration as taught by Cui would be suitable.

42. Regarding claims 69-70, Arumugam in view of Cui teaches the limitations as applied to claim 68 above, and Arumugam further teaches wherein the organic solvent comprises… a hydrocarbon solvent (claim 69), and wherein the organic solvent comprises… diesel (claim 70) (see Arumugam at [0012] teaching suitably, the organic solvent is diesel… diesel is defined as the fractional distillation of crude oil… resulting in a mixture of carbon chains that typically contain between 8 to 21 carbon atoms per molecule).

43. Regarding claim 71, Arumugam in view of Cui teaches the limitations as applied to claim 68 above, but Arumugam does not explicitly teach wherein the organic solvent comprises soybean oil and 2-ethyl hexanol. However, Arumugam teaches the organic solvent is diesel, however other organic solvents known to those of skill in the art may be used (see Arumugam at [0012]). The claimed "soybean oil and 2-ethyl hexanol" is being treated as taught by Arumugam because other organic solvents known to those of skill in the art may be used and there is no evidence indicating that the claimed solvents are critical.

44. Regarding claim 72, Arumugam in view of Cui teaches the limitations as applied to claim 68 above, but Arumugam does not explicitly teach wherein the solvent borne polymeric resin comprises a hydrocarbon resin, an alkyd resin, or a combination thereof. However, Arumugam

teaches that the polymers used to provide enhanced penetration also effectively fix the organic biocide in the wood as seen by the dislodgeable residue assay in the examples (see Arumugam at [0014]).

Cui teaches that the wood preservative compositions… can further comprise an agent to increase the solubility of the preservative… the preservative solubility-enhancing agent is generally present in an amount effective to increase the solubility of the preservative in the organic phase… exemplary preservative solubility-enhancing agents include… alkyd resins (see Cui at [0022]), which is taken to meet the claimed limitations.

As such, one of ordinary skill in the art would appreciate that Cui teaches that alkyd resins increase the solubility of the preservative (or DCOI) in the organic phase, and seek those advantages by adding alkyd resins in the wood treatment composition as taught by Arumugam.

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention, to add alkyd resins as taught by Cui in the wood treatment composition as taught by Arumugam so as to increase the solubility of the preservative (or DCOI) in the organic phase.

Allowable Subject Matter

45. **Claim 67** would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action.

46. **Claims 51 and 52** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

47. The following is an examiner's statement of reasons for allowance:

48. With respect to independent claim 67, the prior art fails to teach all the cumulative limitations of independent claim 67.

Specifically, it is noted that Cui teaches most of the limitations of independent claim 67 (see rejections of claims 43, 45, 47-50 and 53 based on Cui). Cui also teaches exemplary concentrations of the active preservative (or DCOI) are 0.1-30 weight %... based on the weight of the formulation (see Cui at [0019]), and exemplary concentrations of the hydrophobe component (or retaining additive comprising wax) are 0-40 weight %... based on the weight of the total formulation (see Cui at [0021]). Cui fails to teach the DCOI concentration of 45% by weight to 55% by weight based on the total weight of the composition, and the retaining additive concentration of 45% by weight to 55% by weight based on the total weight of the composition. And, there are no prior art references that provide adequate teachings or apparent reason that would lead the person of ordinary skill to modify Cui as claimed.

As such, the prior fails to teach or render obvious the cumulative limitations of independent claim 67 as claimed. Therefore, the cumulative limitations of independent claim 67 is considered allowable.

49. With respect to claims 51 and 52, the prior art fails to teach all the cumulative limitations of independent claim 43 and respective dependent claims 51 and 52.

Specifically, it is noted that Cui teaches most of the limitations of independent claim 67 (see rejections of claim 43 based on Cui). Cui also teaches exemplary concentrations of the

active preservative (or DCOI) are 0.1-30 weight %... based on the weight of the formulation (see Cui at [0019]), and exemplary concentrations of the hydrophobe component (or retaining additive comprising wax) are 0-40 weight %... based on the weight of the total formulation (see Cui at [0021]), which overlaps with the claimed range of 40% by weight to 60% by weight (claim 51). Cui fails to teach the DCOI concentration of 40% by weight to 60% by weight based on the total weight of the composition (claim 51), DCOI concentration of 45% by weight to 55% by weight based on the total weight of the composition (claim 52), and the retaining additive concentration of 45% by weight to 55% by weight based on the total weight of the composition (claim 52). And, there are no prior art references that provide adequate teachings or apparent reason that would lead the person of ordinary skill to modify Cui as claimed.

As such, the prior fails to teach or render obvious all the cumulative limitations of independent claim 43 and respective dependent claims 51 and 52 as claimed. Therefore, all the cumulative limitations of independent claim 43 and respective dependent claims 51 and 52 are considered allowable.

Conclusion

50. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARITES A GUINO-O UZZLE whose telephone number is (571)272-1039. The examiner can normally be reached M-F 9am-5pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bryan D Ripa can be reached on (571)270-7875. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MARITES A GUINO-O UZZLE/
Examiner, Art Unit 1731

Notice of References Cited	Application/Control No. 19/072,608	Applicant(s)/Patent Under Reexamination Kuang et al.	
	Examiner MARITES A GUINO-O UZZLE	Art Unit 1731	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Name	CPC Classification	US Classification
*	A	US-20060057300-A1	2006-03-16	Cui; Futong	A01N25/02	427/440
*	B	US-20070175360-A1	2007-08-02	Ashmore; John William	B27K3/34	106/18.29
*	C	US-20210112812-A1	2021-04-22	Arumugam; Selvanathan	B27K3/50	1/1
	D					
	E					
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title, Date, Publisher, Edition or Volume, Pertinent Pages
	U	IRM. Classification of Refined Petroleum Waxes [retrieved from the internet at 4/16/2025 from <URL:https://www.irmwax.com/FAQ/Classification%20of%20petroleum%20waxes.aspx>] (Year: 2015)
	V	IRM. Classification of Refined Petroleum Waxes [retrieved from the internet at 4/16/2025 from <URL:https://web.archive.org/web/20151202001852/https://www.irmwax.com/FAQ/Classification%20of%20petroleum%20waxes.aspx>] (Year: 2015)
	W	National Center for Biotechnology Information. PubChem Compound Summary for CID 91688, 4,5-Dichloro-2-octyl-3-isothiazolone. [Retrieved April 17, 2025 from <URL: https://pubchem.ncbi.nlm.nih.gov/compound/4_5-Dichloro-2-octyl-3-isothiazolone>] (Year: 2005)
	X	National Center for Biotechnology Information (2025). PubChem Compound Summary for CID 1030, Propylene Glycol. [Retrieved April 17, 2025 from <URL: https://pubchem.ncbi.nlm.nih.gov/compound/Propylene-Glycol>]. (Year: 2004)

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in YYYY-MM-DD format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	19/072,608	Kuang et al.
	Examiner	**Art Unit**
	MARITES A GUINO-O UZZLE	1731

CPC - Searched*		
Symbol	**Date**	**Examiner**
B27K3/343 A01N43/80 B27K3/40 C09D5/14 C09D125/14 C09D167/08 C09D191/08 B27K2200/10 B27K2200/30 B27K2240/20 B27K2240/50 B27K3/00 B27K3/34 B27K5/00 A01N43/00 C09D191/00 C09D191/06	04/15/2025	MGU

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
PDP and PE2E SEARCH- inventor and assignee search	04/15/2025	MGU
Global Dossier search (attached)	04/15/2025	MGU
PE2E SEARCH- similarity, more like this, combination, text, CPC and interference searches (attached)	04/15/2025	MGU
web search (attached)	04/16/2025	MGU
discussed prior art, claim interpretation, double patenting and allowable subject matter with primary examiner Tony Green	04/16/2025	MGU

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Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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Web Search History

date, time	web site	search string
4/15/2025 7:07:54 AM	Google	4,5-dichloro-2-octylisothiazol-3-one
4/15/2025 7:19:52 AM	Google	slack wax
4/15/2025 7:20:36 AM	Google	slack wax vs paraffin wax
4/15/2025 7:30:07 AM	Google	terpenes
4/15/2025 7:31:52 AM	Google	aliphatic solvent
4/15/2025 7:32:33 AM	Google	aromatic solvent
4/15/2025 7:33:08 AM	Google	hydrocarbon solvent
4/15/2025 7:40:14 AM	Google	solvent borne polymeric resin
4/15/2025 7:42:32 AM	Google	alkyd resin
4/15/2025 7:42:53 AM	Google	alkyd resin vs hydrogen resin
4/15/2025 7:43:26 AM	Google	alkyd resin vs hydrocarbon resin
4/16/2025 8:08:57 AM	Google Scholar	wood preservative comprising dcoit biocide and wax
4/16/2025 8:09:05 AM	Google Scholar	wood preservative comprising dcoit biocide and wax [before:2021]

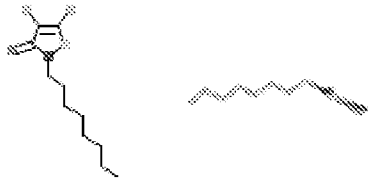
#	CC	Cat.	Citation details	Claims
1	*US*		Application N° US202218294852 (US18294852) - 5 August 2022	
2	*US*		Application N° US202218294874 (US18294874) - 5 August 2022	
3	*MX*		Application N° MX20240001629 (MX2024001629) - 5 August 2022	
4	*MX*		Application N° MX20240001628 (MX2024001628) - 5 August 2022	
5	*CL*		Application N° CL20240000261 (CL2024000261) - 29 January 2024	
6	*CL*		Application N° CL20240000269 (CL2024000269) - 29 January 2024	
7	*BR*		Application N° BR20241102282 (BR112024002282) - 5 August 2022	
8	*AU*		Application N° AU20220324117 (AU2022324117) - 5 August 2022	
9	*AU*		Application N° AU20220323327 (AU2022323327) - 5 August 2022	
10	*CA*		Application N° CA20223225112 (CA3225112) - 5 August 2022	
11	*CA*		Application N° CA20223225114 (CA3225114) - 5 August 2022	
12	*EP*		*Application N° EP20220761916 (EP22761916.0) - 5 August 2022*	
13	*EP*		*Application N° EP20220761914 (EP22761914.5) - 5 August 2022*	
14	*WO*		Application N° WO2022US74619 (WOUS2022/074619) - 5 August 2022	
			International Search Report	
		X	EP2586840 A1 (CHUGOKU MARINE PAINTS [JP]) - 1 May 2013	
		XI	WO2018183615 A1 (DOW GLOBAL TECHNOLOGIES LLC [US], et al) - 4 October 2018	
15	*WO*		Application N° WO2022US74623 (WOUS2022/074623) - 5 August 2022	
			International Search Report	
		Y	EP0349786 B1 (ICHIKAWA GOSEI CHEMICAL CO., LTD) - 10 February 1993	
		Y	US5200188 A (ROHM & HAAS [US]) - 6 April 1993	

PubChem

COMPOUND SUMMARY

4,5-Dichloro-2-octyl-3-isothiazolone

Cite | Download

PubChem CID	91688
Structure	 2D 3D
Chemical Safety	 Corrosive Acute Toxic Environmental Hazard Laboratory Chemical Safety Summary (LCSS) Datasheet
Molecular Formula	$C_{11}H_{17}Cl_2NOS$
Synonyms	64359-81-5 Kathon 930 4,5-Dichloro-2-octylisothiazol-3(2H)-one 4,5-Dichloro-2-octyl-isothiazolone dcoit View More...
Molecular Weight	282.2 g/mol *Computed by PubChem 2.2 (PubChem release 2021.10.14)*
Dates	Create: 2005-08-08 Modify: 2025-04-12
Description	4,5-dichloro-2-n-octyl-3(2H)-isothiazolone is a 1,2-thiazole that is 1,2-thiazol-3(2H)-one substituted by chloro groups at

positions 4 and 5 and an octyl group at position 2. It is used as a fungicide. It has a role as an environmental contaminant, a xenobiotic and a fungicide. It is an organochlorine compound and a member of 1,2-thiazoles.

ChEBI

Contents

Title and Summary

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10 Identification

11 Safety and Hazards

12 Toxicity

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15 Interactions and Pathways

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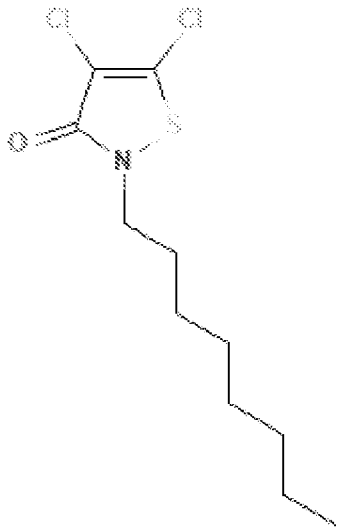
17 Classification

18 Information Sources

1 Structures

1.1 2D Structure

Chemical Structure Depiction



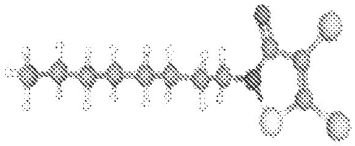
PubChem

1.2 3D Conformer

Interactive Chemical Structure Model

Ball and Stick Sticks Wire-Frame Space-Filling

Show Hydrogens Animate



First Previous Conformer 1 of 10 Next Last

PubChem

2 Names and Identifiers

2.1 Computed Descriptors

2.1.1 IUPAC Name

4,5-dichloro-2-octyl-1,2-thiazol-3-one

Computed by Lexichem TK 2.7.0 (PubChem release 2021.10.14)

PubChem

2.1.2 InChI

InChI=1S/C11H17Cl2NOS/c1-2-3-4-5-6-7-8-14-11(15)9(12)10(13)16-14/h2-8H2,1H3

Computed by InChI 1.0.6 (PubChem release 2021.10.14)

PubChem

2.1.3 InChIKey

PORQOHRXAJJKGK-UHFFFAOYSA-N

Computed by InChI 1.0.6 (PubChem release 2021.10.14)

- PubChem

2.1.4 SMILES

CCCCCCCCN1C(=O)C(=C(S1)Cl)Cl

Computed by OEChem 2.3.0 (PubChem release 2024.12.12)

- PubChem

2.2 Molecular Formula

$C_{11}H_{17}Cl_2NOS$

Computed by PubChem 2.2 (PubChem release 2021.10.14)

- Australian Industrial Chemicals Introduction Scheme (AICIS); PubChem

2.3 Other Identifiers

2.3.1 CAS

64359-81-5

- Australian Industrial Chemicals Introduction Scheme (AICIS); CAS Common Chemistry; ChemIDpl...

2.3.2 Deprecated CAS

442523-55-9

- ChemIDplus; EPA Chemicals under the TSCA

2.3.3 European Community (EC) Number

264-843-8

- European Chemicals Agency (ECHA)

2.3.4 UNII

HCY9Q844W2

- FDA Global Substance Registration System (GSRS)

2.3.5 ChEBI ID

CHEBI:83518

- ChEBI

2.3.6 ChEMBL ID

CHEMBL110764

- ChEMBL

2.3.7 DSSTox Substance ID

DTXSID5032315

- EPA DSSTox

2.3.8 Nikkaji Number

J286.903I

- Japan Chemical Substance Dictionary (Nikkaji)

2.3.9 Wikidata

Q1209407

- Wikidata

2.3.10 Wikipedia

Dichlorooctylisothiazolinone

- Wikipedia

2.4 Synonyms

2.4.1 MeSH Entry Terms

4,5-dichloro-2-(n-octyl)-3(2H)-isothiazolone
4,5-dichloro-2-n-octyl-4-isothiazolin-3-one
Kathon 930
Sea Nine 211
Sea-Nine 211

- Medical Subject Headings (MeSH)

2.4.2 Depositor-Supplied Synonyms

64359-81-5	3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-	CHEBI:83518
Kathon 930	Caswell No. 314B	SEA-NINE
4,5-Dichloro-2-octylisothiazol-3(2H)-one	4,5-dichloro-2-octyl-1,2-thiazol-3-one	DTXCID30123
4,5-Dichloro-2-octyl-isothiazolone	Sea Nine 211	HSDB 8454
dcoit	4,5-Dichloro-2-octyl-2H-isothiazol-3-one	2-n-octyl-4,5
4,5-Dichloro-2-n-octyl-4-isothiazolin-3-one	EINECS 264-843-8	4,5-dichloro-
4,5-Dichloro-2-octyl-3(2H)-isothiazolone	4,5-dichloro-2-octyl-3-isothiazolone	4,5-Dichloro-
4,5-Dichloro-2-n-octyl-3(2H)-isothiazolone	EPA Pesticide Chemical Code 128101	RH-5287
Anti-Foulant C-9211M	HCY9Q844W2	4,5-dichloro-
Sea-Nine 211	DTXSID5032315	C-9211

- PubChem

3 Chemical and Physical Properties

3.1 Computed Properties

Property Name	Property Value	Reference
Molecular Weight	282.2 g/mol	Computed by PubChem 2.2 (PubChem release 2021.10.14)
XLogP3-AA	5.1	Computed by XLogP3 3.0 (PubChem release 2021.10.14)
Hydrogen Bond Donor Count	0	Computed by Cactvs 3.4.8.18 (PubChem release 2021.10.14)
Hydrogen Bond Acceptor Count	2	Computed by Cactvs 3.4.8.18 (PubChem release 2021.10.14)
Rotatable Bond Count	7	Computed by Cactvs 3.4.8.18 (PubChem release 2021.10.14)
Exact Mass	281.0407907 Da	Computed by PubChem 2.2 (PubChem release 2021.10.14)
Monoisotopic Mass	281.0407907 Da	Computed by PubChem 2.2 (PubChem release 2021.10.14)
Topological Polar Surface Area	45.6 $Å^2$	Computed by Cactvs 3.4.8.18 (PubChem release 2021.10.14)
Heavy Atom Count	16	Computed by PubChem
Formal Charge	0	Computed by PubChem
Complexity	281	Computed by Cactvs 3.4.8.18 (PubChem release 2021.10.14)
Isotope Atom Count	0	Computed by PubChem
Defined Atom Stereocenter Count	0	Computed by PubChem
Undefined Atom Stereocenter Count	0	Computed by PubChem
Defined Bond Stereocenter Count	0	Computed by PubChem
Undefined Bond Stereocenter Count	0	Computed by PubChem
Covalently-Bonded Unit Count	1	Computed by PubChem

Compound Is Canonicalized	Yes	Computed by PubChem (release 2021.10.14)

▸ PubChem

3.2 Experimental Properties

3.2.1 Color / Form

Crystals from hexane

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

▸ Hazardous Substances Data Bank (HSDB)

3.2.2 Boiling Point

Decomposes before boiling

USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403. Washington, DC: Environmental Protection Agency, Office of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

▸ Hazardous Substances Data Bank (HSDB)

3.2.3 Melting Point

40-46 °C

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

▸ Hazardous Substances Data Bank (HSDB)

3.2.4 Solubility

In water, 14 ppm at 25 °C

USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403. Washington, DC: Environmental Protection Agency, Office

of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

- Hazardous Substances Data Bank (HSDB)

In deionized water, 6.5 ppm; 4.7 ppm in synthetic seawater

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

- Hazardous Substances Data Bank (HSDB)

Miscible in most organic solvents

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

- Hazardous Substances Data Bank (HSDB)

3.2.5 Density

1.28 g/mL at 25 °C (melted and solidified)

USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403. Washington, DC: Environmental Protection Agency, Office of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

- Hazardous Substances Data Bank (HSDB)

3.2.6 Vapor Pressure

7.4X10-6 mm Hg at 25 °C

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

- Hazardous Substances Data Bank (HSDB)

3.2.7 LogP

log Kow = 2.8, also reported as 4.5

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

Hazardous Substances Data Bank (HSDB)

3.2.8 Stability / Shelf Life

Stable under recommended storage conditions.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

3.2.9 Decomposition

Hazardous decomposition products formed under fire conditions - Carbon oxides, nitrogen oxides (NOx), Sulfur oxides, Hydrogen chloride gas.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

3.2.10 Other Experimental Properties

Technical product is reported as tan-to-brown waxy solid with pungent aromatic odor, MP 40-41 °C /technical 4,5-Dichloro-2-octyl-3-isothiazolone/

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

Hazardous Substances Data Bank (HSDB)

VP: 4.5X10-6 mm Hg, temp not specified; Henry's Law constant: 1.2X10-7 atm-cu m/mol at 25 °C (calc)

USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403. Washington, DC: Environmental Protection Agency, Office of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

Hazardous Substances Data Bank (HSDB)

3.3 Chemical Classes

3.3.1 Endocrine Disruptors

Potential endocrine disrupting compound

S109 | PARCEDC | List of 7074 potential endocrine disrupting compounds (EDCs) by PARC T4.2 | DOI:10.5281/zenodo.10944198

- NORMAN Suspect List Exchange

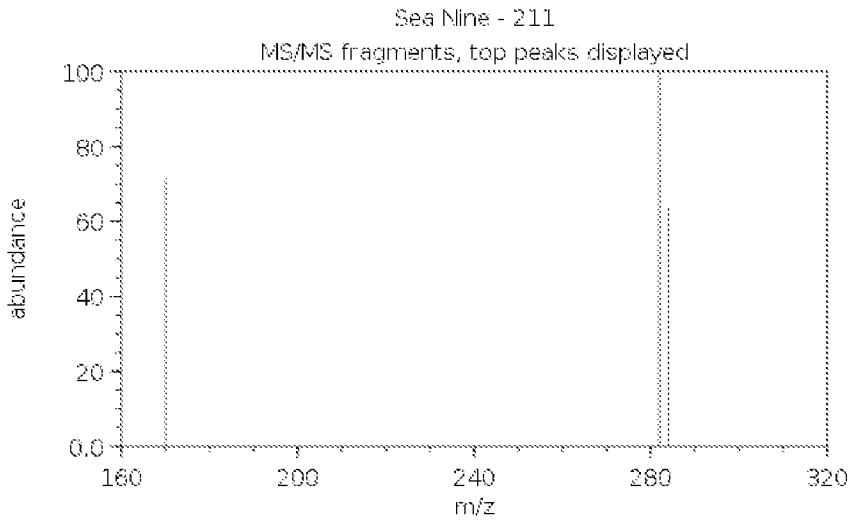
4 Spectral Information

4.1 Mass Spectrometry

4.1.1 MS-MS

NIST Number	1000891
Instrument Type	IT/ion trap
Collision Energy	0
Spectrum Type	MS2
Precursor Type	[M+H]+
Precursor m/z	282.0481
Total Peaks	8
m/z Top Peak	282
m/z 2nd Highest	170
m/z 3rd Highest	284

Thumbnail

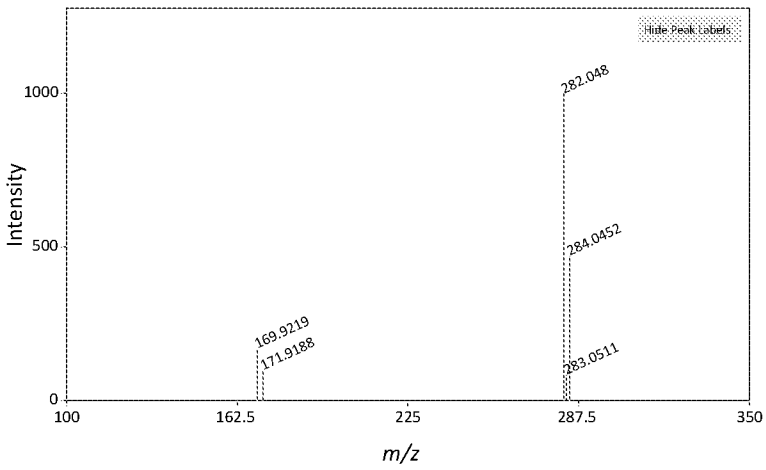


© 2014 by the U.S. Secretary of Commerce.

NIST Mass Spectrometry Data Center

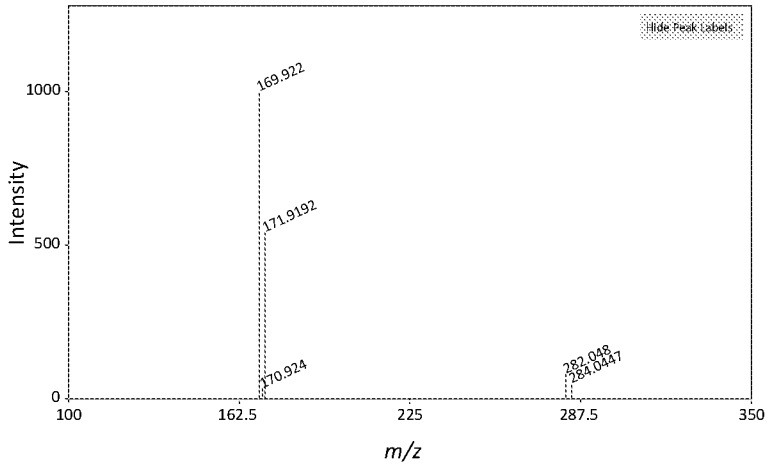
4.1.2 LC-MS

1 of 30	View All
Accession ID	MSBNK-Athens_Univ-AU287501
Authors	Nikiforos Alygizakis, Katerina Galani, Nikolaos Thomaidis, University of Athens
Instrument	Bruker maXis Impact
Instrument Type	LC-ESI-QTOF
MS Level	MS2
Ionization Mode	POSITIVE
Ionization	ESI
Collision Energy	10 eV
Fragmentation Mode	CID
Column Name	Acclaim RSLC C18 2.2um, 2.1x100mm, Thermo
Retention Time	12.462 min
Precursor m/z	282.0481

Precursor Adduct	[M+H]+
Top 5 Peaks	282.048 999 284.0452 471 169.9219 169 171.9188 99 283.0511 83
SPLASH	splash10-001i-0190000000-216a175f2398330438b6
Thumbnail	
License	CC BY

MassBank Europe

2 of 30	View All
Accession ID	MSBNK-Athens_Univ-AU287502
Authors	Nikiforos Alygizakis, Katerina Galani, Nikolaos Thomaidis, University of Athens
Instrument	Bruker maXis Impact
Instrument Type	LC-ESI-QTOF
MS Level	MS2
Ionization Mode	POSITIVE
Ionization	ESI
Collision Energy	20 eV

Fragmentation Mode	CID
Column Name	Acclaim RSLC C18 2.2um, 2.1x100mm, Thermo
Retention Time	12.461 min
Precursor m/z	282.0481
Precursor Adduct	[M+H]+
Top 5 Peaks	169.922 999 171.9192 541 282.048 80 284.0447 49 170.924 33
SPLASH	splash10-01b9-0900000000-4861b1bc6d14826e7185
Thumbnail	
License	CC BY

▸ MassBank Europe

5 Related Records

5.1 Related Compounds with Annotation

Follow these links to do a live 2D search or do a live 3D search for this compound, sorted by annotation score. This section is deprecated (see here for details), but these live search links provide equivalent functionality to the table that was previously shown here.

PubChem

5.2 Related Compounds

Same Parent, Exact Count	8
Mixtures, Components, and Neutralized Forms Count	22
Similar Compounds (2D)	View in PubChem Search
Similar Conformers (3D)	View in PubChem Search

PubChem

5.3 Substances

5.3.1 PubChem Reference Collection SID

505503400

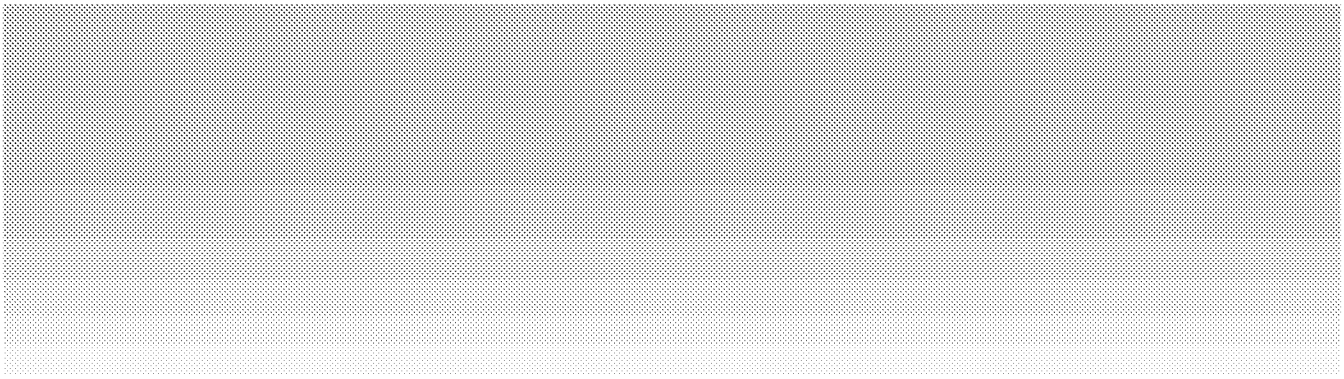
PubChem

5.3.2 Related Substances

All Count	174
Same Count	145
Mixture Count	29

PubChem

5.3.3 Substances by Category



PubChem

5.4 Entrez Crosslinks

PubMed Count	11
Taxonomy Count	1
Gene Count	4

PubChem

6 Chemical Vendors



PubChem

7 Agrochemical Information

7.1 Agrochemical Category

Microbiocide

- EPA Pesticide Ecotoxicity Database

8 Pharmacology and Biochemistry

8.1 Absorption, Distribution and Excretion

Dermal absorption of RH-287 was examined in male Crl:CD:BR rats. There were six experimental groups of 4 rats each. Two concentrations of RH-287 were employed, 3% and 0.045%. Dermal application was made to a shaved 2 x 2 cm area on the interscapular region of the back, which was fitted with a contoured glass ring secured with cyanoacrylate glue and a porous top secured with rubber bands after application of the test substance in a dose aliquot of 60 uL. Two groups (A and B) received either 3% of 0.045% RH287 and urine and feces samples obtained at 10 hours post-dose, at which time the animals were killed and analysis for radioactivity performed in whole blood, plasma, and remaining carcass. Two additional groups (C and D) received either 3% or 0.045% RH-287 and were subjected to the same procedures as groups A and B, except exposure duration was 24 hours. The last two groups (E and F) received either 3% or 0.045 % RH-287, and urine and feces samples taken at 0, 10, 24, 48, and 72 hours post-dose. Animals in this group were sacrificed at 72 hours post-dose and analysis for radioactivity performed as for the other groups. Results of this study showed that at a dose of 0.045% RH-287, 44-50% of the dose was absorbed after a 10 hour exposure, and 70% after a 24 hour exposure. Administration of 3% RH-287 resulted in 31-34% absorption after 10 hours of exposure, and 52% absorption after 24 hours exposure.

US EPA; DCOIT Final Work Plan, Registration Review: Initial Docket, Case Number 5023, EPA-HQ-OPP-2014-0403-0005, p.39-40 (March 2015). Available from, as of August 3, 2018: https://www.regulations.gov/

- Hazardous Substances Data Bank (HSDB)

9 Use and Manufacturing

9.1 Uses

EPA CPDat Chemical and Product Categories



The Chemical and Products Database, a resource for exposure-relevant data on chemicals in consumer products, Scientific Data, volume 5, Article number: 180125 (2018), DOI:10.1038/sdata.2018.125

- EPA Chemical and Products Database (CPDat)

There are 27 products (three are manufacture use products or MUPs) registered for uses for incorporation into products such as adhesives, coatings, fuels, metal working fluids (MUP only), resin emulsions, paints and various other specialty industrial products (as a preservative); and, as a microbiocide in pulp/paper mills, cooling water systems, oil field operations (MUP only), industrial process waters and air washers systems. The compound is also registered for use to treat wood products (seasoned/unseasoned forest products and various finished wood products).

US EPA; DCOIT Final Work Plan, Registration Review: Initial Docket, Case Number 5023, EPA-HQ-OPP-2014-0403-0005, p.12 (March 2015). Available from, as of August 3, 2018: https://www.regulations.gov/

- Hazardous Substances Data Bank (HSDB)

For 4,5-dichloro-2-n-octyl-3(2H)-isothiazolone (USEPA/OPP Pesticide Code: 128101) ACTIVE products with label matches. /SRP: Registered for use in the USA but approved pesticide uses may change periodically and so federal, state and local authorities must be consulted for currently approved uses./

National Pesticide Information Retrieval System's Database on 4,5-Dichloro-2-n-octyl-3(2H)-isothiazolone (64359-81-5). Available from, as of July 20, 2018: https://npirspublic.ceris.purdue.edu/ppis/

- Hazardous Substances Data Bank (HSDB)

Marine antifoulant.

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

- Hazardous Substances Data Bank (HSDB)

Isothiazolinones with longer aliphatic chains tend to be more fungicidal. They are used as fungicides for dry-film protection in paints, sealants, plasticized PVC, for wood stains and as co-fungicides for in-can preservatives based on combination with other biocides. /Isothiazolinones/

Uhr H et al; Biocides. Ullmann's Encyclopedia of Industrial Chemistry 7th ed. (1999-2018). NY, NY: John Wiley & Sons. Online Posting Date: October 9, 2013

- Hazardous Substances Data Bank (HSDB)

9.2 Formulations / Preparations

Sea Grand Prix CF-10 (Chugoku Marine Paints (U.S.A.), Inc): Active ingredient: zinc pyrithione 2.85% and 3(2H)-isothiazolone, 4,5-dichloro-2-octyl- 3.6%.

National Pesticide Information Retrieval System's Database on 3(2H)-Isothiazolone, 4,5-dichloro-2-octyl- (64359-81-5). Available from, as of July 20, 2018: https://npirspublic.ceris.purdue.edu/ppis/

- Hazardous Substances Data Bank (HSDB)

Sea Grandprix 660 HS Light Brown S (Chugoku Marine Paints (U.S.A.), Inc): Active ingredient: cuprous oxide 19.0% and 3(2H)-isothiazolone, 4,5-dichloro-2-octyl- 1.5%.

National Pesticide Information Retrieval System's Database on 3(2H)-Isothiazolone, 4,5-dichloro-2-octyl- (64359-81-5). Available from, as of July 20, 2018: https://npirspublic.ceris.purdue.edu/ppis/

- Hazardous Substances Data Bank (HSDB)

Bioban DC 9P5 Antimicrobial (Dow Chemical Company): Active ingredient: 3(2H)-isothiazolone, 4,5-dichloro-2-octyl- 9.5%.

National Pesticide Information Retrieval System's Database on 3(2H)-Isothiazolone, 4,5-dichloro-2-octyl- (64359-81-5). Available from, as of July 20, 2018: https://npirspublic.ceris.purdue.edu/ppis/

- Hazardous Substances Data Bank (HSDB)

E Paint SN-1 (E Paint Company): Active ingredient: 3(2H)-isothiazolone, 4,5-dichloro-2-octyl- 2.91%.

National Pesticide Information Retrieval System's Database on 3(2H)-Isothiazolone, 4,5-dichloro-2-octyl- (64359-81-5). Available from, as of July 20, 2018: https://npirspublic.ceris.purdue.edu/ppis/

- Hazardous Substances Data Bank (HSDB)

For more Formulations/Preparations (Complete) data for 4,5-Dichloro-2-octyl-3-isothiazolone (33 total), please visit the HSDB record page.

- Hazardous Substances Data Bank (HSDB)

9.3 General Manufacturing Information

EPA TSCA Commercial Activity Status

3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-: ACTIVE

- EPA Chemicals under the TSCA

10 Identification

10.1 Analytic Laboratory Methods

A new, rapid microextraction technique termed solvent microextraction (SME) has been developed for the simultaneous determination of new generation antifouling agents, in water samples. Chlorothalonil, dichlofluanid and Sea nine 211 were employed as model compounds to asses the extraction procedure and were determined by gas chromatography with electron capture detection. Experimental parameters which control the performance of SME, such as selection of solvent, exposure time, agitation, organic drop volume, and salt concentration were optimized. The new method provided good average enrichment factors of >10.7 for all analytes, good precision (RSD < 8.5%) and good linearity (r2 > 0.9880). The limits of detection (LODs) were in the range of 0.00025-0.003 microg/L (S/N = 3). The SME was performed in different type of natural water samples and acceptable recoveries were obtained for the tested analytes. The results demonstrated that SME is a rapid, accurate and effective preparation method and could be successfully performed for the determination of antifouling agents in water samples.

PMID:15499913

Lambropoulou DA, Albanis TA; J Chromatogr A 1049 (1-2): 17-23 (2004)

- Hazardous Substances Data Bank (HSDB)

HPLC analysis and persistence in seawater and sediment.

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 556

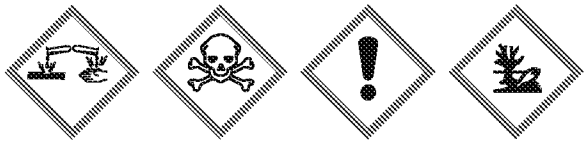
- Hazardous Substances Data Bank (HSDB)

11 Safety and Hazards

11.1 Hazards Identification

11.1.1 GHS Classification

1 of 6 View All

Note	*Pictograms displayed are for 98.7% (368 of 373) of reports that indicate hazard statements. This chemical does not meet GHS hazard criteria for 1.3% (5 of 373) of reports.*
Pictogram(s)	 Corrosive; Acute Toxic; Irritant; Environmental Hazard
Signal	Danger
GHS Hazard Statements	H302+H312 (10.2%): Harmful if swallowed or in contact with skin [**Warning** Acute toxicity, oral; acute toxicity, dermal] H302 (97.6%): Harmful if swallowed [**Warning** Acute toxicity, oral] H312 (29.8%): Harmful in contact with skin [**Warning** Acute toxicity, dermal] H314 (98.1%): Causes severe skin burns and eye damage [**Danger** Skin corrosion/irritation] H317 (98.7%): May cause an allergic skin reaction [**Warning** Sensitization, Skin] H318 (69.2%): Causes serious eye damage [**Danger** Serious eye damage/eye irritation] H330 (76.1%): Fatal if inhaled [**Danger** Acute toxicity, inhalation] H331 (12.6%): Toxic if inhaled [**Danger** Acute toxicity, inhalation] H335 (57.9%): May cause respiratory irritation [**Warning** Specific target organ toxicity, single exposure; Respiratory tract irritation] H400 (97.1%): Very toxic to aquatic life [**Warning** Hazardous to the aquatic environment, acute hazard] H410 (82.3%): Very toxic to aquatic life with long lasting effects [**Warning** Hazardous to the aquatic environment, long-term hazard]
Precautionary Statement Codes	P260, P261, P264, P264+P265, P270, P271, P272, P273, P280, P284, P301+P317, P301+P330+P331, P302+P352, P302+P361+P354, P304+P340, P305+P354+P338, P316, P317, P319, P320, P321, P330, P333+P317, P362+P364, P363, P391, P403+P233, P405, and P501

	(The corresponding statement to each P-code can be found at the GHS Classification page.)
ECHA C&L Notifications Summary	*Aggregated GHS information provided per 373 reports by companies from 28 notifications to the ECHA C&L Inventory. Each notification may be associated with multiple companies.* *Reported as not meeting GHS hazard criteria per 5 of 373 reports by companies.* *There are 27 notifications provided by 368 of 373 reports by companies with hazard statement code(s).* *Information may vary between notifications depending on impurities, additives, and other factors. The percentage value in parenthesis indicates the notified classification ratio from companies that provide hazard codes. Only hazard codes with percentage values above 10% are shown. For more detailed information, please visit ECHA C&L website.*

▸ European Chemicals Agency (ECHA)

11.1.2 Hazard Classes and Categories

Acute Tox. 4 (97.6%)

Acute Tox. 4 (29.8%)

Skin Corr. 1B (98.1%)

Skin Sens. 1A (98.7%)

Eye Dam. 1 (69.2%)

Acute Tox. 2 (76.1%)

Acute Tox. 3 (12.6%)

STOT SE 3 (57.9%)

Aquatic Acute 1 (97.1%)

Aquatic Chronic 1 (82.3%)

▸ European Chemicals Agency (ECHA)

Acute toxicity (ingestion) - category 4

Acute toxicity (inhalation) - category 1

Skin corrosion - category 1

Skin sensitisation - category 1A

Hazardous to the aquatic environment (acute) - category 1

Hazardous to the aquatic environment (chronic) - category 1

- Hazardous Chemical Information System (HCIS), Safe Work Australia

View More...

11.2 Fire Fighting

11.2.1 Fire Fighting Procedures

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

Advice for firefighters: Wear self-contained breathing apparatus for firefighting if necessary.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

11.3 Accidental Release Measures

11.3.1 Cleanup Methods

ACCIDENTAL RELEASE MEASURES: Personal precautions, protective equipment and emergency procedures: Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided. Methods and materials for containment and cleaning up: Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

11.3.2 Disposal Methods

SRP: Recycle any unused portion of the material for its approved use or return it to the manufacturer or supplier. Ultimate disposal of the chemical must consider: the material's impact on air quality; potential migration in air, soil or water; effects on animal, aquatic and plant life; and conformance with environmental and public health regulations. If it is possible or reasonable use an alternative chemical product with less inherent propensity for occupational harm/injury/toxicity or environmental contamination.

- Hazardous Substances Data Bank (HSDB)

Product: Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber; Contaminated packaging: Dispose of as unused product.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

11.3.3 Preventive Measures

ACCIDENTAL RELEASE MEASURES: Personal precautions, protective equipment and emergency procedures: Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

Precautions for safe handling: Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018:

https://www.sigmaaldrich.com/safety-center.html

▸ Hazardous Substances Data Bank (HSDB)

Appropriate engineering controls: Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

▸ Hazardous Substances Data Bank (HSDB)

Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

▸ Hazardous Substances Data Bank (HSDB)

SRP: Local exhaust ventilation should be applied wherever there is an incidence of point source emissions or dispersion of regulated contaminants in the work area. Ventilation control of the contaminant as close to its point of generation is both the most economical and safest method to minimize personnel exposure to airborne contaminants. Ensure that the local ventilation moves the contaminant away from the worker.

▸ Hazardous Substances Data Bank (HSDB)

11.4 Handling and Storage

11.4.1 Storage Conditions

Keep container tightly closed in a dry and well-ventilated place.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

▸ Hazardous Substances Data Bank (HSDB)

11.5 Exposure Control and Personal Protection

11.5.1 Personal Protective Equipment (PPE)

Eye/face protection: Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

Skin protection: Handle with gloves.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

Body Protection: Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

11.6 Stability and Reactivity

11.6.1 Hazardous Reactivities and Incompatibilities

Incompatible materials: Strong oxidizing agents.

Sigma-Aldrich; Safety Data Sheet for 4,5-Dichloro-2-octyl-isothiazolone. Product Number: CDS003259, Version 5.2 (Revision Date 02/23/2017). Available from, as of August 6, 2018: https://www.sigmaaldrich.com/safety-center.html

- Hazardous Substances Data Bank (HSDB)

11.7 Regulatory Information

The Australian Inventory of Industrial Chemicals

Chemical: 3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-

- Australian Industrial Chemicals Introduction Scheme (AICIS)

Safe Drinking Water Act

Kathon 930 is listed in the dataset of EPA Human Health Benchmarks for Pesticides under the Safe Drinking Water Act (40 eCFR 141)

- EPA Safe Drinking Water Act (SDWA)

New Zealand EPA Inventory of Chemical Status

3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-: HSNO Approval: HSR002758 Approved with controls

- New Zealand Environmental Protection Authority (EPA)

11.8 Other Safety Information

Chemical Assessment

IMAP assessments - Isothiazolinones: Human health tier III assessment

IMAP assessments - 3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-: Human health tier II assessment

IMAP assessments - Octylisothiazolinone preservatives and industrial biocides: Environment tier II assessment

- Australian Industrial Chemicals Introduction Scheme (AICIS)

12 Toxicity

12.1 Toxicological Information

12.1.1 Toxicity Summary

IDENTIFICATION AND USE: 4,5-Dichloro-2-octyl-3-isothiazolone (DCOIT) is a solid. It is used as a marine antifoulant. HUMAN STUDIES: An outbreak of occupational contact dermatitis occurred due to the biocide DCOIT. Eight of 19 persons, six females, 20 to 63 years old, employed in a Japanese textile finishing factory developed edematous reddish eruptions on their forearms, upper arms, face, or neck. The subjects have been sensitized to DCOIT without apparent cross sensitization to DCOIT. ANIMAL STUDIES: In dogs decreased body weight and food consumption, hematologic and clinical chemistry parameter changes observed at 1500 ppm. After inhalation in rats at concentrations of 0.02, 0.63, and 6.72 mg/cu m for 6 hours per day, 5 days per week, for thirteen weeks, treatment-related microscopic lesions in the nose, larynx, and lungs were observed in mid- and high-dose treated rats. Minimal or mild subacute inflammation of the nose was observed in increased incidence, as was transitional respiratory epithelial hyperplasia and goblet cell hyperplasia. In the epiglottis, hyperplasia of the squamous and cuboidal epithelium was observed in mid- and high dose rats, as was chronic-active inflammation of the epiglottis. Goblet cell hyperplasia and acute inflammation was observed in increased incidence in the lungs of high dose rats. In the developmental study in rabbits, there were no treatment-related external, visceral, or skeletal malformations or variations. In rats, fetuses at 100 mg/kg/day showed an increase in the number of fetuses with wavy ribs, along with an increase in number of litters with this effect as well as the severity of the effect. It was not mutagenic in Salmonella strains TA1535, TA1537, TA98, TA100 with or without metabolic activation. It induced clastogenic response in Chinese hamster ovary in vitro cytogenetic assays in the presence or absence of metabolic activation. ECOTOXICITY STUDIES: In marine medaka (Oryzias melastigma) gene transcription analysis showed that DCOIT had positive regulatory effects mainly in male of the hypothalamus-pituitary-gonadal-liver axis with lesser extent in females. The stimulated steroidogenic activities resulted in increased concentrations of steroid hormones, including estradiol (E2), testosterone (T), and 11-KT-testosterone (11-KT), in the plasma of both sexes, leading to an imbalance in hormone homeostasis and increased E2/T ratio. The relatively estrogenic intracellular environment in both sexes induced the hepatic synthesis and increased the liver and plasma content of vitellogenin (VTG) or choriogenin. Furthermore, parental exposure to DCOIT transgenerationally impaired the viability of offspring, as supported by a decrease in hatching and swimming activity. DCOIT induced differential expression of 26 proteins in male brains and of 27 proteins in female brains of the marine medaka (Oryzias melastigma) after a 28-day exposure to environmentally-realistic concentration at 2.55 ug/L.

Hazardous Substances Data Bank (HSDB)

12.1.2 RAIS Toxicity Values

Oral Acute Reference Dose (RfDoa)(mg/kg-day)	0.03
Oral Acute Reference Dose Reference	OPP
Oral Chronic Reference Dose (RfDoc) (mg/kg-day)	0.002
Oral Chronic Reference Dose Reference	OPP

Risk Assessment Information System (RAIS)

12.1.3 EPA Human Health Benchmarks for Pesticides

Chemical Substance	Kathon 930
Acute or One Day PAD (RfD) [mg/kg/day]	0.03
Acute or One Day HHBPs [ppb]	200
Acute HHBP Sensitive Lifestage/Population	Children
Chronic or One Day PAD (RfD) [mg/kg/day]	0.002
Chronic or One Day HHBPs [ppb]	10
Chronic HHBP Sensitive Lifestage/Population	General Population
Reference (PDF)	Human Health Benchmarks for Pesticides - 2021 Update

EPA Safe Drinking Water Act (SDWA)

12.1.4 Interactions

The toxicity of three antifoulants (Sea-Nine, Irgarol, and TBT) was determined individually and in mixtures in two tests with microalgae. Effects on periphyton community photosynthesis and reproduction of the unicellular green algae Scenedesmus vacuolatus were investigated. The tested antifoulants were highly toxic in both tests. Observed mixture toxicities were compared with predictions derived from two concepts: Independent Action (IA), assumed to be more relevant for the tested mixtures that were composed of dissimilarly acting substances, and Concentration Addition (CA), regarded as a reasonable worst-case approach in predictive mixture hazard assessment. Despite the corresponding mechanistic basis, IA failed to provide accurate predictions of the observed mixture toxicities. Results show the same pattern in both assays. Mixture effects at high concentrations were slightly overestimated and effects at low concentrations were slightly underestimated. Maximum observed deviations between observed and IA-predicted concentrations amount to a factor of 4. The suggested worst-case approach using CA was protective only in effect regions above 20%. Nevertheless, the application of any concept that accounts for possible mixture effects is more realistic than the present chemical-by-chemical assessment.

PMID:16392016

Arrhenius A et al; Arch Environ Contam Toxicol 50 (3): 335-45 (2006)

▸ Hazardous Substances Data Bank (HSDB)

12.1.5 Antidote and Emergency Treatment

/SRP:/ Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR if necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160

▸ Hazardous Substances Data Bank (HSDB)

/SRP:/ Basic treatment: Establish a patent airway (oropharyngeal or nasopharyngeal airway, if needed). Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if needed. Administer oxygen by nonrebreather mask at 10 to 15 L/min. Monitor for pulmonary edema and treat if necessary ... . Monitor for shock and treat if necessary ... .

Anticipate seizures and treat if necessary ... . For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with 0.9% saline (NS) during transport ... . Do not use emetics. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool ... . Cover skin burns with dry sterile dressings after decontamination ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160

Hazardous Substances Data Bank (HSDB)

/SRP:/ Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious, has severe pulmonary edema, or is in severe respiratory distress. Positive-pressure ventilation techniques with a bag valve mask device may be beneficial. Consider drug therapy for pulmonary edema ... . Consider administering a beta agonist such as albuterol for severe bronchospasm ... . Monitor cardiac rhythm and treat arrhythmias as necessary ... . Start IV administration of D5W TKO /SRP: "To keep open", minimal flow rate/. Use 0.9% saline (NS) or lactated Ringer's (LR) if signs of hypovolemia are present. For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload ... . Treat seizures with diazepam (Valium) or lorazepam (Ativan) ... . Use proparacaine hydrochloride to assist eye irrigation ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160-1

Hazardous Substances Data Bank (HSDB)

12.1.6 Human Toxicity Excerpts

/CASE REPORTS/ An outbreak of occupational contact dermatitis due to the biocide Kathon-930 was described. Eight of 19 persons, six females, 20 to 63 years old, employed in a Japanese textile finishing factory developed edematous reddish eruptions on their forearms, upper arms, face, or neck between 24 July and 8 August 1991. Two patients worked in the textile finishing unit. The other six worked in the drying and inspection unit. All eight wore protective gloves; however, they wore short sleeved shirts and used no protective equipment on their upper arms or forearms. The patients reported that on 2 July a new biocide consisting of 30% Kathon-930 in xylene was added to the finishing agent. Open patch testing was performed with Kathon-930 and closed patch testing was performed with Kathon-CG and the finishing agent without Kathon-930. Seven of the eight patients reacted to the Kathon-930 patch. None of the patients reacted to the Kathon-CG patch or to the finishing agent without Kathon-930. The authors conclude that since the manufacturer indicated that Kathon-930 is a strong skin irritant and sensitizer, it should not be used in products that come into contact with the skin.

The subjects have been sensitized to Kathon-930 without apparent cross sensitization to Kathon-CG.

Kawai K et al; Contact Dermatitis 28 (2): 117-8 (1993)

Hazardous Substances Data Bank (HSDB)

12.1.7 Non-Human Toxicity Excerpts

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ In the subchronic rat oral study, oral administration of DCOIT Technical via the diet to Crl:CDBR rats[10/sex/group for 13 weeks at dose levels of 0, 100 ppm [6.2 males/7.2 females mg/kg/day], 500 ppm [32.5 males/36.7 females mg/kg/day], 1000 ppm [60.7 males/74.7 females mg/kg/day], and 4000 ppm [248.2 males/278.4 females mg/kg/day] resulted in decreased body weight throughout the study at the high dose level in both sexes [males 86%/ females 80% of control at 13 weeks], decreased overall body-weight gain [males 79%/ females 77% (4000 ppm) females 85% (1000 ppm) of control], decreased food consumption at 4000 ppm for both sexes and at 1000 ppm in females initially, decreased water consumption 4000 ppm, changes in several hematology/blood chemistry parameters consistent with chronic, low level blood loss, and microscopic, treatment related, changes in the forestomach [increase in mucosal erosion/ulceration, submucosal edema, acute inflammation, hyperplasia of the mucosal epithelium, and/or hyperkeratosis). The NOAEL is at 500 ppm [32.5 males/36.7 females ug/kg/day], the LOAEL at 1000 ppm [60.7 males / 74.7 females mg/kg/day], based on microscopic lesions in the forestomach in males and decreased body weight/gain and food consumption, decreased serum triglyceride levels, and microscopic lesions in the forestomach in females.

US EPA; DCOIT Final Work Plan, Registration Review: Initial Docket, Case Number 5023, EPA-HQ-OPP-2014-0403-0005, p.32 (March 2015). Available from, as of August 3, 2018: https://www.regulations.gov/

Hazardous Substances Data Bank (HSDB)

Viance Exhibit 1004, Part 1 of 2
Viance v. Koppers Performance Chemicals
PGR2026-00023
Page 144 of 205

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ In this subchronic rat inhalation study, groups of 32 male and 32 female Crl;CD BR rats received nose-only inhalation exposure for 6 hours per day, 5 days per week, for thirteen weeks to air, an aerosol of o-xylene (the vehicle) at 238.5 mg/cu m, or DCOIT at concentrations of 0.02, 0.63, and 6.72 mg/cu m. At the end of the thirteen week exposure period, half of the animals in each group were necropsied, 5 from each group were necropsied at six months, and the remaining animals were necropsied at the end of a one-year recovery period. Mean mass median aerodynamic diameter of DCOIT was 1.4 um, and the mean geometric standard deviation was 4.6, with 72% respirable fraction. Increased mortality was observed in the vehicle control group of female rats during the exposure period, but was attributed to over-restraint in the nose-only tubes. There was no other treatment-related increase in mortality either during the treatment period or during the recovery period. The incidence of rales was increased in high dose males and females

beginning at weeks 2-3 of exposure. Significant differences were observed in body weight gain between the air control and vehicle control group during treatment, indicating an effect of vehicle on body weight gain. When compared with the vehicle control, the test material resulted in decreased body weight gain of approximately 20% at the high dose level beginning at week 2 and persisting throughout the thirteen week exposure period for male and female rats. During recovery, there were no significant effects on body weight gain in treated male or female rats. No statistically significant differences were observed in treated rats vs. vehicle or control rats in clinical chemistry or hematology parameters at any dose tested. Treatment-related microscopic lesions in the nose, larynx, and lungs were observed in mid- and high-dose treated rats. Minimal or mild subacute inflammation of the nose was observed in increased incidence, as was transitional respiratory epithelial hyperplasia and goblet cell hyperplasia. In the epiglottis, hyperplasia of the squamous and cuboidal epithelium was observed in mid- and high dose rats, as was chronic-active inflammation of the epiglottis. Goblet cell hyperplasia and acute inflammation was observed in increased incidence in the lungs of high dose rats. Based upon the histopathological alterations observed in the nose, larynx, and lungs, the systemic LOAEL is determined to be 0.63 mg/cu m, and the systemic NOAEL is determined to be 0.02 mg/cu m.

US EPA; DCOIT Final Work Plan, Registration Review: Initial Docket, Case Number 5023, EPA-HQ-OPP-2014-0403-0005, p.33-4 (March 2015). Available from, as of August 3, 2018: https://www.regulations.gov/

- Hazardous Substances Data Bank (HSDB)

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ In the subchronic dog oral toxicity study, DCOIT [98.42 a.i.] was administered to beagles (4/sex/dose) in the diet at dose levels of approximately 0, 100, 300 and 1500 ppm for 13 weeks. No treatment-related effects were observed on survival, clinical or neurobehavioral findings, ophthalmology, physical examinations, organ weights or macroscopic pathology in either sex at = 1500 ppm. Some microscopic effects were considered to be secondary and caused by decreased body weight and food consumption (thymic atrophy). One 1500 ppm female beagle exhibited severe morbidity due to complications with the feeding regimen, morbidity was not associated with treatment with the test material. There were no changes in mean body weight gain and mean food consumption for Groups 1-3 for both sexes. Administration of 1500 ppm resulted in decreased mean body weight gain for both males and females over the length of treatment, compared to controls. The decrease in body weight was correlated with reductions in mean food consumption for these animals. Several changes were observed in hematology parameters including substantial decreases in erythrocyte count (20 decrease at week 7; 14% decrease at week 13), hemoglobin (21% decrease at week 7; 15% decrease at week 13), reticulocyte count (61% decrease at week 7; 39% decrease at week 13), and hematocrit values (20% decrease at week 7; 11% decrease at week 13) in 1500 ppm males. Statistical significance was only reached at Week 7 for erythrocyte count, hemoglobin and hematocrit. Platelet counts were elevated in both males and females at Week 7 (22 and 26%, respectively) and Week 13

(47 and 43%, respectively), but only reached statistical significance in males at Week 7. Several changes in clinical chemistry parameters also were noted in 1500 ppm animals. Total protein, albumin, and hemoglobin were reduced in 1500 ppm males (Week 7 and 13), and total protein and globulin were reduced in 1500 ppm females (Weeks 7 and 13). Statistical significance was reached in males at Week 7 for total protein and albumin at Week 13 in females. It is likely that these changes were a result of the decreased body weights observed in these animals. A decrease was seen in the absolute thymus weight in both 1500 ppm males and females. The decrease in thymus organ weight was supported by both macroscopic and microscopic findings. At the 1500 ppm dose level, the thymus gland was reported as small in males and 2/4 females, ranging from mild to severe. Consistent with necropsy findings, a marked diffuse atrophy of the cortical and medullary lymphoid areas of the thymus were observed in the 1500 ppm females was secondary to the decreased body weight and food consumption observed. A NOAEL of 300 ppm (10.2 mg/kg/day in males, 10.1 mg/kg/day in females) is indicated. The LOAEL is based on decreased body weight and food consumption, hematologic and clinical chemistry parameter changes observed at 1500 ppm (47.5 mg/kg/day in males and 25.9 mg/kg/day in females).

US EPA; DCOIT Final Work Plan, Registration Review: Initial Docket, Case Number 5023, EPA-HQ-OPP-2014-0403-0005, p.32-3 (March 2015). Available from, as of August 3, 2018: https://www.regulations.gov/

- Hazardous Substances Data Bank (HSDB)

/LABORATORY ANIMALS: Developmental or Reproductive Toxicity/ ... In the /two-generation reproduction/ study, DCOIT (100.3% a.i.) was administered via diet to male and female Crl:CDBR rats at dose levels of 0, 200, 800, or 3200 ppm (equivalent to 0, 16-20, 62-88, and 235 mg/kg/day in males during premating and 0, 18-21, 67-93, and 259 mg/kg/day in females during premating). Significant offspring mortality at 3200 ppm caused an insufficient number of pups available to produce a second generation; consequently, all surviving 3200-ppm offspring were euthanized prior to sexual maturation. An additional treatment group of 400 ppm (equivalent to 30-39 mg/kg/day in males during premating and 33-41 mg/kg/day in females during premating) and a concurrent control group were initiated. P1 and P2 males and females were 6 or 3 weeks of age, respectively, when dosing was initiated and were exposed to the test article for at least 10 weeks prior to mating. Treatment continued until termination and included gestation and lactation periods. There was clear evidence of parental effects in 800- and 3200-ppm animals including clinical signs of toxicity (paleness), significantly decreased body weights (3200-ppm P1 and 800-ppm P2 animals), significantly decreased body weight gain (3200-ppm P1 and 800-ppm P2 animals), significantly decreased body weight and body weight gain in 3200-ppm P1 females during gestation, significantly decreased body weight in 3200-ppm P1 females during lactation, and significantly decreased mean food consumption (3200-ppm P1 and 800-ppm P2 animals). Other findings included treatment-related hyperplasia and hyperkeratosis of the nonglandular stomach in 3200-ppm P1 males and females. Additionally, at 3200 ppm, an increased incidence of hypertrophy/vacuolation of the

zona glomerulosa of the adrenal cortex was observed in both P1 males and females. Therefore, the NOAEL for parental toxicity is 400 ppm for males (30-39 mg/kg/day) and females (33-41 mg/kg/day), while the LOAEL for parental toxicity is 800 ppm (male: 62-88, female: 67-93 mg/kg/day) and is based on decreased body weight and body weight gain (and food consumption in the females). There was clear evidence of offspring effects in 800- and 3200-ppm animals including clinical signs of toxicity (paleness and distended abdomens in 3200-ppm F1 pups), significant decrease in pup weight (800-ppm F1 and F2 animals and 3200-ppm F1 animals), significant gross necropsy findings (3200- and 800-ppm F1 pups), significant decreases in absolute and relative mean thymus (800 and 3200 ppm) and spleen (400, 800, and 3200 ppm) weights in F1 males, significant decreases in mean thymus weights (800 and 3200 ppm) in F1 females, and significant decreases in absolute and relative mean thymus weights (400 and 800 ppm) in F2 animals (both sexes). The mean age at preputial separation was delayed at 800 ppm and the mean age at vaginal opening delayed at 400 and 800 ppm. There was no treatment related effect on anogenital distance in the F2 offspring. Additionally, at 3200 ppm, the lactation index for P1 females was significantly decreased due to the significant increase in the number of litters with liveborn pups that did not survive to postnatal day (PND) 21. Concurrently, the number of pups dying, missing and/or cannibalized significantly increased on PND 5-21 and 0-21, contributing to the decreased lactation index. Therefore, the offspring toxicity NOAEL is 200 ppm (male: 16-20, female: 18-21 mg/kg/day) and the offspring toxicity LOAEL is 400 ppm (male: 30-39, female: 33-41 mg/kg/day) based on decreased absolute and relative spleen and thymus weight.

US EPA; DCOIT Final Work Plan, Registration Review: Initial Docket, Case Number 5023, EPA-HQ-OPP-2014-0403-0005, p.35-6 (March 2015). Available from, as of August 3, 2018: https://www.regulations.gov/

- Hazardous Substances Data Bank (HSDB)

For more Non-Human Toxicity Excerpts (Complete) data for 4,5-Dichloro-2-octyl-3-isothiazolone (12 total), please visit the HSDB record page.

- Hazardous Substances Data Bank (HSDB)

12.1.8 Ongoing Test Status

EPA has released the Interactive Chemical Safety for Sustainability (iCSS) Dashboard. The iCSS Dashboard provides an interactive tool to explore rapid, automated (or in vitro high-throughput) chemical screening data generated by the Toxicity Forecaster (ToxCast) project and the federal Toxicity Testing in the 21st century (Tox21) collaboration. /The title compound was tested by ToxCast and/or Tox21 assays/[USEPA; ICSS Dashboard Application; Available from, as of August 9, 2018: http://actor.epa.gov/dashboard/]

- Hazardous Substances Data Bank (HSDB)

12.2 Ecological Information

12.2.1 EPA Ecotoxicity

Pesticide Ecotoxicity Data from EPA



- EPA Pesticide Ecotoxicity Database

12.2.2 Ecotoxicity Values

LC50; Species: Anas platyrhynchos (Mallard Duck) age 14 days; food >10000 ppm for 8 days /60% purity/

USEPA/OPP; EFED; Pesticide Ecotoxicity Database (2000) as cited in the ECOTOX database. Available from, as of July 22, 2018: https://cfpub.epa.gov/ecotox/

- Hazardous Substances Data Bank (HSDB)

LD50; Species: Anas platyrhynchos (Mallard Duck) age 14 days; oral via capsule >4640 mg/kg /60% purity/

USEPA/OPP; EFED; Pesticide Ecotoxicity Database (2000) as cited in the ECOTOX database. Available from, as of July 22, 2018: https://cfpub.epa.gov/ecotox/

- Hazardous Substances Data Bank (HSDB)

LC50; Species: Colinus virginianus (Northern Bobwhite Quail) age 10 days; food >4639 ppm for 8 days /96.9% purity/

USEPA/OPP, EFED; Pesticide Ecotoxicity Database (2000) as cited in the ECOTOX database. Available from, as of July 22, 2018: https://cfpub.epa.gov/ecotox/

- Hazardous Substances Data Bank (HSDB)

EC50; Species: Chlorella fusca var. vacuolata (Green Algae) strain 211-15; Conditions: saltwater, static; Concentration: 314 nM for 24 hr (95% confidence interval: 286-342 nM); Effect: decreased population growth rate /99.6% purity/

Arrhenius A et al; Arch Environ Contam Toxicol 50 (3): 335-345 (2006) as cited in the ECOTOX database. Available from, as of August 11, 2018

- Hazardous Substances Data Bank (HSDB)

For more Ecotoxicity Values (Complete) data for 4,5-Dichloro-2-octyl-3-isothiazolone (30 total), please visit the HSDB record page.

- Hazardous Substances Data Bank (HSDB)

12.2.3 Ecotoxicity Excerpts

/AQUATIC SPECIES/ Sea-Nine211 has been introduced as a new biocide in antifouling paints with an immediate degradation when it is released from ship hulls. The active component of Sea-Nine211 is 4,5-dichloro-2-n-octyl-isothiazoline-3-one (DCOI). In the present study, the toxicity of DCOI and the occurrence of Pollution Induced Community Tolerance (PICT) were tested in microcosms containing eutrophic coastal water with its natural composition of phytoplankton. The experiment was performed in closed systems with a single addition of the nominal concentrations 0, 3.2, 10, 32 and 100 nM DCOI, for a period of 16 days. Pollution induced community tolerance (PICT) was observed in the phytoplankton communities exposed to the nominal concentrations 32 and 100 nM DCOI. Chemical analysis of DCOI in the coastal water utilized in the toxicity and PICT experiment was performed by GC-MS using a solid-phase extraction method. Half-life was calculated to be 2.5 days for the nominal concentrations 32 and 100 nM DCOI. The results of the present study show that nominal concentrations of 32 and 100 nM DCOI significantly increased the community tolerance ... after 2 days of exposure and that the tolerance was maintained for a period of 16 days even when DCOI was degraded during this period. The causes for the persistent tolerance are discussed in relation to the degradation of DCOI and structural changes in the phytoplankton communities.

PMID:12413792

Larsen DK et al; Aquat Toxicol 62 (1): 35-44 (2003)

/AQUATIC SPECIES/ After the definitive ban on tin-based antifouling substances, new organic compounds have recently been introduced in antifouling paint formulations, as either principal or booster biocides. In most cases, previous risk assessment of these biocides has been inadequate so that their possible effects on aquatic ecosystems is a matter of great concern. ...The effects of two new organic biocides often associated in paint formulations, Sea-Nine 211 (4,5 dichloro-2-n-octyl-4-isothiazoline-3-one) and chlorothalonil (2,4,5,6-tetrachloroisophthalonitrile), on hemocytes of the compound ascidian Botryllus schlosseri exposed for 60 min to various concentrations (from 0.1 to 10 uM) of the xenobiotics /were studied/. This species had previously proved to be a good bioindicator of organotin compounds. Both compounds, at concentrations of 1 and 10 uM, altered the morphology of phagocytes, and these changes were closely related to disrupting effects on cytoskeletal components. At the same concentrations, phagocytosis, which requires cytoskeletal modifications for pseudopod formation, was severely hindered. Both compounds were able to induce apoptosis of Botryllus blood cells, probably as a consequence of severe oxidative stress related to the reported decrease of intracellular reduced glutathione (GSH) content. In the case of Sea-Nine 211, a substantial increase in intracellular Ca(2+) and a negative effect on Ca(2+)-ATPase activity may also be involved in the activation of the cell death machinery. Cytochrome-c-oxidase was also significantly inhibited by the two biocides, indicating perturbation of the mitochondrial respiratory chain. Isodynamic mixtures of Sea-Nine 211 and chlorothalonil were used to evaluate the occurrence of interactions between the two compounds. Results suggest the combined action of partial additivity when cell-spreading and cytochrome-c-oxidase activity were considered, and were indicative of antagonism in the case of the GSH depletion. On the whole, our results indicate that short-term in vitro exposure of hemocytes to high concentrations of Sea-Nine 211 and chlorothalonil provokes a marked reduction in hemocyte functionality, higher than or comparable to that of TBT. These assays of acute toxicity stress the immunosuppressive potential of these compounds, which, although counterbalanced by their short half-life in the marine environment, can lead to biocoenosis dismantling through rapid bioaccumulation by filter-feeding non-target benthic organisms.

PMID:18155783

Cima F et al; Aquat Toxicol 86 (2): 299-312 (2008)

Hazardous Substances Data Bank (HSDB)

/AQUATIC SPECIES/ The toxicity of the alternative antifouling compound Sea-Nine to the early developmental stages of the sea urchin Paracentrotus lividus was investigated. The inhibition of the fertilization rate and the induction of transmissible damages to the offspring, measured as inhibition of embryonic development and larval growth, were studied by preexposure of gametes to a range of Sea-Nine concentrations. Sperm and egg exposures resulted in a significant decrease of the fertilization rate and induced a transmissible damage to the

offspring. The effects of Sea-Nine throughout the embryonic development were also studied by a 48 hr exposure of fertilized eggs. The larval growth was the most sensitive response tested, with toxic effects detected at 8.6 nM=2.4 ug/L (EC(10)). The inhibition of P. lividus embryonic development and larval growth was also used to study the loss of toxicity in Sea-Nine solutions exposed for 8 hr to direct sunlight and maintained for 28 hr in dark conditions. The results showed that the toxicity of Sea-Nine solutions did not decrease but a slight increase in toxicity was observed in comparison with control solutions. The risk of Sea-Nine maximum concentrations measured in marinas around Europe to P. lividus early developmental stages was calculated and the obtained risk quotient was 5.5, indicating that adverse ecological effects of this compound are likely to occur.

PMID:17434607

Bellas J; Aquat Toxicol 83 (1): 52-61 (2007)

- Hazardous Substances Data Bank (HSDB)

/AQUATIC SPECIES/ ...In the present study, affinity pull-down assays were used to identify target proteins for 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one (DCOIT), a costal pollutant of emerging concern, in various tissues (e.g., brain, liver, plasma, and gonad) from marine medaka (Oryzias melastigma) and zebrafish (Danio rerio). Pull-down results showed that, in male and female brains from medaka and zebrafish, DCOIT had a consistently high affinity for G protein alpha subunits (Ga), suggesting the targeted effects of DCOIT on signaling transduction from G protein-coupled receptors (GPCRs) and an extrapolatable mode of action in teleost brains. Validation using recombinant proteins and molecular docking analysis confirmed that binding of DCOIT to Ga protein competitively inhibited its activation by substrate. Considering the involvement of GPCRs in the regulation of myriad biological processes, including the hypothalamus-pituitary-gonadal-liver axis, binding of DCOIT to upstream Ga proteins in the brain may provide a plausible explanation for the diversity of toxic effects resulting from DCOIT challenge, especially abnormal hormonal production through the mitogen-activated protein kinase pathway. A new mechanism of action based on GPCR signaling is thus hypothesized for endocrine disrupting chemicals and warrants further research to clearly elucidate the link between GPCR signaling and endocrine disruption.

PMID:28026967

Chen L et al; Environ Sci Technol 51 (3): 1840-1847 (2017)

- Hazardous Substances Data Bank (HSDB)

For more Ecotoxicity Excerpts (Complete) data for 4,5-Dichloro-2-octyl-3-isothiazolone (9 total), please visit the HSDB record page.

- Hazardous Substances Data Bank (HSDB)

12.2.4 Environmental Fate / Exposure Summary

4,5-Dichloro-2-octyl-3-isothiazolone's production and use in adhesives, coatings, fuels, metal working fluids, resin emulsions, paints and various other specialty industrial products (as a preservative) may result in its release to the environment through various waste streams; its use in microbiocide in pulp/paper mills, cooling water systems, oil field operations (MUP only), industrial process waters and air washers systems, as a marine antifoulant paint, in industrial process water, in ornamental fountains, in industrial caulkings, paints and pressure treated lumber will result in its direct release to the environment. If released to air, a vapor pressure of 7.4X10-6 mm Hg at 25 °C indicates 4,5-dichloro-2-octyl-3-isothiazolone will exist in both the vapor and particulate phases in the atmosphere. Vapor-phase 4,5-dichloro-2-octyl-3-isothiazolone will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 13 hrs. 4,5-Dichloro-2-octyl-3-isothiazolone absorbs UV light weakly at wavelengths >290 nm and, therefore, may be susceptible to direct photolysis by sunlight. If released to soil, 4,5-dichloro-2-octyl-3-isothiazolone is expected to have slight mobility based upon an estimated Koc of 2300. Volatilization from moist soil surfaces is not expected to be an important fate process based upon an estimated Henry's Law constant of 2.0X10-7 atm-cu m/mole. 4,5-Dichloro-2-octyl-3-isothiazolone is not expected to volatilize from dry soil surfaces based upon its vapor pressure. A biodegradation half-life of 22 hours in activated sludge suggests that biodegradation is an important environmental fate process in soil. If released into water, 4,5-dichloro-2-octyl-3-isothiazolone is expected to adsorb to suspended solids and sediment based upon the estimated Koc. A reported half-life of <24 hours in seawater indicates that biodegradation may be an important environmental fate process in water. Volatilization from water surfaces is expected occur slowly based upon this compound's estimated Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 310 and 2300 days, respectively. A photolytic half-life of 322 hours in aqueous solution at pH 7 was reported. A BCF of 13 suggests that bioconcentration in aquatic organisms is low. Hydrolysis is expected to be an important environmental fate process based reported hydrolytic half-lives of 216, 720 and 288 hours under environmental conditions (pH 5, 7 and 9, respectively). Occupational exposure to 4,5-dichloro-2-octyl-3-isothiazolone may occur through inhalation and dermal contact with this compound at workplaces where 4,5-dichloro-2-octyl-3-isothiazolone is produced or used. Use data indicate that the general population may be exposed to 4,5-dichloro-2-octyl-3-isothiazolone via dermal contact when using consumer products containing this compound. (SRC)

- Hazardous Substances Data Bank (HSDB)

12.2.5 Artificial Pollution Sources

4,5-Dichloro-2-octyl-3-isothiazolone's production and use in adhesives, coatings, fuels, metal working fluids (MUP only), resin emulsions, paints and various other specialty industrial products (as a preservative)(1) may result in its release to the environment through various waste streams; its use in microbiocide in pulp/paper mills, cooling water systems, oil field operations (MUP only), industrial process waters and air washers systems(1), as a marine antifoulant paint(1,2), in industrial process water, in ornamental fountains, in industrial caulkings, paints and pressure treated lumber(1) will result in its direct release to the environment(SRC).

(1) USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403. Washington, DC: Environmental Protection Agency, Office of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

(2) O'Neil MJ, ed; The Merck Index. 15th ed., Cambridge, UK: Royal Society of Chemistry, p. 556 (2013)

▸ Hazardous Substances Data Bank (HSDB)

12.2.6 Environmental Fate

TERRESTRIAL FATE: Based on a classification scheme(1), an estimated Koc value of 2300(SRC), determined from a structure estimation method(2), indicates that 4,5-dichloro-2-octyl-3-isothiazolone is expected to have slight mobility in soil(SRC). Volatilization of 4,5-dichloro-2-octyl-3-isothiazolone from moist soil surfaces is expected to be a slow process(SRC) given an estimated Henry's Law constant of 2.0X10-7 atm-cu m/mole(SRC) based upon its vapor pressure, 7.4X10-6 mm Hg(3), and water solubility, 14 mg/L(4). 4,5-Dichloro-2-octyl-3-isothiazolone is not expected to volatilize from dry soil surfaces(SRC) based upon its vapor pressure(3). A biodegradation half-life of 22 hours in activated sludge(5) suggests that biodegradation is an important environmental fate process in soil(SRC).

(1) Swann RL et al; Res Rev 85: 17-28 (1983)

(2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of July 23, 2018: https://www2.epa.gov/tsca-screening-tools

(3) O'Neil MJ, ed; The Merck Index. 15th ed., Cambridge, UK: Royal Society of Chemistry, p. 556 (2013)

(4) USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403. Washington, DC: Environmental Protection Agency, Office of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

(5) Jacobson A, Williams TM; Chim Oggi 18: 105-8 (2000)

▸ Hazardous Substances Data Bank (HSDB)

AQUATIC FATE: Based on a classification scheme(1), an estimated Koc value of 2300(SRC), determined from a structure estimation method(2), indicates that 4,5-dichloro-2-octyl-3-isothiazolone is expected to adsorb to suspended solids and sediment(SRC). Volatilization from water surfaces is expected to be a slow process(3) based upon an estimated Henry's Law constant of 2.0X10-7 atm-cu m/mole(SRC), derived from its vapor pressure, 7.4X10-6 mm Hg(4), and water solubility, 14 mg/L(5). Using this Henry's Law constant and an estimation method(3), volatilization half-lives for a model river and model lake are 310 and 2300 days, respectively(SRC). According to a classification scheme(6), a BCF of 13(7) suggests that bioconcentration in aquatic organisms is low(SRC). A photolytic half-life of 322 hours in aqueous solution at pH 7 was reported(8). A reported half-life of <24 hours in seawater(8) indicates that biodegradation may be an important environmental fate process in water(SRC).

(1) Swann RL et al; Res Rev 85: 17-28 (1983)

(2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of July 23, 2018: https://www2.epa.gov/tsca-screening-tools

(3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 15-1 to 15-29 (1990)

(4) O'Neil MJ, ed; The Merck Index. 15th ed., Cambridge, UK: Royal Society of Chemistry, p. 556 (2013)

(5) USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403. Washington, DC: Environmental Protection Agency, Office of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

(6) Franke C et al; Chemosphere 29: 1501-14 (1994)

(7) Jacobson A, Williams TM; Chim Oggi 18: 105-8 (2000)

(8) Jacobson AH, Willingham GL; Sci Total Environ 258: 103-10 (2000)

- Hazardous Substances Data Bank (HSDB)

AQAUTIC FATE: SeaNine 211, with 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one (DCOIT) being the biocidal ingredient, is a widely-used antifouling agent to deter the undesirable biofouling phenomenon. It is commercially promoted as an environmentally acceptable antifoulant mainly due to its claimed rapid degradation in marine environment. However, ... SeaNine 211 is actually not degraded equally fast around the world (half-life between <1 day and 13.1 days). Large-scale application of SeaNine 211 in antifouling coatings has also caused global contamination of marine environment in various compartments. ...

PMID:29191317

Chen L, Lam JCW; J Environ Sci (China) 61: 68-79 (2017)

- Hazardous Substances Data Bank (HSDB)

AQUATIC FATE: Here, we investigated the degradation kinetics of butenolide, a promising antifouling compound, under various environmental conditions. The active ingredient of the

commercial antifoulant SeaNine 211, 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one (DCOIT), was used as positive control. The results showed that the degradation rate increased with increasing temperature. Half-lives of butenolide at 4 °C, 25 °C and 40 °C were>64 d, 30.5 d and 3.9 d, respectively. Similar half-lives were recorded for DCOIT: >64 d at 4 °C, 27.9 d at 25 °C and 4.5d at 40 °C. Exposure to sunlight accelerated the degradation of both butenolide and DCOIT. The photolysis half-lives of butenolide and DCOIT were 5.7 d and 6.8 d, respectively, compared with 9.7 d and 14.4 d for the dark control. Biodegradation led to the fastest rate of butenolide removal from natural seawater, with a half-life of 0.5 d, while no obvious degradation was observed for DCOIT after incubation for 4 d. The biodegradative ability of natural seawater for butenolide was attributed mainly to marine bacteria. During the degradation of butenolide and DCOIT, a gradual decrease in antifouling activity was observed, as indicated by the increased settlement percentage of cypris larvae from barnacle Balanus amphitrite. Besides, increased cell growth of marine diatom Skeletonema costatum demonstrated that the toxicity of seawater decreased gradually without generation of more toxic by-products. Overall, rapid degradation of butenolide in natural seawater supported its claim as a promising candidate for commercial antifouling industry.

PMID:25460745

Chen L et al; Chemosphere 119: 1075-1083 (2015)

- Hazardous Substances Data Bank (HSDB)

ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), 4,5-dichloro-2-octyl-3-isothiazolone, which has a vapor pressure of 7.4X10-6 mm Hg at 25 °C(2), in the ambient atmosphere. Vapor-phase 4,5-dichloro-2-octyl-3-isothiazolone is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC); the half-life for this reaction in air is estimated to be 13 hrs(SRC), calculated from its rate constant of 3.0X10-11 cu cm/molecule-sec at 25 °C(SRC) that was derived using a structure estimation method(3). Particulate-phase 4,5-dichloro-2-octyl-3-isothiazolone may be removed from the air by wet and dry deposition(SRC). 4,5-Dichloro-2-octyl-3-isothiazolone absorbs UV light weakly at wavelengths >290 nm(4) and, therefore, may be susceptible to direct photolysis by sunlight(SRC).

(1) Bidleman TF; Environ Sci Technol 22: 361-367 (1988)

(2) O'Neil MJ, ed; The Merck Index. 15th ed., Cambridge, UK: Royal Society of Chemistry, p. 556 (2013)

(3) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of July 23, 2018: https://www2.epa.gov/tsca-screening-tools

(4) Sakkas VA et al; J Chromatogr A. 959: 215-27 (2002)

- Hazardous Substances Data Bank (HSDB)

12.2.7 Environmental Biodegradation

AEROBIC: A half-life of less than 1 hour was reported using a 30-day seawater/sediment microcosm and 4,5-dichloro-2-octyl-3-isothiazolone concentrations 0.05 and 1.0 ppm. A half-life of <24 hours was reported using a seawater microcosm(1). Based on 14CO2 evolution, biodegradation half-lives of 22 and 26 hours at 25 and 6 °C, respectively, were reported using activated sludge in a 28-day terrestrial microcosm test(2).

(1) Jacobson AH, Willingham GL; Sci Total Environ 258: 103-10 (2000)

(2) Jacobson A, Williams TM; Chim Oggi 18: 105-8 (2000)

Hazardous Substances Data Bank (HSDB)

ANAEROBIC: 4,5-dichloro-2-octyl-3-isothiazolone, present at 0.05 and 1 ppm, exhibited a half-life of less than one hour when incubated in seawater and sediment in a one-year microcosm study(1).

(1) Jacobson AH, Willingham GL; Sci Total Environ 258: 103-10 (2000)

Hazardous Substances Data Bank (HSDB)

12.2.8 Environmental Abiotic Degradation

Photodegradation of 4,5-dichloro-2-octyl-3-isothiazolone present at 1 mg/L in aqueous media under natural and simulated sunlight(1).

Aquatic media	Natural solar irradiation half-life (hrs)	Synthetic solar irradiation half-life (hrs)
Distilled water	433	14
Sea water	315	10
River water	154	8
Lake water	131	6

(1) Sakkas VA et al; J Chromatogr A. 959: 215-27 (2002)

Hazardous Substances Data Bank (HSDB)

12.2.9 Environmental Bioconcentration

A BCF of 13 was reported using bluegill sunfish (Lepomis macrochirus) which were exposed for 49 days. It is reported to be metabolized rapidly in fish(1,2). According to a classification scheme(3), this BCF suggests bioconcentration in aquatic organisms is low(SRC).

(1) Jacobson A, Williams TM; Chim Oggi 18: 105-8 (2000)

(2) Jacobson AH, Willingham GL; Sci Total Environ 258: 103-10 (2000)

(3) Franke C et al; Chemosphere 29: 1501-14 (1994)

▸ Hazardous Substances Data Bank (HSDB)

12.2.10 Soil Adsorption / Mobility

Using a structure estimation method based on molecular connectivity indices(1), the Koc of 4,5-dichloro-2-octyl-3-isothiazolone can be estimated to be 2300(SRC). According to a classification scheme(2), this estimated Koc value suggests that 4,5-dichloro-2-octyl-3-isothiazolone is expected to have slight mobility in soil(SRC). 4,5-Dichloro-2-octyl-3-isothiazolone and its metabolites have been reported as being essentially immobile in sediment(3).

(1) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of July 23, 2018: https://www2.epa.gov/tsca-screening-tools

(2) Swann RL et al; Res Rev 85: 17-28 (1983)

(3) Jacobson AH, Willingham GL; Sci Total Environ 258: 103-10 (2000)

▸ Hazardous Substances Data Bank (HSDB)

12.2.11 Volatilization from Water / Soil

The Henry's Law constant for 4,5-dichloro-2-octyl-3-isothiazolone is estimated as 2.0X10-7 atm-cu m/mole(SRC) derived from its vapor pressure, 7.4X10-6 mm Hg(1), and water solubility, 14 mg/L(2). This Henry's Law constant indicates that 4,5-dichloro-2-octyl-3-isothiazolone is expected to volatilize slowly from water and moist soil surfaces(2). Based on this Henry's Law constant, the volatilization half-life from a model river (1 m deep, flowing 1 m/sec, wind velocity of 3 m/sec)(3) is estimated as 310 days hours(SRC). The volatilization half-life from a model lake (1 m deep, flowing 0.05 m/sec, wind velocity of 0.5 m/sec)(3) is estimated as 2300 days(SRC). 4,5-Dichloro-2-octyl-3-isothiazolone is not expected to volatilize from dry soil surfaces(SRC) based upon its vapor pressure(1).

(1) O'Neil MJ, ed; The Merck Index. 15th ed., Cambridge, UK: Royal Society of Chemistry, p. 556 (2013)

(2) USEPA/OPP: Pesticide Chemical Search. 3(2H)-Isothiazolone, 3,5-dichloro-2-octyl- (64359-81-5). DCOIT Preliminary Work Plan. EPA-HQ-OPP-2014-0403Washington, DC: Environmental Protection Agency, Office

of Pesticide Programs. Available from, as of July 20, 2018: https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1

(3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 15-1 to 15-29 (1990)

- Hazardous Substances Data Bank (HSDB)

12.2.12 Environmental Water Concentrations

SEAWATER: 4,5-Dichloro-2-octyl-3-isothiazolone was introduced to the aquatic environment as a result of leaching from two painted Danish Navy ships 8 days after being moored in Korser Harbor, Denmark. The ship was moved to the harbor five weeks after painting. A second ship had been painted 6 months earlier. Compound concentrations in the immediate vicinity of the ships ranged from 30 to 79 ng/L(1). The compound has been reported present in Spanish seawater at concentrations as high as 3700 ng/L(2).

(1) Steen RJCA et al; Chemosphere 57: 513-521 (2004)

(2) Chen L, Lam JCW; J Environ Sci (China) 61: 68-79 (2017). Available from, as of July 24, 2018: https://www.ncbi.nlm.nih.gov/pubmed/29191317

- Hazardous Substances Data Bank (HSDB)

12.2.13 Effluent Concentrations

The emission sources of biocidal active substances in households have been under discussion since these substances have been detected frequently in municipal wastewater and receiving surface water bodies. Therefore, the goal of this study was to investigate the products responsible for the emission of these substances to wastewater. We analysed the wastewater of two streets for a set of biocidal active substances. Time-proportional sampling was conducted for one week of each season during one year in each street. The 14 substances analysed with liquid chromatography coupled with tandem mass spectrometry were 1,2-benzisothiazol-3(2H)-one (BIT), C12-benzalkonium chloride, carbendazim, 5-chloro-2-methyl-2H-isothiazol-3-one (CMIT), dichlorooctylisothiazolinone (DCOIT), N,N-diethyl-meta-toluamide (DEET), diuron, icaridine, 2-octyl-2H-isothiazol-3-one (OIT), piperonyl butoxide (PBO), triclosan, tebuconazole, terbutryn and tetramethrin. Using data available from household product inventories of the two streets, we searched the lists of ingredients for the products possibly being responsible for the emissions. Except for four substances, all substances have been detected in at least 10% of the samples. Highest concentrations were measured for C12-benzalkonium chloride with an average concentration in the daily samples of 7.7 ug/L in one of the streets. Next to C12-benzalkonium chloride, BIT, DEET and icaridine were detected in all samples in average concentrations above 1 ug/L in at least one street. The

results show that washing and cleaning agents were important sources for preservatives such as BIT and OIT, while triclosan was apparently mainly emitted through personal care products. The mosquito repelling substances DEET and icaridine were found throughout the year, with highest emissions in summer and autumn. In conclusion, the results demonstrate that the sources of biocidal active substances in municipal wastewater are complex and that measures for the prevention of the emission of biocidal active substances into the aquatic environment have to be carried out under different legislations. This has to be taken into account discussing emission reduction at the source.

PMID:29605677

Wieck S et al; Environ Int 115: 247-56 (2018)

- Hazardous Substances Data Bank (HSDB)

12.2.14 Sediment / Soil Concentrations

SEDIMENT: 4,5-Dichloro-2-octyl-3-isothiazolone was tested for but not detected in sediment beneath two painted Danish Navy ships moored in Korser Harbor, Denmark; detection limit = 0.02 ug/g(1). The compound has been detected at 281 ng/g dry weight in Korean sediment(2).

(1) Steen RJCA et al; Chemosphere 57: 513-521 (2004)

(2) Chen L, Lam JCW; J Environ Sci (China) 61: 68-79 (2017). Available from, as of July 24, 2018: https://www.ncbi.nlm.nih.gov/pubmed/29191317

- Hazardous Substances Data Bank (HSDB)

SEDIMENT: Antifouling biocides in surface sediments and gastropod tissues were assessed for the first time along coastal areas of Panama under the influence of maritime activities, including one of the world's busiest shipping zones: the Panama Canal. Imposex incidence was also evaluated in five muricid species distributed along six coastal areas of Panama. This TBT-related biological alteration was detected in three species, including the first report in Purpura panama. Levels of organotins (TBT, DBT, and MBT) in gastropod tissues and surficial sediments ranged from <5 to 104 ng Sn/g and <1-149 ng Sn/g, respectively. In addition, fresh TBT inputs were observed in areas considered as moderate to highly contaminated mainly by inputs from fishing and leisure boats. Regarding booster biocides, TCMTB and dichlofluanid were not detected in any sample, while irgarol 1051, diuron and DCOIT levels ranged from <0.08 to 2.8 ng/g, <0.75-14.1 ng/g, and <0.38-81.6 ng/g, respectively. The highest level of TBT (149 ng tin/g) and irgarol 1051 (2.8 ng/g), as well as relevant level of DCOIT (5.7 ng/g), were detected in a marina used by recreational boats. Additionally, relatively high diuron values (14.1 ng/g) were also detected in the Panama Canal associate to a commercial port. DCOIT concentrations were associated with the presence of antifouling paint particles in sediments obtained nearby shipyard or boat maintenance sites. The highest levels of TBT, irgarol 1051, and diuron

exceeded international sediment quality guidelines indicating that toxic effects could be expected in coastal areas of Panama. Thus, the simultaneous impacts produced by new and old generations of antifouling paints highlight a serious environmental issue in Panamanian coastal areas.

PMID:29179127

Batista-Andrade JA et al; Environ Pollut 234: 243-52 (2018)

▸ Hazardous Substances Data Bank (HSDB)

SEDIMENT: Antifouling paint particles (APPs) are generated during periodical maintenance of boat hulls. Chemical composition and toxicity (either chronic or acute) of APPs found in the sediment was evaluated using the epibenthic copepod Nitokra sp. The APPs analyzed showed the presence of high levels of metals such as Cu (234,247 ug/g), Zn (112,404 ug/g) and the booster biocide DCOIT (0.13 ug/g). ... This study was the first assessment of toxicity associated with the presence of APPs in sediment to benthic organisms, and it calls attention to the need of improving regulations in boatyards and marina areas.

PMID:28212512

Soroldoni S et al; J Hazard Mater 330: 76-82 (2017)

▸ Hazardous Substances Data Bank (HSDB)

12.2.15 Other Environmental Concentrations

Biocides are included in organic building facade coatings as protection against biological attack by algae and fungi but have the potential to enter the environment via leaching into runoff from wind driven rain. The following field study correlates wind driven rain to runoff and measured the release of several commonly used organic biocides (terbutryn, Irgarol 1051, diuron, isoproturon, OIT, DCOIT) in organic facade coatings from four coating systems. During one year of exposure of a west oriented model house facade in the Zurich, Switzerland area, an average of 62.7 L/sq m, or 6.3% of annual precipitation came off the four facade panels installed as runoff. The ISO method for calculating wind driven rain loads is adapted to predict runoff and can be used in the calculation of emissions in the field. Biocide concentrations tend to be higher in the early lifetime of the coatings and then reach fairly consistent levels later, generally ranging on the order of mg/L or hundreds of ug/L. On the basis of the amount remaining in the film after exposure, the occurrence of transformation products, and the calculated amounts in the leachate, degradation plays a significant role in the overall mass balance.

PMID:22524149

Burkhardt M et al; Environ Sci Technol 46: 5497-503 (2012)

- Hazardous Substances Data Bank (HSDB)

12.2.16 Probable Routes of Human Exposure

Occupational exposure to 4,5-dichloro-2-octyl-3-isothiazolone may occur through inhalation and dermal contact with this compound at workplaces where 4,5-dichloro-2-octyl-3-isothiazolone is produced or used. Use data indicate that the general population may be exposed to 4,5-dichloro-2-octyl-3-isothiazolone via dermal contact when using consumer products containing this compound. (SRC)

- Hazardous Substances Data Bank (HSDB)

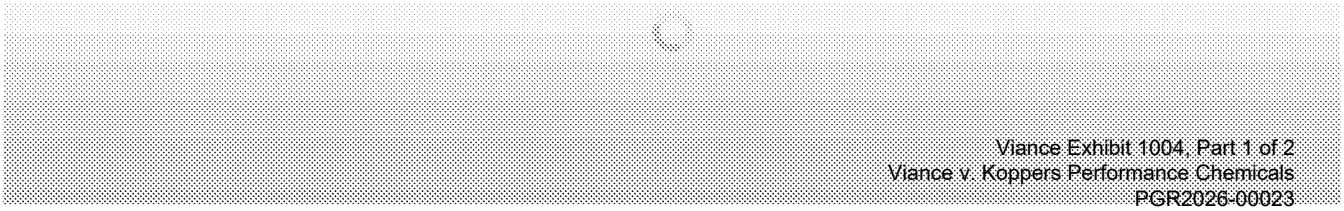
13 Literature

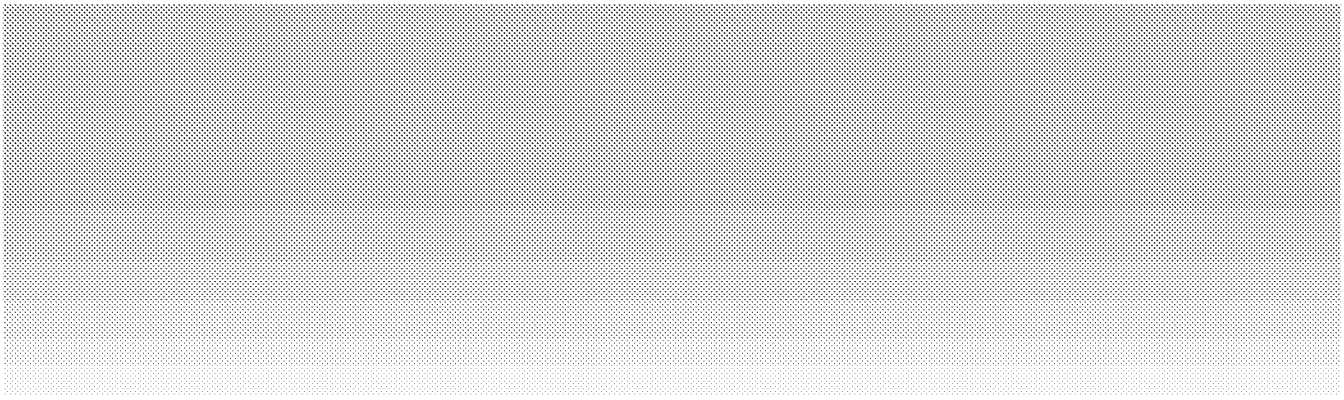
13.1 Consolidated References



- PubChem

13.2 NLM Curated PubMed Citations





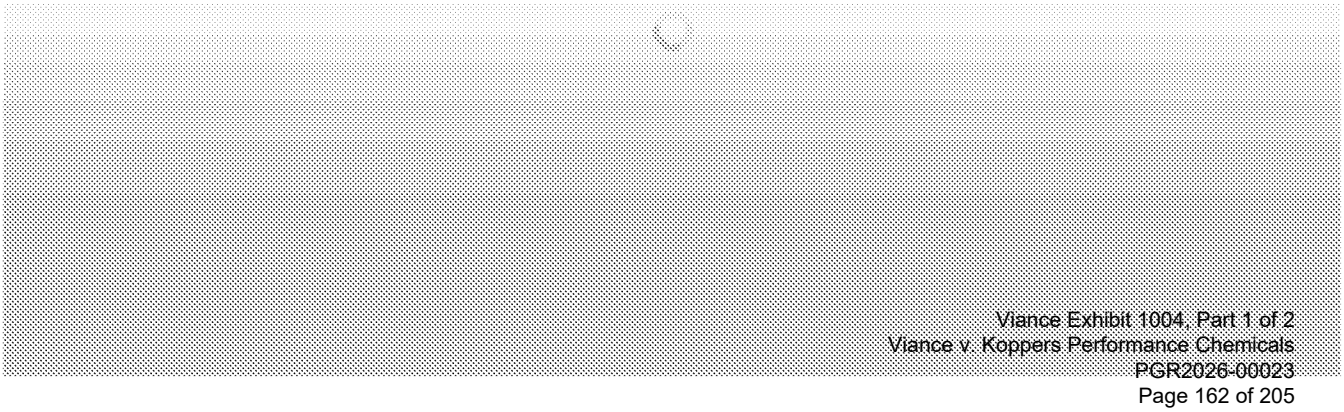
- PubChem

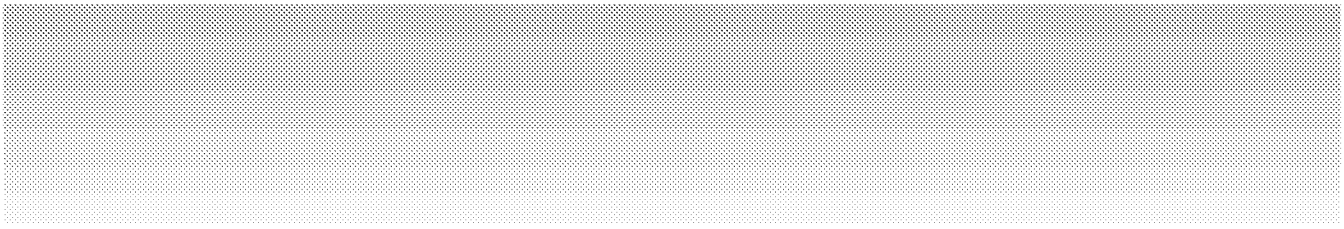
13.3 Springer Nature References



- Springer Nature

13.4 Chemical Co-Occurrences in Literature





- PubChem

13.5 Chemical-Gene Co-Occurrences in Literature



- PubChem

13.6 Chemical-Disease Co-Occurrences in Literature



PubChem

14 Patents

14.1 Depositor-Supplied Patent Identifiers



PubChem

Link to all deposited patent identifiers

PubChem

14.2 WIPO PATENTSCOPE

Patents are available for this chemical structure:

https://patentscope.wipo.int/search/en/result.jsf?inchikey=PORQOHRXAJJKGK-UHFFFAOYSA-N

PATENTSCOPE (WIPO)

14.3 Chemical Co-Occurrences in Patents



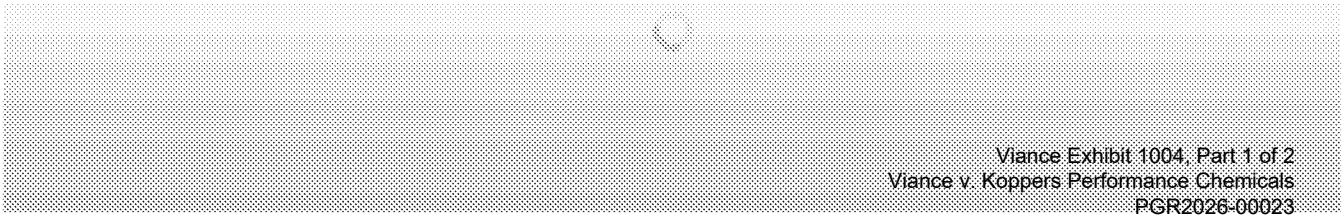
- PubChem

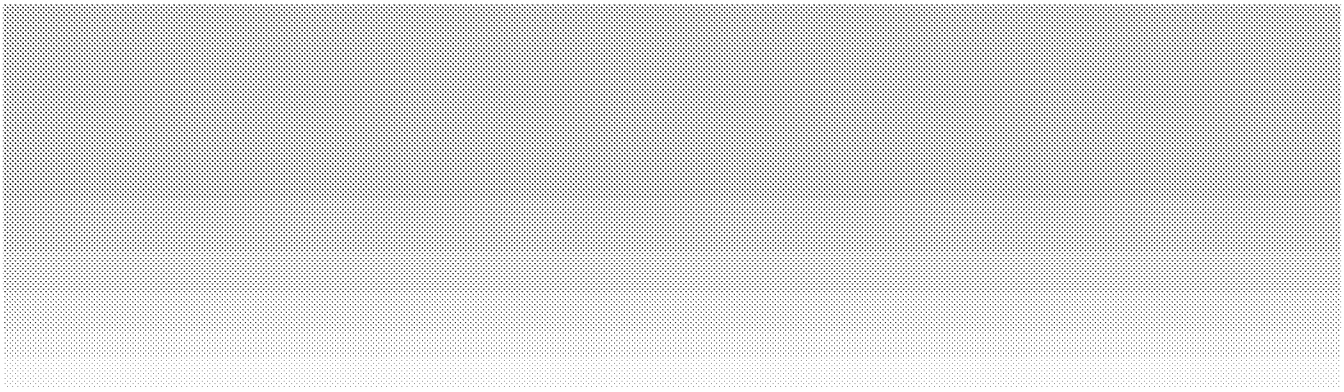
14.4 Chemical-Disease Co-Occurrences in Patents



- PubChem

14.5 Chemical-Gene Co-Occurrences in Patents





- PubChem

15 Interactions and Pathways

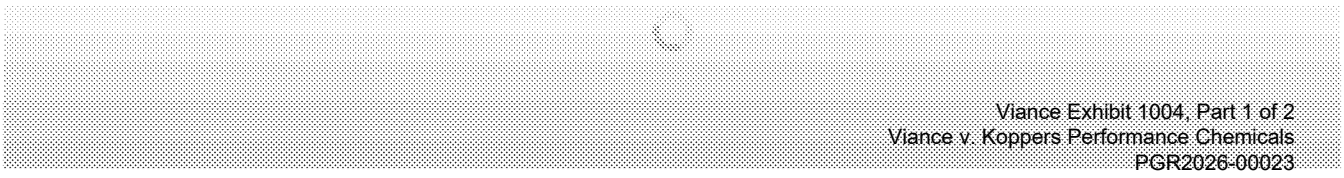
15.1 Chemical-Target Interactions

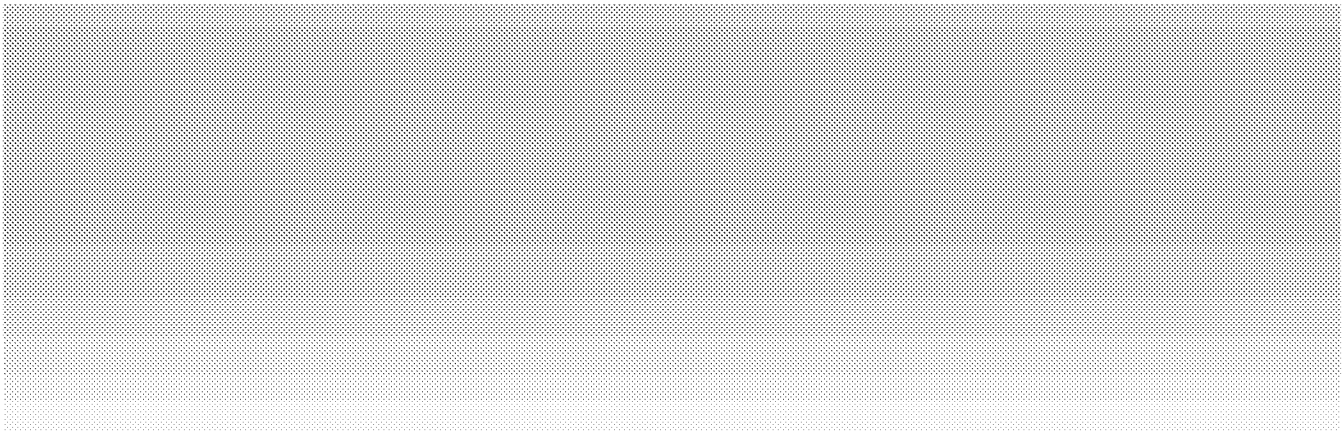


- Comparative Toxicogenomics Database (CTD)

16 Biological Test Results

16.1 BioAssay Results





- PubChem

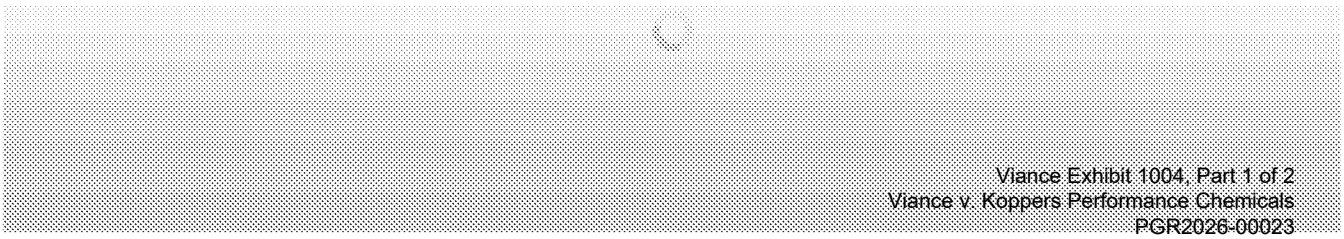
17 Classification

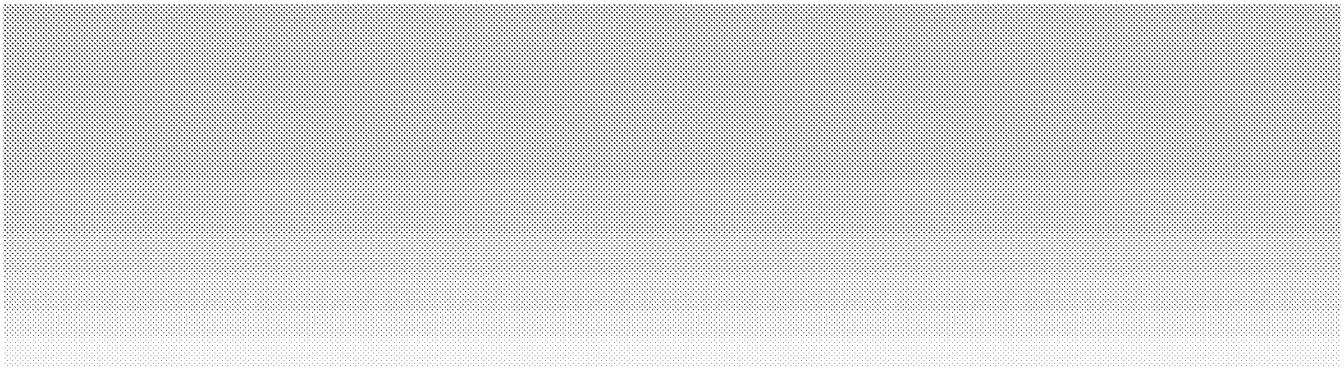
17.1 MeSH Tree



- Medical Subject Headings (MeSH)

17.2 ChEBI Ontology





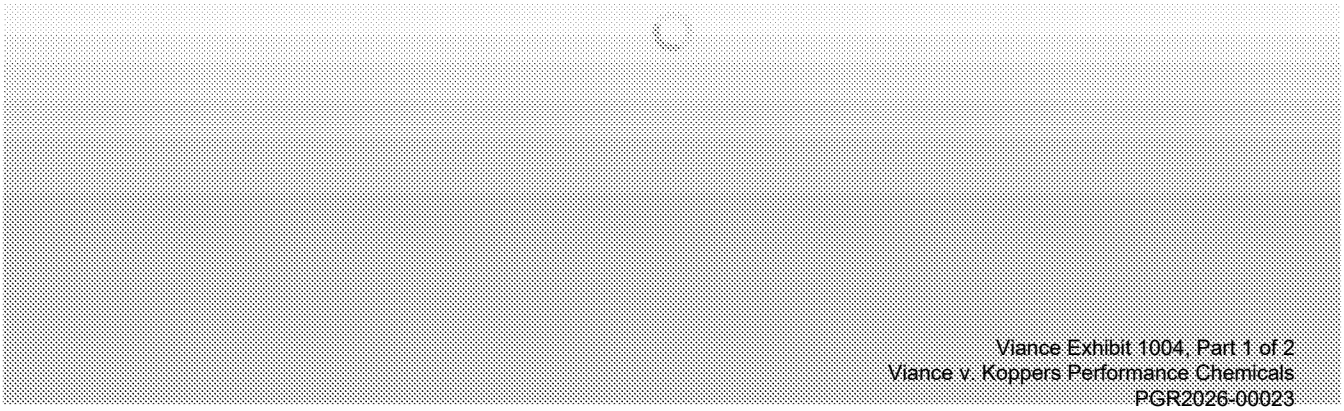
- ChEBI

17.3 ChemIDplus



- ChemIDplus

17.4 UN GHS Classification



- GHS Classification (UNECE)

17.5 EPA CPDat Classification



- EPA Chemical and Products Database (CPDat)

17.6 NORMAN Suspect List Exchange Classification



- NORMAN Suspect List Exchange

17.7 EPA DSSTox Classification



- EPA DSSTox

17.8 EPA TSCA and CDR Classification



- EPA Chemicals under the TSCA

17.9 EPA Substance Registry Services Tree



- EPA Substance Registry Services

17.10 MolGenie Organic Chemistry Ontology



- MolGenie

17.11 Chemicals in PubChem from Regulatory Sources



PubChem

18 Information Sources

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3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-
https://services.industrialchemicals.gov.au/search-assessments/

3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-
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2. CAS Common Chemistry

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ChemIDplus Chemical Information Classification

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4. EPA Chemicals under the TSCA

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3(2H)-Isothiazolone, 4,5-dichloro-2-octyl-

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EPA TSCA Classification

https://www.epa.gov/tsca-inventory

5. EPA DSSTox

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4,5-Dichloro-2-octyl-3(2H)-isothiazolone

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https://www.epa.gov/sdwa/2021-human-health-benchmarks-pesticides

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4,5-dichloro-2-octyl-2H-isothiazol-3-one

https://echa.europa.eu/substance-information/-/substanceinfo/100.058.930

4,5-dichloro-2-octyl-2H-isothiazol-3-one (EC: 264-843-8)

https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/111981

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4,5-DICHLORO-2-OCTYL-3-ISOTHIAZOLONE

https://gsrs.ncats.nih.gov/ginas/app/beta/substances/HCY9Q844W2

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https://rais.ornl.gov/

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https://rais.ornl.gov/cgi-bin/tools/TOX_search

12. ChEBI

4,5-dichloro-2-n-octyl-3(2H)-isothiazolone

https://www.ebi.ac.uk/chebi/searchId.do?chebiId=CHEBI:83518

ChEBI Ontology

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4,5-Dichloro-2-octyl-3(2H)-isothiazolone

https://comptox.epa.gov/dashboard/DTXSID5032315#exposure

EPA CPDat Classification

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17. Hazardous Chemical Information System (HCIS), Safe Work Australia

64359-81-5

http://hcis.safeworkaustralia.gov.au/HazardousChemical/Details?chemicalID=6597

18. NITE-CMC

4,5-Dichloro-2-octylisothiazol-3(2H)-one - FY2021 (New/original classication)

https://www.chem-info.nite.go.jp/chem/english/ghs/21-moe-0042e.html

4,5-dichloro-2-octyl-2H-isothiazol-3-one - FY2020 (New/original classication)

https://www.chem-info.nite.go.jp/chem/english/ghs/20-meti-0027e.html

19. Regulation (EC) No 1272/2008 of the European Parliament and of the Council

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4,5-dichloro-2-octyl- 2H-isothiazol-3-one; [DCOIT]

https://eur-lex.europa.eu/eli/reg/2008/1272/oj

20. Japan Chemical Substance Dictionary (Nikkaji)

http://jglobal.jst.go.jp/en/redirect?Nikkaji_No=J286.903I

21. MassBank Europe

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https://github.com/MassBank/MassBank-web/blob/main/MassBank-Project/LICENSE.txt

DCOIT

https://massbank.eu/MassBank/Result.jsp?inchikey=PORQOHRXAJJKGK-UHFFFAOYSA-N

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query=exists(compound.metaData.name:%27InChIKey%27%20and%20compound.metaData.value:%27PORQOHRXAJJKGK-UHFFFAOYSA-N%27)

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25. Springer Nature

https://pubchem.ncbi.nlm.nih.gov/substance/341183596

26. Wikidata

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27. Wikipedia

Dichlorooctylisothiazolinone

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28. PubChem

https://pubchem.ncbi.nlm.nih.gov

29. Medical Subject Headings (MeSH)

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MeSH Tree

http://www.nlm.nih.gov/mesh/meshhome.html

30. GHS Classification (UNECE)

GHS Classification

http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html

31. EPA Substance Registry Services

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EPA SRS List Classification

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MolGenie Organic Chemistry Ontology

https://github.com/MolGenie/ontology/

33. PATENTSCOPE (WIPO)

SID 403419858

https://pubchem.ncbi.nlm.nih.gov/substance/403419858

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	6	(WO-2018183615-$ | EP-2586840-$).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 08:05 AM
L2	2	16/497089	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 08:09 AM
L3	1	13/805831	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 08:12 AM
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			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
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L6	223	((("KOPPERS") near3 ("PERFORMANCE") near3 ("CHEMICALS") near3 ("INC"))).AS,AANM.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 08:39 AM
L7	3028	((("KUANG") near3 ("Min")) OR (("ZHANG") near3 ("Jun"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2025/04/15 08:39 AM
L8	513068	((("KUANG") near3 ("Min")) OR (("ZHANG") near3 ("Jun"))).INV.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 08:39 AM
L9	142	(L6 L8) AND ((octyl NEAR isothiazol$3) di$1chloro$1octyl$1isot	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY,	OR	ON	ON	2025/04/15 08:40 AM

		hiazolinone octhilinone "DCOI" "DCOIT")	CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L10	137	L9 AND (wax paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 08:41 AM
L11	77	L10 AND (wood timber lumber plank$3)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 08:41 AM
L12	6	(EP-0349786-$ | US-5200188-$).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK,	OR	ON	ON	2025/04/15 11:09 AM

			TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L13	52	(Artificial Intelligence) Similar to: 19/072,608 with 0 CPC Selections and 0 Text Selections Text: (US-5777110-A OR GB-2447005-A OR WO-0032371-A1 OR CA-2352052-A1 OR AU-770641-B2 OR AU-1398200-A OR EP-1135239-B1 OR CN-1133039-A OR AU-3932797-A OR NO-305837-B1 OR RU-2127266-C1 OR BR-8503466-A OR GB-2239012-A OR PL-134307-B1 OR CS-217982-B2 OR CS-220787-B2 OR DE-69938108-T2 OR CS-208671-B2 OR CS-219902-B2 OR KR-910002777-A OR DD-202233-A5 OR NO-155132-B OR DD-208751-A5 OR EP-1209976-B1 OR JP-2024546893-A OR AU-2021203642-A1 OR US-3779737-A OR US-20130252811-A1 OR NZ-337695-A OR KR-100335756-B1 OR US-3723523-A OR JP-WO2017115781-A1 OR US-3748360-A OR US-8455394-B2 OR EP-1563732-A1 OR US-9872498-B2 OR PL-184514-B1 OR JP-2020530474-A OR CN-1070025-C OR CN-108471750-A OR KR-970073341-A OR CN-107922395-B OR KR-100699740-B1 OR UA-56140-C2 OR TW-202012399-A OR US-20040063763-A1 OR KR-20110099113-A OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN))	OR	ON	ON	2025/04/15 11:33 AM

		EP-2292098-B1 OR WO-2017115781-A1 OR US-3776936-A).did.					
L14	53	(Artificial Intelligence) Similar to: 19/072,608 with 0 CPC Selections and 7 Text Selections Text: (JP-2000256109-A OR US-3840599-A OR JP-S6178702-A OR JP-2011190198-A OR JP-H09227314-A OR US-3779737-A OR US-4515627-A OR US-3748360-A OR JP-S63126859-A OR CA-1192054-A OR WO-2024165563-A1 OR HU-185803-B OR JP-H06145006-A OR US-3776936-A OR CH-567356-A5 OR JP-H02256602-A OR TW-202012399-A OR GB-1564374-A OR JP-H01249704-A OR BR-102022004384-A2 OR JP-S63162607-A OR US-5777110-A OR RU-2003126585-A OR AU-2007338428-A1 OR US-20040106518-A1 OR JP-H0597612-A OR JP-H04235102-A OR EP-0782997-A2 OR JP-H07110801-B2 OR CN-1133039-A OR JP-5213320-B2 OR US-4082800-A OR US-4049424-A OR JP-H0597611-A OR JP-S6072803-A OR US-4223025-A OR BR-102022004385-A2 OR US-4551447-A OR ES-2280508-T3 OR IE-51574-B1 OR EP-0269874-A1 OR US-3989831-A OR BR-102022004386-A2 OR US-4536497-A OR KR-910004433-B1 OR TH-30198-A OR KR-970073341-A OR JP-H02292268-A OR EP-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN))	OR	ON	ON	2025/04/15 11:36 AM

		1135239-B1 OR TW-200303199-A).did.					
L15	5	(L14 L13) AND ((octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT") AND (wax paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 11:37 AM
L16	14	(L14 L13) AND biocide AND (wax paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene) AND (wood timber lumber plank$3)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 11:47 AM
L17	81	(L14 L13) AND (wax paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 12:01 PM
L18	29	(Artificial Intelligence) More like doc: US-20240342946-A1 Text: (DE-68904828-T2 OR US-5200188-A OR WO-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2025/04/15 12:09 PM

		2011162359-A1 OR US-12082583-B2 OR US-20240342946-A1 OR EP-4380364-A1 OR AU-2022324117-A1 OR CA-3225114-A1 OR WO-2023015302-A1 OR US-20240342947-A1 OR EP-4380365-A1 OR WO-2023015305-A1 OR CA-3225112-A1 OR AU-2022323327-A1 OR AU-2015215849-B2 OR AU-2015215849-A1 OR JP-S61144305-A OR CA-3149341-A1 OR CA-3149341-C OR JP-H10258403-A).did.	HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L19	32	(Artificial Intelligence) More like doc: US-20240342947-A1 Text: (DE-68904828-T2 OR US-5200188-A OR WO-2011162359-A1 OR US-12082583-B2 OR US-20240342947-A1 OR EP-4380365-A1 OR CA-3225112-A1 OR WO-2023015305-A1 OR AU-2022323327-A1 OR US-20240342946-A1 OR EP-4380364-A1 OR AU-2022324117-A1 OR WO-2023015302-A1 OR CA-3225114-A1 OR CA-2580079-A1 OR US-20170320230-A1 OR CA-3149341-C OR AU-2015101144-A4 OR EP-1796469-A2 OR AU-2015101141-A4).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 12:09 PM
L20	15	("5023309" | "5478866" | "6437020" | "6610282" | "7740906" | "7959723" | "9273210" | "9402860" | "20020115765" | "20030018760" | "20060240263" | "20060276468" | "20110098417" | "20150274876" | "20210112812").pn. OR ("12082583").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2025/04/15 12:10 PM

L21	37	(Artificial Intelligence) More like doc: US-12082583-B2 Text: (AU-2006201474-B2 OR US-20060276468-A1 OR JP-5046635-B2 OR KR-20140019410-A OR WO-2014081916-A2 OR US-12082583-B2 OR US-20210112812-A1 OR WO-2018183615-A1 OR ES-2992042-T3 OR EP-3599858-A1 OR CN-114845547-B OR CN-114845547-A OR EP-3599858-B1 OR US-20210339425-A1 OR CA-3058624-A1 OR CN-114845548-B OR DE-112019004378-T5 OR US-20210337785-A1 OR US-12168307-B2 OR DE-112019004500-T5).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 12:10 PM
L22	38	(Artificial Intelligence) More like doc: US-20070037001-A1 Text: (CA-1005757-A OR DE-3906556-A1 OR ZA-94344-B OR DE-69730122-T2 OR US-6274199-B1 OR US-20070037001-A1 OR WO-2007022114-A2 OR EP-1954410-A2 OR CA-2619683-A1 OR AU-2006279671-A1 OR US-20100297273-A1 OR US-20060000139-A1 OR BR-PI1100383-A2 OR WO-2010049070-A2 OR US-20030022121-A1 OR DE-9414784-U1 OR KR-20220037317-A OR AU-2010214873-B2 OR US-9283173-B2 OR KR-20110132329-A).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 12:10 PM
L23	100	(L17 L18 L19 L20 L21 L22) AND wax$2	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2025/04/15 12:12 PM

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L24	2	11/222552	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 12:58 PM
L25	28	("4496613" | "4542146" | "4954338" | "5013748" | "5536305" | "5827522" | "5874025" | "5880143" | "6274199" | "6348089" | "6423307" | "6464764" | "6558685" | "6641927" | "6686056" | "7297193" | "20030060504" | "20030108759" | "20040011244" | "20050132926" | "20060057300" | "20080187669").pn. OR ("7850771").urpn. AND (PGPB | USPT | USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2025/04/15 12:58 PM
L26	54	(US-6686056-B2 | EP-0148526-A1 | US-20030108759-A1 | US-6348089-B1 | US-5013748-A | US-4496613-A | WO-02076696-A1 | US-20040011244-A1 | US-6641927-B1 | US-20050132926-A1 | EP-0402697-A1 | US-20030060504-A1 | US-4954338-A | US-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2025/04/15 12:58 PM

		7297193-B1 | WO-0071313-A1 | US-5827522-A | US-5874025-A | US-5536305-A | US-4542146-A | US-5880143-A | US-6464764-B1 | US-20080187669-A1 | US-6274199-B1 | WO-0071314-A1 | US-20060057300-A1 | US-6558685-B1 | US-6423307-B2).did.	VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L27	44	(Artificial Intelligence) More like doc: US-7850771-B2 Text: (DE-3200782-A1 OR US-4542146-A OR US-4954338-A OR FR-2626740-B1 OR DE-3918978-A1 OR US-5536305-A OR DE-4441672-A1 OR DE-19513903-A1 OR IT-1284874-B1 OR US-5827522-A OR WO-9939886-A1 OR US-6348089-B1 OR DE-19834028-A1 OR US-6274199-B1 OR EP-1249165-B1 OR US-6641927-B1 OR US-6686056-B2 OR US-7264886-B2 OR CA-2580079-A1 OR AU-2006243369-A1).did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 12:59 PM
L28	35	(L26 L27 L25) AND wax$2	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 12:59 PM
L29	2	11/656100	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY,	OR	ON	ON	2025/04/15 01:01 PM

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L30	424727	(preservative biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) AND (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 01:31 PM
L31	5360	L30 AND (B27K3/343 A01N43/80 B27K3/40 C09D5/14 C09D125/14 C09D167/08 C09D191/08 B27K2200/10 B27K2200/30 B27K2240/20 B27K2240/50 B27K3/00 B27K3/34 B27K5/00 A01N43/00 C09D191/00 C09D191/06).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 01:34 PM
L32	131	L31 AND ((preservative biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isot	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2025/04/15 01:35 PM

		hiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) AND (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))).clm.	CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L33	642	L31 AND ((preservative biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) AND (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))).spec.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 01:35 PM
L34	0	L31 AND ((preservative biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) AND (wax$2 SAME (paraffin olefin petroleum carnauba	(USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 01:35 PM

		poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))).spec.					
L35	0	L31 AND ((preservative biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) AND (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))).spec.	(FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN))	OR	ON	ON	2025/04/15 01:36 PM
L36	35	L31 AND ((preservative biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) SAME (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)))	(USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/15 01:37 PM
L37	1072	L31 AND ((preservative	(FIT (AP, AT, AU, BE,	OR	ON	ON	2025/04/15

		biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) SAME (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)))	BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))				01:44 PM
L38	1	15/064,119	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/16 08:15 AM
L39	1	15/064119	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/16 08:15 AM
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			MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
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L42	3	WO-02076696-$.did.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2025/04/16 10:14 AM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
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		silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))					
N2	1024	N1 AND (B27K3/343 A01N43/80 B27K3/40 C09D5/14 C09D125/14 C09D167/08 C09D191/08 B27K2200/10 B27K2200/30 B27K2240/20 B27K2240/50 B27K3/00 B27K3/34 B27K5/00 A01N43/00 C09D191/00 C09D191/06).cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2025/04/15 01:34 PM
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		isothiazolinone)) AND (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))).clm.					
N5	28	L31 AND ((preservative biocide (octyl NEAR isothiazol$3) di$1chloro$1octyl$1isothiazolinone octhilinone "DCOI" "DCOIT" (halogenated NEAR isothiazolinone)) AND (wax$2 SAME (paraffin olefin petroleum carnauba poly$2ethylene slack silicone poly$1propylene "PTFE" synthetic poly$1tetra$1fluoro$1ethylene)) AND (solvent SAME (hydrocarbon amine glycol ketone ester alcohol halogenated aliphatic aromatic terpene biodegradable vegetable soy$1bean))).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2025/04/15 01:35 PM

Classification of Refined Petroleum Waxes

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It is difficult to draw up a classification of petroleum waxes that could not be subject to criticism. The classification here given is somewhat different from others that have been proposed; it comprises the various types of waxes produced in American refineries.

(1) Paraffin Wax Group

- Softer paraffin waxes (e.g., slack waxes)
- Intermediate paraffin waxes (e.g., scale waxes)
- Harder paraffins (e.g., fully refined waxes)

(2) Petrolatums

(3) Microcrystalline Wax Group

- Medium soft (e.g., “Petrowax”)
- Medium hard (e.g., “Petrosene A”)
- Hard (e.g., “Be Square 190/195”)

These three groups can be distinguished by their crystalline characteristics. Group (1) waxes have relatively large crystals (macro crystals). The slack or subscale waxes contain more oil than scale waxes, and the melting points usually are between 122 and 140°F. The scale waxes have negligible tensile strength and the melting points are between 118 and 135°F. The refined waxes (block paraffines) range in melting point from about 123 to 165°F, but usually from 126 to 146°F.

Group (2) which are not true waxes have crystals so minute because of occluded oil that they can be regarded as amorphoid (amorphous-like) in structure. Not much more than 25 per cent of the hydrocarbons of petrolatum are waxlike.

Group (3) waxes have very minute crystals (micro crystals) and are of high melting point, generally above 145°F and exceptionally as high as 200°F. Waxes which are by-products of the motor oil raffinate have 26 to 42 carbons, melt within the range of 145-175°F, and have an SUS viscosity at 210°F of about 55 seconds. They have needle-like crystals, and are somewhat brittle. These waxes are sometimes referred to as "micro waxes." Waxes which are prepared from *distillation residuals* have 36 to 70 carbons, melt within the range of 145-175°F, and have an SUS viscosity at 210°F of about 55 seconds. They have small needle-like crystals, and are flexible. These waxes are sometimes termed "petrolatum waxes." Waxes which have been recovered from *tank bottoms* of crude oil have 40 to 75 carbons, melt within the range of 180-200°F, and are hard. They have very small needlelike crystals.
The medium soft microcrystalline waxes have a needle penetration of 25 to 80 (100 g/77°F/5 sec); the medium hard waxes have a value of 10 to 25; and the hard waxes a value of 3 to 10. Penetrations are determined by the ASTM D5-25 method; the values are expressed as mm actual penetration X 10.
Roughly speaking: *paraffin waxes* come from the dewaxing of paraffin distillates, *petrolatum* from high-viscosity lube distillates, and *microcrystalline waxes* from residuum. In dewaxing the paraffin distillates, the various steps along the way, to almost complete freedom from oil, yield *slack wax, scale wax, semirefined wax,* and finally *fully refined paraffine.*

Paraffin Waxes

Specific Sources of Paraffin Waxes

Paraffin wax associates with paraffinic-base oils in many crudes. The wax content of the *wax-bearing raffinate* from the crude is about 10 per cent. A pressible Pennsylvania distillate has a gravity of about 34 API, and a viscosity of 70 seconds Saybolt at 100°F or even higher viscosity. To obtain a chillproof high-grade lube oil it is necessary either to recover the wax from the raffinate or to treat it with a pour-point depressant.
Mid-Continent (Arkansas, Louisiana, and Oklahoma) oils provide a better economic source for a paraffin wax by-product than do the Appalachian (Pennsylvania and West Virginia), and are thus extensively employed. A pressible wax distillate of Mid-Continent origin has a gravity of 30 to 31° API. California oils, on the other hand, carry little or no wax, e.g., Midway is almost wax free. Gulf Coast crudes, however, vary from naphthenic oils with almost no wax to oils such as Rodessa which contain more wax (5.2%) than the Appalachian (2.4%). Differences in the physical characteristics of the paraffin waxes can often be ascribed to the origin of the crude, and the particular refinery at which such a crude is handled.

Recovery of Paraffin Wax Group

There are ordinarily three principal types of wax encountered in crude oil, namely *paraffin wax, slop wax,* and *petrolatum.* The first is contained in distillates from which it may be pressed. When Pennsylvania crude, or other paraffin wax-yielding petroleum is distilled by the *batch type process*), using a cylindrical still, there are five steps to this method of distillation. The first out yields light naphtha, the second heavy naphtha, the third high test burning oil, and the fourth low test burning oil; the fifth portion is the undistilled residuum, which is the source of paraffin wax. This residuum is pumped to the *tar still*, which holds about 200 barrels, and is reheated with high-pressure live steam to the point at which it will again give off the desired vapors. A *heavy distillate* is taken off which is wax bearing and pressible. About 5 per cent of tar coke remains in the still and is recovered for sale to the industries.

Paraffin wax is also recovered by the *continuous-type process* . A *continuous tower still* (pipe still with fractionating column) is a less expensive process since it yields a wider range of products in the same run, and has a much lower cost of maintenance. With a tower still it is not necessary to pump the residuum to a separate tar still. The *heavy distillate* is taken off at the first trap; it is *wax-bearing,* and in the last part of the run is known as *wax failings.* An "intermediate distillate" or raffinate is taken off at the second trap, and a "light distillate," which is a raffinate of high test oil, such as BOO oil, is taken at the third trap.
The heavy distillate above referred to is one which distills over at 315 to 125°C (600-800°F), and contains not less than 6 to 8 per cent of wax. This *wax-bearing distillate* goes to the "chill rooms," where cooling to a temperature of 25 to 30°F is effected by pumping the distillate through tubes jacketed by cold brine and provided with helical scrapers. The resultant crystal mush is subjected to powerful pressure by plate and frame filter presses set in refrigerator rooms, and the heavy oil raffinate which drains off from the press is collected as lubricating oil. It is known as "spindle oil" and has a gravity of 32° Baum6 and a pour point of plus 6 to 7°C (20°F).

The press cake ("slack wax") which may contain as much as 50 per cent or more of wax may be broken up, melted, chilled, and sweated to form *scale wax*, which contains 1 to 6 per cent of oil, and *foots oil*, made up of lower melting point wax plus oil. The scale wax is then refined to paraffin waxes of different melting points, leaving a *slop oil* which is of little or no value.
Paraffin waxes consist of mixtures of purely paraffinic compounds, whereas the dewaxed stocks (e.g., slop oil) from the heavy distillate consist essentially of compounds containing up to eight aromatic or naphthenic rings with paraffin side chains.

Softer Paraffin Waxes

The softer paraffin waxes include *slack wax* and *sweat wax,* the latter a more oily by-product of the former. In the refinery the crude oil raffinate known as "paraffin distillate" (wax distillate) has a boiling point range of 170-310°F when distilled at a very low pressure. To separate the paraffin wax from the oil, the wax distillate may be chilled until the wax crystallizes, and the resultant slurry may be filter pressed. If the wax forms a filter cake from which the oil drains easily the wax distillate is said to be "pressible." If the oil cannot be separated well from the wax crystals in the pressing operation, the wax distillate is "unpressible." The wax left on the filter presses is called *slack wax.* The consistency of slack wax may be soft or semisolid and the oil content is normally 10 to 35 per cent.
Slack Wax. The paraffin distillate at a temperature of 80 to 100°F is pumped to the *paraffin sheds* (wax plant), where it is allowed to repose in tanks to promote settling at the lowest room temperature (between 0-and 32°F). It is then pumped through a bank of cooling units *(wax chillers*) to *hydraulic presses* which squeeze out the wax from the chilled distillate. The cooling units, usually "double-pipe horizontal" or "double-pipe vertical" chillers, consist of a series of pipe coils placed in a steel jacket of circulating liquid ammonia. One section of a double-pipe chiller will reduce the temperature of 30 barrels of distillate from 90 to 15°F in twenty-four hours.
Some wax plants use a vertical double-shell tank chiller, known as the "Gray unit;" the distillate enters at the top of the inner shell and leaves at the bottom. The refrigerant enters at the bottom of the outer shell, passes around the inner shell, and leaves at the top. Through the inner shell extends a shaft filled with arms carrying scrapers; these are thrown against the inner surface as the shaft revolves driven by an overhead mechanism.
In the hydraulic presses, usually of horizontal type, there are locked hundreds of canvas-covered circular metal plates and rings, arranged so that a space is formed between each two plates when they are pressed together.

Chilled wax distillate comes into each space; the oil it contains flows out through the canvas blanket, whereas the wax remaining on the blanket is removed. The wax filter cake produced is then acid treated, and the sludge withdrawn; it is then neutralized and washed. The resultant product is *slack wax*. The slack wax is slowly melted and charged into sweat ovens where it is chilled to solidify it somewhat, and then is slowly heated. If oil and low-melting waxes drain away from the slack wax during the sweating operation and leave a high yield of wax with low oil content, the slack wax is "sweatable;" otherwise it is "unsweatable." Slack wax is marketed as such to a limited extent. A product containing about 19 per cent of oil has been marketed as a "luster cleaner."
Several samples of slack wax give the following melting point characteristics: drop points (ASTM) 135-145°, softening point (CC&S) 112-122°, ball and ring 130-140°, Fisher-Johns spread 117-130°, maximum 135-145°F. The penetration values (100 g/5 sec/25°C) ranged between 60 and 80.

Sweat Wax

The term "sweat wax" is sometimes confused with "slack wax" from which it differs in that the *sweat wax* is a mixture of oil and paraffins of a rather limited range of melting points in the lower melting point series.
In the sweating of slack wax the oil which is drawn off contains a large quantity of wax crystals. This mixture when chilled at only a moderately low temperature will yield on sweating the paraffins of the higher melting points and a sweat oil containing crystals that melt at 60°F and also some that melt at somewhat higher and lower temperatures. Sweat wax therefore is a solid mass at 60°F or thereabouts but appears to have 60 per cent or more of oil at 80 or 90°F.
Sweat wax is used whenever it is essential to secure extreme wax penetration, as in the textile and paper industries. It is used in wax emulsion with naphtha, or without it. A mixture of 87 parts of sweat wax; 11 parts of bentonite, whiting, or other mineral filler; and 2 parts of pigment, makes a paint suitable for closing the mesh of woven fabric, imparting color, and rainproofing.
Tent cloth can be treated with sweat wax using naphtha as a carrier. In water emulsions it is of value in waterproofing krafts. Bags for holding chemicals can be prevented from rotting by weaving the material with some form of scale wax or sweat wax treated thread.

Intermediate Paraffin Waxes

Scale wax can be considered a paraffin wax intermediate between softer waxes, such as slack wax, and the harder paraffines. It is derived by a process of sweating the greater part of oil from slack wax. Grades of crude scale wax which are marketed contain up to 6 per cent of oil. Crude scale waxes are obtainable in both yellow and white, the yellow usually containing less than 4 per cent of oil, and the white less than 2 per cent. They are produced in high as well as low melting points, although their softening points are invariably low.

Refined Scale Waxes.
Ordinarily a white crude scale wax of 124-126°F melting point will contain several per cent of oil and moisture; however, a "second pudging and pressing" will bring the oil content down to below 1 per cent. Such a wax is referred to as a *special refined white scale wax*, or a *semirefined paraffine.*
Crude scale fractions when passed through bauxite beds at relatively high temperatures lose their oil content, at least down to less than 0.5 per cent, thus greatly improving the high light and stability of the scale wax.
Refined scale waxes of 126/130 grade gave the following melting points: drop 126-130°F (ASTM); softening 96-lll°F

(CC&S); ball & ring 126- 130°F (ASTM); Fisher-Johns spread 117-122°F, maximum 126-130°F. Penetration values (100g-5 sec-25°C) were 23-33.

White scale waxes of the Atlantic Refining Company are furnished in 124-126, 128-130, and 133-135°F (AMP) grades, with an optimum expressed oil and moisture content of 0.5 per cent, and a Saybolt color of 19 average.

In the fabrication of cotton duck and canvas the thread is treated with a crude scale wax of 124-126°F (AMP) grade to impart waterproofing. A refined scale wax of 133-135°F (AMP) grade is used with material where a drier, nongreasy, finished product, which is not very susceptible to atmospheric change, is desired.

Higher-melting scale waxes are sometimes required for superior waterproofing, and to accomplish this purpose small quantities of other material, such as carnauba wax, gilsonite, or high melting asphaltume, are incorporated in the scale wax. Such adjusted scale waxes are referred to as "textile proofere." They work out economically since a thinner application will give the article the required degree of waterproofing.

Refined scale wax is used in the formulation of certain grades of artificial ceresin where lubricity to the wax is required. The use of a scale wax with much oil, or of a slack wax, may yield a product with large macrocrystals of paraffin tending to destroy the flexing or elongation. The hardness of an artificial ceresin which has been prepared by adding carnauba wax to paraffin-ozokerite mixtures can be offset by the addition of several per cent of low-melting refined scale wax.

Scale waxes of 124-126°F. (AMP) grade are used in the match industry. Scale waxes of high melting point are used in the kraft paper industry, e.g., for builder's papers, cement bag stock, roofer's felt, car liners, and heavy kraft wrappings. Petrolatums of high melting point (140°F) are used in much the same way as the scale waxes for the waterproofing of kraft papers, cotton ducks, and canvas. Scale waxes of very low oil content are required in the manufacture of crayons.

Harder Paraffin Waxes

The harder paraffin waxes are referred to as *paraffines,* customarily accompanied by a designation of the melting point, such as "paraffine 128- 130°F (AMP)"; or as *fully refined paraffin waxes.* The term *block paraffine* is sometimes used to designate a harder paraffin wax, one which, can be molded into a hard firm block. The production of harder paraffin waxes constitutes by far the greater proportion of the refinery output of petroleum waxes in the United States, approaching a billion pounds per year.

Slack wax which comes from the hydraulic presses, already described, contains 10 to 15 per cent oil, and this oil as well as the softer waxes must be removed in order to produce block paraffines. This is customarily done by "sweating" beyond the stage employed in producing slack wax, or intermediate waxes.

Principle of Sweating.

Sweating is a process by which the oil and very soft waxes can be liquated from the firmer, harder paraffins by means of supplying heat to a previously chilled slack wax at a carefully regulated temperature. The solubility of paraffin wax in oil increases very markedly with even slight elevation of heat at temperatures 10 degrees below the melting point of the wax, thus permitting the separation of the components of slack wax by sweating. Low-melting waxes are more soluble in oil than higher-melting paraffins. Mixtures of high- and low-melting waxes have solubilities between those of the components, which makes it necessary to resweat the liquates after they have been chilled, if further recoveries of high-melting wax are to be made.

In the refining of paraffin wax, the pudged and pressed wax retains about 2 per cent of the oil at room temperature; but the amount retained at the temperature at which final sweating is carried out is too small to be

detected. The presence of this small amount of oil in solution offers an explanation for some of the difficulties encountered in the separation of oil from wax. The greatest loss in wax in the sweating process occurs at the temperature at which most of the oil is removed. The wax separated from slack wax by chilling and then sweating in the initial stage is known as *scale wax*, and the by-product made up of lower-melting wax plus oil as *foots oil.* The oil sweated out in subsequent pudgings and pressings is known as *slop oil.*

Production of Paraffin Wax at the Refinery

The following process and equipment has been prescribed for the refining of block paraffine from an Eastern Texas crude wax distillate. Basically the *sweating process* follows the Henderson modification of the early methods of Price's Candle Company.

The slack wax from the chill room is melted and pumped to shallow steel pans in the *sweater house,* which houses several *sweating ovens.* The latter are well insulated rooms which accommodate one or two stacks of the long pans or trays. The pans are 8 by 20 feet and about 8 inches deep at the ends, but slope to a depth of 14 inches at the center, the pans are usually stacked eight high.

A rack of light angle or tee iron is laid in the pan and carefully leveled. A very coarse galvanized iron mesh is stretched across the rack; and over this is placed a brass wire gauze which is securely fastened to the rack, and which supports the cooling coil. There is a 2-inch space between the bottom of the pan and the gauze into which the cold water is pumped and circulated. The melted wax is run onto the surface where it congeals to a sheet of 4 to 6 inches thickness. After solidification the pans are tilted, the oven is lightly closed, and the water run off.

The sweater oven has steam coils along the walls and under the pans for controlling the interior air temperature, and is equipped with vertical ducts between the frames to allow for air circulation. By a thermostatic regulator the temperature is raised 1 or 2 °F per hour, and the oil and soft wax that sweats out is drained off from time to time. The first running, or *light foots oil,* is used as a plant fuel, but the next, or *heavy foots oil* fraction, is pumped back to the wax distillate, and subsequent fractions are resweated, or used later for blending before the acid treatment. The end product is a block wax of 130-132°F melting point, which still requires a finishing treatment to remove color.

Thereafter the wax is melted and run into agitators (lead-lined and steam-jacketed), treated with strong sulfuric acid, violently agitated for 30 minutes, and settled for one hour. The acid sludge is then drawn off and the melted wax is run into another agitator, in which it is washed with hot water and then with sodium hydroxide and finally with a hot water spray. After removing traces of water by long settling, the wax is dried finally by blowing air through it.

The melted wax at this stage is not entirely colorless, and hence is run through vertical filters of hot fuller's earth. The filtered, bleached, refined wax is run into a slab mold, 40 feet or more in length, which consists of a tank-like structure having a sealed bottom, open top, and a large-size turnscrew at one end. In this housing is a series of compartments formed by *chill plates,* each plate is filled with chilled brine and connected to the other with a flexible hose so as to provide a continuous circulation. The plates are about 2 inches thick and spaced inches apart. The mold is filled with melted wax and the wax seeks its level by filling each compartment. When the wax shrinks on cooling, an extra portion of melted wax is released into the mold. After the wax is congealed, the screw at the end of the mold is unturned to loosen the plates, the plates are manually pried apart sufficiently to lift out the slabs of wax. After stripping, surplus wax is removed from the end of the slab. These slabs constitute

the *fully refined paraffine* of commerce. They are 12" x 18" x *1H"* in size, weigh about 10 pounds each, and are packed in bags or cartons stamped with the AMP melting point. The paraffin is also packed loose or on pallets and shipped in paper-lined freight cars.

Wax Oils

Wax oils are products which are commercially available for converters who wish to employ blends of wax and oil for the impregnation of paper. These oils have been so refined that papers treated with them will impart no taste nor odor to foodstuffs. The wax oils contain 15 to 30 per cent of wax, and have a high pour point of 80 to 110°F. If used alone the paper sheet is soft and oily. Blends with petrolatum will impart less oiliness and more grease resistance for meat wrapping paper.

Two types of wax oils marketed by the Socony Mobil Oil Company (New York) known as "S/V Wax Oil No. 1" and "S/V Wax Oil No. *2"* have the following physical characteristics: No. 1 gravity (API) 28.8, specific gravity (d15-8) 0.883, bulks 7.35 lb per gal, pour point 80°F, flash point 395°F, Saybolt viscosity 126 at 100°F, color (ASTM) light 2; No. 2 gravity (API) 32.1, specific gravity *(da-e)* 0.865, bulks 7.2 lb per gal, pour point 110°F, flash point 405°F, Saybolt viscosity 63 at 130°F, color (ASTM) light 2.

Refined Paraffin Wax

A refined mixture of associated solid paraffin hydrocarbons or paraffins is commonly designated as "paraffin wax." The word "paraffin" appears to be a French derivative of the Latin *parum,* meaning "little," and *affinis*, meaning "affinity"; in other words, a chemically inactive substance. The high-melting grades are customarily produced free from impurities and are referred to as "fully refined paraffin waxes," or by the simple designation or English term "paraffines"; for example, Asiatic *paraffines* are said to contain paraffins in the range of Cn to C3<. Reichenbach obtained paraffin wax from wood tar in 1830, and later by the distillation of lignite, as patented by James Young in 1850. In the United States paraffin wax was first obtained from petroleum in 1868. Today, paraffin wax is produced from many "crudes" that are designated "paraffin-base oils" because of their wax content.

The wax-bearing crudes of America contain on the average less than 5 per cent of merchantable wax. Those of Galicia yield less than 3 per cent, and those of Burma 8-10 per cent. Canadian crude oils yield less than 3 per cent of paraffin wax. Much of the Russian petroleum contains no paraffin wax; an exception is the so-called "mazouts" of Northwest Caucasus which are wax-bearing.

Fully Refined Paraffin Wax

The term "fully refined" is given to paraffin waxes which are water white, free from more than a mere trace of oil, odorless and tasteless, and hard or firm in consistency. The oil plus moisture content should be well within the allowable optimum of 0.5 per cent.

Fully refined paraffin wax has a friable, coarse, fibrous crystalline structure which is translucent to opaque white in appearance, particularly noticeable when a slab of the wax is broken. Microscopically its structure when crystallized from a solvent shows more or less circular or oval aggregates or platelets of cells; the fibrous characteristic in large masses appears to be due to superimposed aggregates of platelets.

Paraffines have a melting point range of 118-155°F (ASTM D-87), but ordinarily the graded melt in the range of 126-137°F, or considerably lower than microcrystalline wax. A paraffine has a color of +21 or lighter (ASTM D-156).

When melted the average grade of paraffine has a viscosity of 40-50 seconds, Saybolt at 210°F, equivalent to 4.2-7.3 centistokes, or appreciably lower than the viscosity of microcrystalline wax. Fully refined paraffin wax (m. ca. 130°F) has a specific gravity of 0.910; a flash point not less than 177°C (350°F) and usually over 400°F, and a specific heat of about 0.694 calorie per gram. Its mean refractive index (nd) is 1.5277-1.538 at 25°C, and 1.430-1.433 at 100°C. The average paraffin wax has a molecular weight of 350-420 and contains normal hydrocarbons with a mean value of C25 to C27. Waxes prepared from mixed base type crudes are said to have a small proportion of side-chain hydrocarbons (side-chain alkanes).

A specimen of Esso brand paraffin wax 128/130°F (ASTM) melted at 129.5°F, and had an oil content of 0.3 per cent, color +30 Saybolt, tensile strength 300 psi, modulus of rupture 400, and flexibility 0.001" units-50.

The demand for American paraffines of the higher melting points, 130/132,133/135, and 135/137°F AMP, has greatly increased, and the use of lower melting point paraffines has correspondingly decreased. There is only a restricted demand for paraffines melting between 143 and 150°F. These higher melting point waxes may constitute 25 per cent of the total yield of a modem refinery, and hence they are used largely to blend with paraffin waxes melting below 128°F to obtain marketable grades. A paraffine of 151°F melting point has a SITS viscosity of 43 at 210°F, a tensile strength of 151 psi at 70°F, 195 psi at 40°F, a color of 30 Saybolt, a stain pass at 135°F, and an oil content (MEK) of less than 0.5 per cent.

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Classification of Refined Petroleum Waxes

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It is difficult to draw up a classification of petroleum waxes that could not be subject to criticism. The classification here given is somewhat different from
proposed. It comprises the various types of waxes produced in American refineries.

(1) Paraffin Wax Group

- Softer paraffin waxes (e.g., slack waxes)
- Intermediate paraffin waxes (e.g., scale waxes)
- Harder paraffins (e.g., fully refined waxes)

(2) Petrolatums

(3) Microcrystalline Wax Group

- Medium soft (e.g., "Petrowax")
- Medium hard (e.g., "Petrosene A")
- Hard (e.g., "Be Square 190/195")

These three groups can be distinguished by their crystalline characteristics. Group (1) waxes have relatively large crystals (macro crystals). The slack or soft
oil than scale waxes, and the melting points usually are between 122 and 140°F. The scale waxes have negligible tensile strength and the melting points a
The refined waxes (block paraffines) range in melting point from about 125 to 165°F, but usually from 126 to 146°F.