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WOOD PRESERVATIVES

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ABSTRACT OF THE DISCLOSURE

A process for inhibiting the growth of wood-decaying fungi comprising impregnating wood with a small but effective amount of a trialkyltin compound having the general formula R_3SnY wherein R is selected from the group consisting of alkyl, aryl, and alkenyl radicals and Y is selected from the group consisting of perchlorate and nitrate.

This invention relates to wood preservatives.

Preservation of wood is highly desirable in the wood industry for protecting sleepers, telegraph poles, mine pillars, civil engineering and construction wood, materials for vehicles and vessels, plywood and fiberboard. Preservation of logs is considered important and is utilized in the field of forestry for protecting logs from damage by insects such as ambrosia beetles and bark beetles, wood-discoloring fungi and wood-decaying fungi. Research on preservatives against such insects and fungi has been conducted but it appears that effective wood preservatives have not heretofore been developed.

This invention is a novel process for inhibiting the growth of wood-decaying fungi comprising impregnating wood with a small but effective amount of a trialkyltin compound having the general formula R_3SnY wherein R is selected from the group consisting of alkyl, aryl, and alkenyl radicals and Y is selected from the group consisting of perchlorate and nitrate.

In this compound, R may be a hydrocarbon radical preferably selected from the group consisting of alkyl, alkenyl, cycloalkyl, aralkyl, aryl, alkaryl, including such radicals when inertly substituted. When R is alkyl, it may typically be straight chain alkyl or branched alkyl, including methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-amyl, neopentyl, isoamyl, n-hexyl, isohexyl, heptyls, octyls, decyls, dodecyls, tetradecyl, octadecyl, etc. Preferred alkyl includes lower alkyl, i.e. having less than about 8 carbon atoms, i.e. octyls and lower. When R is alkenyl, it may typically be vinyl, allyl, 1-propenyl, methallyl, buten-1-yl, buten-2-yl, buten-3-yl, penten-1-yl, hexenyl, heptenyl, octenyl, decenyl, dodecenyl, tetradecenyl, octadecenyl, etc. When R is cycloalkyl, it may typically be cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, etc. When R is aralkyl, it may typically be benzyl, β-phenylethyl, υ-phenylpropyl, β-phenylpropyl, etc. When R is aryl, it may typically be phenyl, naphthl, etc. When R is alkaryl, it may typically be tolyl, xylyl, p-ethylphenyl, p-nonylphenyl, etc. R may be inertly substituted, e.g. may bear a non-reactive substituent such as alkyl, aryl, cycloalkyl, aralkyl, alkaryl, alkenyl, ether, halogen, nitro, ester, etc. Typical substituted alkyls include 3-chloropropyl, 2-ethoxyethyl, carboethoxymethyl, etc. Substituted alkenyls include 4-chlorobutyl, υ-phenylpropenyl, chloroallyl, etc. Substituted cycloalkyls include 4-methylcyclohexyl, 4-chlorocyclohexyl, etc. Inertly substituted aryl includes chlorophenyl, anisyl, biphenyl, etc. Inertly substituted aralkyl includes chlorobenzyl, p-phenylbenzyl, p-methylbenzyl, etc. Inertly substituted alkaryl includes 3-chloro-5-methylphenyl, 2,6-di-tert-butyl-4-chlorophenyl, etc.

The compounds of this invention are diluted from a 0.01 to 10% (preferably 0.05 to 1.0%) aqueous solution and used as wood preservatives for construction materials, vessel materials or logs. The novel wood preservatives of this invention may be used alone, or in combination with other fungicides and insecticides such as blue vitriol, sodium fluoride, arsenious acid, arsenic acid, sodium arsenate, boric acid, mercuric chloride, organomercury compounds, creosote oil, pentachlorophenol, sodium pentachlorophenolate, BHC, DDT, aldrin, endrin or dieldrin, or assistants. When added agents are insoluble in water, it may be preferable to emulsify the combination with a suitable surface active agent or to dissolve the combination in a hydrophilic solvent.

The treatment methods for the novel preservative for wood are immersion, painting, spraying, injection by pressure, head injection, diffusing penetration, or standing timber injection and are chosen according to the application, the amount, and the desired period of use of wood. Wood previously or initially preserved is completely protected from injury by insects or fungi such as ambrosia beetles, wood-discoloring fungi and wood-decaying fungi from outside over a long period of time.

Since solutions containing the compounds used in this invention are made economically and are effective at low concentrations, they may be applied to low-cost goods such as fences and packing cases. Being colorless and transparent, the solutions may be applied to raw logs or constructional materials without any coloration.

The thus treated wood is completely protected for a long period of time from damage by fungi or insects, e.g. such as wood decaying fungi, wood discoloring fungi or wood boring insects.

EVALUATION 1

Effect on wood decaying fungi

The culture medium of malt agar may be contaminated by aliquots of 5% aqueous solutions of tripropyltin perchlorate and tripropyltin nitrate and completely mixed before solidified. After the inoculation with each fungus shown in Table I, cultivation may be made at 28+5° C., over 75% of humidity for 14 days. The results are shown in Table I.

TABLE I

Compound	Minimum concentration causing inhibition of growth (percent)		
	Poria vaporaria	*Trametes sanguinea*	*Schizophyllum commune*
Tripropyltin perchlorate	0.001	0.0005	0.001
Tripropyltin nitrate	0.001	0.001	0.002

EVALUATION 2

Weatherability test

0.1% aqueous solutions of tripropyltin perchlorate and tripropyltin nitrate may be put into a flask and exposed to the light of an arc lamp in a weatherometer for 104 hours (equivalent to 6 months' natural exposure). Each exposed solution may be evaluated as to the concentration causing inhibition of growth of *Poria vaporaria*, pursued the same procedure as in Evalution 1. Ethyl mercuric acetate, sodium pentachlorophenolate, and tributyltin sulfamate may be tested for comparison. The results are shown in Table II.

TABLE II

Compound	Percent			
	Before irradiation		After irradiation	
	Conc. ($\times 10^{-4}$)	Inhibition	Conc. ($\times 10^{-4}$)	Inhibition
Tripropyltin perchlorate	1	70	1	45
	2	85	4	80
	4	95	6	95
	6	100	10	100
Tripropyltin nitrate	1	65	1	40
	2	80	4	75
	4	95	6	90
	6	100	10	100
Ethyl mercuric acetate	0.2	60	1	20
	0.4	70	4	60
	0.6	95	10	80
	0.8	100	20	95
Sodium pentachlorophenolate	4	40	4	15
	6	50	6	20
	8	75	10	30
	10	100	20	45
Tributyltin sulfamate	2	50	4	50
	4	70	6	60
	6	80	10	75
	10	100	20	85

The table may indicate that the novel wood preservatives may be superior to the conventional in light stability.

In the following examples, unless otherwise indicated, amounts of materials are expressed in terms of parts by weight.

EXAMPLE 1

A 0.1–5% aqueous solution of tripropyltin prechlorate of tripropyltin nitrate was made. The solution was injected into the wood by pressure. It may also be used by immersing or painting wood. No decay of wood was observed.

EXAMPLE 2

0.5 part of tripropyltin perchlorate, 1.0 part of BHC, 5 parts of xylene and 10.0 parts of polyoxyethylene sorbitan monouried was mixed with 83.5 parts of water and emulsified with violent agitation. The emulsion was diluted with water for use. The solution was sprayed or painted on green logs to protect said green logs from insects and fungus attacks.

EXAMPLE 3

1.0 part of tripropyltin perchlorate, 2.0 parts of creosote oil and 5 parts of methyl alcohol was dissolved in 92 parts of water. The solution was diluted to one-fifth concentration with water. The dilution was injected into wood by pressure. No decay of wood was observed.

EXAMPLE 4

A mixture of 0.5 part of tripropyltin perchlorate, 1.5 parts of Aldrin, 5.0 parts of xylene, 50 parts of emulsion of vinyl acetate resin, 2.0 parts of dibutyl phthalate and 41 parts of water was stirred with vigor to make an emulsion. The emulsion was diluted to the desired concentration for use. The diluted solution was painted on the surface of wood so that the formed film protected

wood from insect and fungus attacks for a long period of time.

EXAMPLE 5

10 parts of tripropyltin perchlorate or tripropyltin nitrate, 2 parts of arsenious acid, 30 parts of tetrametylamine perchlorate and 58 parts of water were well mixed. The solution was diluted to one-twentieth concentration. The dilution was injected into wood by pressure or sprayed to protect wood from insects and fungus attacks. The foregoing solution was highly permeable when used for treatment of green logs. No decay of wood was observed.

EXAMPLE 6

A solution consisting of 1 part of tripropyltin perchlorate, 8 parts of boric acid and 91 parts of water was prepared. The solution was diluted to one-tenth concentration. The diluted solution was used for treatment of dried materials, e.g. veneer boards, furniture of building materials by a painting or immersion method. The solution was also added to adhesives for plywood as an effective wood preservative. No deleterious effect on said wood was observed.

Although this invention has been illustrated by reference to specific examples, numerous changes and modifications thereof which clearly fall within the scope of the invention will be apparent to those skilled-in-the-art.

We claim:

1. A process for inhibiting the growth of wood-decaying fungi comprising impregnating wood with a small but effective amount of a trialkyltin compound having the general formula R_3SnY wherein R is selected from a group consisting of alkyl radicals having from 1 to 10 carbon atoms and Y is selected from the group consisting of perchlorate and nitrate.

2. The process of claim 1 in which the trialkyltin compound is tripropyltin perchlorate.

3. The process of claim 1 in which the trialkyltin compound is tripropyltin nitrate.

References Cited

UNITED STATES PATENTS

3,256,143	6/1966	Zedler	424—288
3,284,157	11/1966	Peters	21—7
3,305,442	2/1967	Nishimoto	424—288
3,344,019	9/1967	Sowa	424—288 X

FOREIGN PATENTS

950,970	10/1956	Germany.

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