Patented Jan. 15, 1946 2,392,987

UNITED STATES PATENT OFFICE

2,392,987

PRESERVATIVE COMPOSITION

Eugene Farrell Hill, Grosse Ile, Mich., assignor, by mesne assignments, to Wyandotte Chemicals Corporation, Wyandotte, Mich., a corporation of Michigan

No Drawing. Application February 13, 1942, Serial No. 430,806

9 Claims. (Cl. 167—38.7)

The present invention relates to a method and a chemical composition for preventing sap stain and mold growth in green wood and lumber. The terms "sap stain" and "blue stain" have been synonymously employed in the lumber trade, and refer to a discoloration of that portion of the wood or lumber which contains sap. It has been established that such sap stain or discoloration is caused by various fungus growths, one of the most prominent of which is the species *Ceratostomella pilifera*. Sap stain generally has the physical appearance of a bluish or blue blackish discoloration within the body of the wood and running with the grain.

Mold growth, on the other hand, may be of various colors, ranging from black to white, generally of fuzzy appearance and are surface growths only which do not penetrate the body of the wood as in the case of sap stain.

The primary objection to sap stain in lumber is that it renders it unfit for many purposes and requires that the lumber be placed in a lower grade, and thereby subject to devaluation. Two general methods of controlling or preventing sap stain have been heretofore employed. These methods are kiln drying and chemical treatment. Both of these methods have the effect of creating conditions in green or freshly sawed wood or lumber, which are inimicable to the growth of the spores and/or mycelium of the sap staining fungi. Kiln drying reduces the moisture content of the wood rapidly below the point of favorable growth of the sap staining organism, and chemical treatment so effects the nutrient products of the sapwood, which constitute the food supply of the sap staining fungi, as to render it unfit for nourishment and further growth of such organism. A sap stain preventive or chemical preservative need be effective only until the lumber is seasoned, i. e., until the moisture content of the wood is reduced by air drying to a point below that at which the staining organisms can grow.

A great number of chemical compounds and chemical compositions have been heretofore employed in attempts to prevent sap stain. These efforts have been known for a period of at least forty years. Thus, alkali compounds in the form of sodium carbonate and bicarbonate, or a mixture of the two, generally termed "modified soda," was found to be effective when used upon soft wood such as pine, and when employed in hot solution. Lindgren and Scheffer, of the United States Department of Agriculture, in the past decade or more, have tried out a large number of chemical compounds to determine their sap stain preventative ability. (See: "Prevention of sap stain and mold in southern woods by chemical treatment," Southern Lumbermen, issue of Feb. 1, 1931; "Stains of sapwood and sapwood products and their control," U. S. Department of Agriculture Technical Bulletin No. 714, March 1940.)

As a result of these previous efforts, three different classes of chemical compounds have been generally adopted for commercial use by the lumber trade. These are: (1) alkalis, including sodium carbonates, bicarbonates, borax and various fluorides, (2) chlorophenolic compounds, chiefly tetra and penta chlorophenols, and the sodium salts thereof, and (3) organic mercury derivatives comprising essentially ethyl mercury chloride and ethyl mercury phosphate.

These three different classes of chemicals nevertheless possessed certain individual disadvantages and objectionable features. Thus, for example, the alkalis, such as soda, cause a discoloration of the lumber, probably due to the relatively high concentration of their solutions which must be used, and are not effective upon hard woods. On the other hand, borax (viz., commercial borax of the formula $Na_2B_4O_7.10H_2O$), although effective in controlling sap stain on hard woods, is relatively ineffective on soft woods, such as pine. Both soda and borax have been found to stimulate rather than retard certain fungus growths, particularly the surface mold growths.

The chlorophenolic and the organic mercury derivatives are dangerous to human health and safety, if they are not handled with extreme care.

It is therefore the general object and nature of my present invention to produce a chemical composition capable of preventing sap stain and mold growth in green wood and lumber, both of the hard and soft wood variety, while at the same time eliminating the various objectionable features and disadvantages heretofore encountered. After considerable experimentation, both in the laboratory and in the field, I have discovered a chemical preservative composition achieving this objective. Such composition comprises the alkali metal salt of a chlorophenolic compound, an alkali metal salt of boric acid, and the alkali metal salts of carbonic acids. This composition has been found to accomplish the following objectives and to possess the following advantages:

1. The prevention of sap stain at low concentrations in both hard and soft woods.

2. The prevention of mold growth.

3. An economically feasible cost to the user, viz., one at which the added expense of chemical treatment is adequately justified by savings in elimination of decreased sales value of degraded lumber.

4. Relatively non-poisonous to humans and non-irritating to the mucous membranes as compared with straight chlorophenols.

5. Effective at ordinary, atmospheric temperature.

6. No chemical discoloration of wood.

The preservative composition of the present invention possesses all of the optimum preserva-

tive or sap stain preventive qualities of each of its individual ingredients, while at the same time, it most unexpectedly does not possess, and in fact, eliminates the more detrimental and undesirable qualities of each individual ingredient. Furthermore, the sap stain preventive action of the individual ingredients going to make up the composition of my invention, has been found to be synergistic, in that the fungus growth controlling effect of all of the ingredients, present and in combination with each other, is greater than that of the sum total of the individual ingredients themselves. In other words, the amount present of all of the ingredients of the preservative composition of the instant invention is less than the amount required for any one of them to produce an equivalent sap stain control.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

More particularly describing my invention, the respective ingredients are present in the following critical, percentage range amounts: alkali metal salt of a halogenated phenol, e. g., sodium pentachlorphenate, 20 to 40% by weight; alkali metal salt of boric acid, e. g., borax ($Na_2B_4O_7.10H_2O$) 20 to 50% by weight; and alkali metal salts of carbonic acid, or modified soda, e. g.,

$$Na_2CO_3.1.6NaHCO_3.2H_2O$$

30 to 50% by weight.

A mixture of the foregoing chemical ingredients, in the percentage ranges indicated is dissolved in water at a predetermined concentration, and placed in a vat or dipping tank through which the freshly sawed green lumber from the saw mill is immersed. The lumber after such dipping is then stacked in the customary manner in the lumber yard and allowed to air dry for the usual period which may be as long as three or four months time. After such drying, the lumber is unstacked and inspected for the presence of sap stain and mold growth.

The extent of sap stain control, or alternatively, the degree of prevention of sap stain in green wood and lumber, as determined by customary commercial practice, will be found to vary, dependent chiefly upon the different grades of lumber which are being treated. Thus, for example, the presence of any sap stain at all upon certain select varieties of wood or lumber will cause the latter to be placed in a lower grade, or simply to be "degraded." On the other hand, in the case of No. 2 common southern pine lumber the presence of 10% or more of sap stain in the total area of board surface is permissible in commercial practice, before the degrading limit is reached.

The strength of concentration of a sap stain preventative composition will, accordingly, be varied by commercial users, dependent upon the grade and type of lumber which they are producing. The preservative composition of my invention can be used in a concentration range of 5 to 20 lbs. per 100 gallons of water. Concentrations in this range are effective to produce a sufficient control of sap stain to prevent the degrading of lumber under all of the various conditions encountered in the field. The upper limit of this range, viz., 20 lbs. per 100 gallons of water concentration of the preservative composition of my invention is sufficient to prevent the presence of any sap stain at all, under the severest and most demanding conditions.

A preferred formulation of the ingredients of the composition of the present invention (such formulation being hereinafter referred to as "Formulation No. 7") is of the following constituency: sodium pentachlorphenate 20% by weight, borax ($Na_2B_4O_7.10H_2O$) 50% by weight and modified soda ($Na_2CO_3.1.6NaHCO_3.2H_2O$) 30% by weight. This Formulation No. 7 was subjected to rigorous field tests, under commercial lumber mill operating conditions, namely, at Warren, Arkansas. In the course of such tests some of the lumber was not subjected to chemical treatment, but was otherwise stacked and air dried under the same conditions and for the same period of time as the treated lumber, thus serving as an untreated control, serving as a basis for measuring the effective sap stain preventative ability of Formula No. 7. Measurements were taken as to the percentage of sapwood stain and the percentage of stain on the untreated controls. Where the percentage of stain upon the untreated controls was greater than 50%, thus establishing relatively severe and rigorous conditions of tests, it was found that not over 13 lbs. per 100 gallons of water concentration of Formula No. 7 was effective in completely preventing the presence of any sap stain.

The following table sets forth the comparative results obtained in field tests upon the individual ingredients in Formula No. 7 as well as the results obtained in the case of the latter:

Results of field tests on sap stain control materials—southern pine

	Concentration		Per cent sapwood stained	Per cent stain on untreated controls	Corrected value,[1] per cent sapwood stained
	Lbs./100 gals. H_2O	Per cent by weight			
Borax	(No effective control on pine)				
Soda	41.5	5.0	36.0	[2] 65.0	55.3
Do	41.5	5.0	39.0	[2] 68.0	57.4
Na pentachlorphenate	6	.72	15.3	87.8	[3] 17.5
Do	8	.95	8.5	78.7	[3] 10.8
Do	10	1.20	[4] 4.15	68.0	[4] 6.1
Do	14	1.68	[4] 1.15	78.0	[4] 1.5
Formulation No. 7	7.67	.92	[4] 1.78	52	[4] 3.45
Do	9.16	1.10	[4] 2.5	76	[4] 3.30
Do	12.9	1.55	[4] 0	71	[4] 0.0

[1] Obtained by dividing per cent of sapwood stained by per cent stain on untreated controls.

[2] Lindgren and Scheffer—"Stains of sapwood and sapwood products and their control," U. S. Dept. of Agriculture Technical Bulletin No. 714, March 1940, page 59.

[3] Hay U. S. Pat. No. 2,209,970 (lowest stain per cent results) page 2, col. 2.

[4] E. F. Hill—Field Tests at Southern Lumber Co., Warren, Arkansas, 1941.

From the foregoing table it will be readily appreciated that the sap stain control ability of the composition of my invention is at least equivalent to or greater than the corresponding ability of any one of the individual ingredients, when subjected to actual field tests and during commercial operation. Thus, slightly less than 13 lbs. per 100 gallons of water of Formulation No. 7 produced a better sap stain control result than 14 lbs. per 100 gallons of water of the individual ingredient, sodium pentachlorphenate. With 9.16 lbs. of applicant's Formulation No. 7, the per cent sapwood stained was about one-half that when using 10 lbs. of Na-pentachlorphenate alone. And obviously, the results obtained by the other individual ingredients, viz., borax and soda were not at all comparable to the results obtained by Formulation No. 7.

Similar results were obtained in the treatment of southern hardwoods. These results are particularly unusual when it is considered that borax, in addition to having no effective control upon sap stain in green pine lumber, stimulates mold growth thereon; but when it is incorporated with pentachlorphenate and modified soda even in the predominant amount of 50%, as is the case in Formulation No. 7, no such mold growth occurs, and the sap stain preventative ability is increased.

The preservative composition of my invention can be obtained within an economically feasible range, viz., within the maximum cost of $.20 per 1000 board feet of lumber treated. In fact, the cost of my preservative composition when compared to the cost of compositions heretofore known and used and on the basis of the amount required to produce an equivalent degree of sap stain control, results in approximately a one-third saving in raw materials' cost alone.

Furthermore my preservative composition is non-poisonous and is not dangerous to human health and safety. It is readily soluble in water and may, of course, be used at ordinary temperatures. The composition of my invention will not produce any "blooming" or crystalline formation upon the surface of the lumber, and likewise no chemical discoloration thereof.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the composition and method herein disclosed, provided the ingredients or steps stated by any of the following claims or the equivalent of such stated ingredients or steps be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A preservative composition for preventing sap stain and mold growth in green wood comprising a mixture of sodium pentachlorphenate present in the amount of 20 to 40% by weight, of borax present in the amount of 20 to 50% by weight and modified soda present in the amount of 30 to 50% by weight.

2. A preservative composition for preventing sap stain and mold growth in green wood comprising approximately 20% sodium pentachlorphenate by weight, approximately 50% borax by weight and approximately 30% modified soda by weight.

3. A preservative composition for preventing sap stain and mold growth in green wood comprising approximately 20% by weight sodium pentachlorphenate, approximately 50% by weight $Na_2B_4O_7.10H_2O$ and approximately 30% by weight $Na_2CO_3.1.6NaHCO_3.2H_2O$.

4. An aqueous solution bath for preventing sap stain in green lumber sufficient to cause a degrading thereof, comprising 5 to 20 lbs. per 100 gallons of water of a mixture of 20 to 40% by weight sodium pentachlorphenate, 20 to 50% by weight borax and 30 to 50% by weight of a sodium salt of carbonic acid, the total concentration of all of these enumerated chemicals in said water solution being less than the amount of any one of them required to control sap stain in such lumber to an equivalent extent.

5. An aqueous solution bath for eliminating sap stain in green, hard and soft woods, comprising not over 20 lbs. per 100 gallons of a mixture of approximately 20% by weight sodium pentachlorphenate, approximately 50% by weight borax and approximately 30% by weight modified soda.

6. The method of controlling sap stain in green lumber to a point below the degrading limit, while preventing the stimulation of mold growth on such lumber, which comprises applying a water solution of 5 to 20 lbs. per 100 gallons of water of a mixture of 20 to 40% by weight sodium pentachlorphenate, 20 to 50% by weight borax and 30 to 50% by weight of a sodium salt of carbonic acid, the total concentration of all of these enumerated chemicals in said water solution being less than the amount of any one of them required to control sap stain in such lumber to an equivalent extent.

7. The method of controlling sap stain in green lumber to a point below the degrading limit, while preventing the stimulation of mold growth on such lumber, which comprises applying a water solution of not over 20 lbs. per 100 gallons of water of a mixture of approximately 20% by weight sodium pentachlorphenate, approximately 50% by weight borax and approximately 30% by weight of a sodium salt of carbonic acid, the total concentration of all of these enumerated chemicals in said water solution being less than the amount of any one of them required to control sap stain in such lumber to an equivalent extent.

8. The method as in claim 6 wherein the green lumber is dipped in a bath of said solution at atmospheric temperature.

9. The method as in claim 7 wherein the green lumber is dipped in a bath of said solution at atmospheric temperature.

EUGENE FARRELL HILL.