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3,756,850

ANTI-STAIN TREATMENT FOR LUMBER IN TRANSIT

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8 Claims

ABSTRACT OF THE DISCLOSURE

Disclosed are methods and compositions for preventing or minimizing staining of lumber during transit, particularly during rail and ship transit, under conditions of exposure to iron contaminants by adhering to the lumber an essentially atinctorial deposit of exposed particles of a slow-leaching base in an amount sufficient to maintain the surface of the lumber at a pH at about 10 or above for the period of transit.

This invention relates to methods and compositions especially adapted for coating lumber to prevent staining of lumber during transit. More specifically, this invention relates to compositions and methods for preventing or controlling the degradation of lumber through color changes resulting from undesired chemical reactions.

An unusual problem has been encountered when the freshly cut lumber is transported great distances by rail under conditions where the lumber is exposed to rain, snow, mist, dew, fog, salt water and sunshine and other elements of weather. Under these conditions, the lumber is observed to darken to a brown or black color. This darkening condition is known as "rail transit stain" or merely "transit stain." Up to now, transit stain was accepted as an inherent problem in the transportation of lumber by rail. To a lesser extent, transit stain forms on lumber transported by rail or truck when the lumber has a prior history of rail transit. Apparently air currents carry iron dust from the rail car wheels and the brake car shoes to the lumber. Staining will begin when atmospheric moisture such as rain or dew contacts the iron-contaminated wood. Thus, if no moisture is encountered during transit, staining could develop upon exposure to moisture while sitting in a lumber yard after exposure to iron dust during transit. The iron dust which was deposited during transit did not cause the immediate darkening because sufficient free moisture was not available for the reaction to proceed.

Freshly cut or green lumber from trees such as redwood, cedar, spruce, fir, pine and hemlock contains wood acids, tannins, lignins and other chemicals which react with environmental chemicals to form new compounds the color of which are generally unlike that of freshly cut lumber. Green lumber is rather acidic in nature due to the relatively high content of wood acids and when wetted by rain, forms a suitable vehicle for dissociation of certain metals, such as iron, into their ionic state. When this occurs, certain chemical reactions result which produce chemical discoloration on the lumber surface wherein the lumber becomes darkened. Continued exposure of the wood allows the reaction to penetrate the surface and at the same time increases the discoloration on the surface.

One method of preventing transit staining is to wrap the lumber with paper or other protective covering material to physically shield the lumber from the elements. This method is time consuming, costly and inconvenient.

In my Canadian Pat. 756,052, a method is disclosed for keeping the lumber surface at an acid pH such as with oxalic acid so that the appearance of freshly milled wood remains for an extended period of time. The oxalic acid reacts with contaminants to form oxalate salts which

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closely approximate the color of wood. Unfortunately, some oxalate salts are water soluble and with heavy rain the oxalate salt may be washed away leaving the wood susceptible to further staining. Thus, the present invention represents an advance over my Canadian Pat. 756,052 in providing a different mechanism for preventing travel staining.

U.S. Pats. 3,333,977 and 3,333,978 proposes acidic anti-staining coating for redwood and cedar comprising certain polyester resins together with water-soluble salts, oxidizing agents, organic peroxides and water-soluble acids for prevention of sap staining. This proposal does not apply to and is not effective against transit stain.

U.S. Pat. 3,565,681 concerns a method of preparing anti-rust paper for use as labels on metallic containers. These anti-rust papers are provided with a coating of calcium hydroxide, water-dispersible adhesive compatible with the calcium ions and selected from the group consisting of starch, protein, synthetic binder and mixtures thereof. This patent does not concern the problem of transit staining on lumber.

U.S. Pats. 2,818,344; 3,085,893 and 3,033,700 disclose the use of certain barium borate pigments in paints for the purpose of promoting cleaner, longer-lasting films. The films are of the paint type which encapsulate the pigment so that the pigment is not "exposed to the elements but rather is embedded in the paint film." These patents do not discuss the formation of transit stains on lumber or the prevention of stain. The barium borate pigments disclosed in these three patents are used in the percentage of 2 to 20% of the paint for the purpose of inhibiting mold growth. The barium pigments disclosed in these three patents are suitable for use as alkaline-earth base in the practice of the present invention, and accordingly the teachings of these three patents is incorporated by reference.

It has now been discovered that this rail transit stain can be eliminated or materially reduced by adhering to the exposed surfaces of said lumber at an exposed essentially atinctorial deposit of a particulate base which is slowly leachable upon exposure to atmospheric mixture to produce a basic extract solution having a pH of about 10 or greater. The deposit is adhered to the lumber in an amount sufficient to maintain the pH of at least a substantial portion of the exposed surface above about 10 for the period of transit. Thus, the present invention is completely contrary to the prior methods of maintaining the freshly cut appearance of the lumber wherein the wood surface was maintained at an acid pH to prevent staining. The binder is used merely to fasten or glue the base particles to the lumber and keep the particles from being physically dislodged by the forces of handling or shipping or by the physical force of the wind and rain.

The deposit is in no sense of the word a "paint" because the deposit is intentionally "binder starved" or "pigment rich" so that the deposit particles are exposed for leaching with atmospheric moisture. Paint has been defined as a pigmented liquid composition which is converted to an opaque solid film after application as a thin layer.

In the context of the present invention, it is more appropriate to think of the binder as an adhesive to distinguish from the term "binder" as it is used in describing paint films. In fact, an adhesive which is also water repellent is ideal so that it will not be washed away during heavy rainfalls.

The exact chemical mechanism responsible for the effectiveness of the present invention is not completely understood, although it is strongly suspected that the actual cause of transit staining in lumber is the chemical reaction occurring between the wood acids, tannins and other chemicals in the wood with the ambient iron con-

taminants in the presence of atmospheric moisture to produce brown or black iron compounds on the lumber surface. Surprisingly, iron oxide in pigmentary form as ferric oxide does not react with the wood to form discolored products. In fact, yellow and red iron oxide pigments can be used to tint the inventive coating to closely match the wood color. Apparently, only metallic iron is responsible for transit staining.

The iron contaminants come from the iron and steel transportation equipment. For example, railroad car brakes under friction release significant quantities of iron particles in the form of dust. The friction of the steel railroad wheels on the railroad tracks can result in the release of metallic iron dust. Moreover, steel transportation compartments as well as the chains and straps for securing the lumber to the compartment are sources of iron contaminants. In the presence of rain and moisture, these iron contaminants react with the wood acids to produce the brown or black stain on wood surfaces. Whatever the exact chemical mechanisms, the freshly cut lumber can be prevented from transit staining by maintaining the pH above about 10 for the duration of exposure.

To maintain the surface of the lumber at a pH of about 10 for the duration of the journey, the exposed surface is buffered by adhering an essentially atinctorial deposit of slow-leaching (i.e., having a solubility of at least about 0.001% in water at 32° F.) base particles which are slightly or moderately soluble in water (e.g., having a water solubility of less than about 50% by weight at 32° F. but greater than about 0.001%). If the base were too water soluble, the deposit would be dissolved during the first rain to leave the lumber unprotected for the remainder of the period of exposure, although this may be acceptable for short periods of exposure.

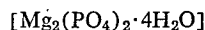
The term "atinctorial" as used herein means that the base does not have a tendency to react with the wood to tint it from its natural color. In other words, the base is neutral with respect to color, although colorants and tints can be added to the coating composition for the purpose of color coding or to highlight or approximate the natural color of the lumber.

The term "base" refers to a compound which yields hydroxyl ions in aqueous solution. These base particles due to the slight or moderate solubility are slowly leachable with atmospheric water to form a basic buffer solution which prevents the iron from reacting with the wood chemicals to form a stain. Usually at least a portion of and preferably all of the base particles have solubility in water of less than about 10% by weight at 32° F. and preferably less than 1% at 32° F.

When the lumber requires protection for prolonged periods of up to several months, at least a portion and preferably all of the base particles having a water solubility of about 0.001% to about 0.5% by weight are particularly effective so that the particles are very slowly leachable with atmospheric moisture to yield a buffer solution on the surface of the lumber throughout the period of exposure.

Suitable atinctorial slowly leachable bases are alkaline-earth metal bases which include oxides, carbonates, phosphates, hydroxides, borates, borosilicates and hydrates of the same of the alkaline-earth metals magnesium, calcium and barium such as barium oxide (BaO), barium carbonate (BaCO₃), barium hydroxide [Ba(OH)₂], barium hypophosphate (BaPO₃), barium monohydrogen orthophosphate (BaHPO₄), barium metasilicate (BaSiO₃), barium octaborate (3BaO·B₂O₃), barium methaborate (BaO·B₂O₃), barium octaborate (BaO·4B₂O₃), barium borosilicate (3BaO·3B₂O₃·2SiO₂), magnesium carbonate (MgCO₃), magnesium carbonate hydrates (MgCO₃·3H₂O and MgCO₃·5H₂O) and other barium borates and barium borosilicates described in U.S. Pat. 2,818,344; basic magnesium carbonate [MgCO₃·Mg(OH)₂·3H₂O and

3MgO·Mg(OH)₂·3H₂O], magnesium oxide (MgO), magnesium acid carbonate (MgHCO₃), magnesium hydroxide [Mg(OH)₂], magnesium orthophosphate



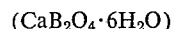
magnesium monohydrogen orthophosphate



calcium tetraborate (CaB₄O₇), calcium carbonate



calcium hydroxide [Ca(OH)₂], calcium oxide (CaO), calcium orthophosphate [Ca₂(PO₄)₂], calcium monohydrogen orthophosphate (CaHPO₄·2H₂O), calcium metaborate (CaB₂O₄), calcium metaborate hexahydrate



Other slow leaching bases include trisodium phosphate, sodium carbonate, sodium sesquicarbonate, borax and sodium bicarbonate. These slow-leaching bases are often used to supplement the alkaline-earth bases.

The particle size of the base particles is not particularly critical as long as the particles are in the size range generally used for pigmentary purposes. The average particle size for these purposes is usually less than 50 microns and preferably about 1 micron to about 15 microns. The bases can be supplemented with water-soluble bases (i.e., those bases having a solubility in water in excess of 50% by weight at about 32° F.) such as sodium and potassium hydroxides, ammonium hydroxide and so on in the proportion of up to 50% by weight of the total base when the particular type of wood can withstand such water-soluble bases without reacting therewith to form stains.

The base deposit is adhered to the lumber with a suitable binder or adhesive as a "wash coat" rather than a paint. The purpose of the binder here is not to encase or encapsulate the base particle to form a conventional paint coating, but rather adhere or glue the deposit to the lumber so that it will not be dislodged from the lumber by the forces of the rain, wind and normal abrasion occasioned during the course of the journey. The binder should not be present in an amount that would tend to encapsulate the deposit thus acting as a barrier between the atmospheric moisture and the particle to prevent or inhibit leaching.

Pigments and fillers can also be used in admixture with the base particles to obtain properties such as thixotropy, coloration, stability and other properties. Thus, supplemental pigments such as titania, silica, iron oxide, zirconia and other pigmentary or filler materials can be included in the coating composition along with the base and binders.

The binder can be any thermoplastic or thermosetting composition in solution, dispersion, suspension or emulsion in organic or aqueous solvent. The selection of the binder is not particularly critical as long as the binder is compatible with the base particles and capable of curing to adhere the deposit of particulate base to the lumber substrate. Curing as used herein means that the binder forms as adherent residue on drying, heating or otherwise processing. Curing does not necessarily infer cross-linking inclusively, but it can include coalescence as upon drying a latex.

Suitable film-forming binders include the natural or conventional pigment binders such as casein; glues, gelatin; starch; polyvinyl alcohol; gums and cellulose esters and ethers (e.g., carboxy methyl cellulose, sodium carboxy methyl cellulose, cellulose acetate and hydroxy ethyl cellulose). Some of these binders tend to be water sensitive or water soluble and are usually used with water-insoluble binders.

Other suitable binders include the conventional thermoplastic and thermosetting resinous polymers (including homopolymers, copolymers, terpolymers, etc.), resinous

coating such as polyolefins (e.g., polyethylene, oxidized or emulsified polyethylene and polypropylene); natural or synthetic waxes such as paraffin wax, carnauba wax and petroleum wax; modified or unmodified polyesters (e.g., the ethylene glycol/maleic/phthalate styrene type and glycerol phthalate type including those known as alkyds); shellac; petroleum resins; natural resins; epoxide resins, phenol formaldehyde resins; allyl resins; polystyrene resins; polyamides such as nylon; vinyl resins such as polyvinyl chloride, polyvinylidene chloride; polyvinyl acetate, polyvinyl-chloride-polyvinyl acetate resins, vinyl chloride-styrene resins, vinyl chloride-butadiene resins, vinyl chloride-acrylonitrile resins; acrylic acid and acrylic ester polymers such as polymethyl methacrylate, and methyl methacrylate-styrene; acetal polymers and copolymers; chlorinated rubber; acrylonitrile-butadiene-styrene polymers; isoprene polymers; butadiene-styrene copolymers; polyvinyl butyral resins; styrene-ethylene copolymers; polyfluoroethylene resins, polyvinylidene fluoride resins and polyurethane resins. These resins can be in the form of solvent solution (e.g., in aromatic hydrocarbons such as toluene and xylene; aliphatics such as hexane, octane or even cycloaliphatics such as cyclohexane; alcohols such as methanol and ethanol; or even in solution in a vinyl monomer polymerization with ethylene unsaturation present in the film-forming resins), water solution or aqueous latex depending on chemical and physical conditions. When the lumber is coated at sub-freezing temperatures as in the northwoods of Canada, organic solvents are used so the coating does not freeze. At temperatures above freezing, aqueous solvent can be used.

Several latices suitable for use in the present invention are available commercially. These include butadiene-styrene latices (Latex 512R, Dow Chemical) containing 35 to 55% total solids; vinyl chloride latices containing 50 to 55% total solids; vinylidene chloride-acrylonitrile copolymers (Saran F122-A15, Dow Chemical); polystyrene latices containing 35 to 45% solids vinyl ester latices such as polyvinyl acetate containing 40 to 55% total solids (Gelva S-55, Shawinigan); latices of polyvinyl acetate-polyvinyl chloride (resyn 2507, National Starch) containing 40 to 50% total solids; butadiene-acrylonitrile copolymers (Hycar 1577, Goodrich); styrene-acrylonitrile latices, polymethylmethacrylate latices and butadiene-acrylic ester latices. The latices usually have an average molecular weight in the range of about 25,000 to about 100,000.

For application, a coating composition comprising a slurry or dispersion of base particles (with or without pigments and fillers) and binder in an aqueous or organic solvent carrier is prepared according to the usual mixing techniques for preparing conventional pigment in binder dispersions using conventional anti-foam agents, dispersing agents, wetting agent and emulsifiers.

The coating composition can be prepared in the form of a concentrate of the base particles in binder and carrier containing as much as 2 to 75% by weight of base particles for subsequent dilution with water or solvent at the point of application. The base particle concentration of the coating as applied to the lumber is about 0.1 to 10% by weight and preferably about 0.1% to about 5% by weight of the coating composition together with sufficient binder to adhere the base particles to the lumber. About 1 part by weight of binder is sufficient to bind up to 10 parts by weight of base particles plus pigment (if any). Usually about 1 part by weight of binder is used for every 1 to 6 parts by weight of base particles plus pigment to achieve effective adhesion to the lumber.

The coating composition can be applied to the lumber by conventional coating means, such as brushing, spray coatings, roller coating, dip coating, air doctoring and the like. For most applications where the period of exposure is up to six months, the coating composition is applied to the surface of the lumber to be protected in the proportion of about 0.001 U.S. gallon/foot² to about 0.01 U.S.

gallon/foot² of lumber surface. Preferably for efficiency and economy, the application rate of coating composition to the lumber surface is about 0.003 to about 0.006 U.S. gallon/foot².

The following examples illustrate the practice of the invention. All parts are parts by weight, all percentages are weight percentages and all temperatures are degrees F unless otherwise indicated.

EXAMPLE 1

A coating concentrate composition is prepared by thoroughly blending the following ingredients in an agitated vessel at a temperature between 80° and 100° F. until a stable dispersion is formed:

EXAMPLE 1

Ingredient	Parts	Percent by weight (approximate)
Base particles and pigment:		
Alkaline-earth base [barium metaborate pigment (BaB ₂ O ₄ ·H ₂ O) having a specific gravity of about 3.3, solubility in water of 0.4%, maximum at 70° F. and an average particle size of about 5 to 10 microns].....	282	22
Water-dispersible white pigment grade rutile titania (pigmentary particle size and quality).....	105	8
Binders; emulsified paraffin wax having a melting point of 125 to 135° F. and an average particle size of 1 to 2 microns.....	135	10
Wetting agents and thickeners:		
Ethylene glycol.....	15	3
Hydroxy ethyl cellulose thickener.....	4	
Anionic polyelectrolyte dispersing agent.....	1	
Silicone anti-foam agent.....	1	
Lubricating oil.....	1	
Ammonium hydroxide (28% NH ₃ solution).....	3	57
Carrier; water.....	729	
Total.....	1,276	100

¹ Wax solid.

This coating concentrate composition is white in color and suitable for dilution with water for application at the lumber mill.

EXAMPLE 2

The coating concentrate composition prepared in Example 1 is diluted for application with water in the proportion of 6 parts of water to 1 part of coating concentrate to yield a coating composition containing 3.7% barium metaborate, 1.3% titania and 1.7% paraffin wax. The diluted coating composition is sprayed with a spray-gun type applicator onto the exposed surfaces of freshly cut 2" x 2" pine lumber loaded for rail shipment in one open flatcar of steel construction in a train of similarly loaded flatcars. The coating is sprayed at the rate of about 0.003 U.S. gallon/foot² of exposed lumber surface at ambient outdoor temperature of about 60° to 70° F. The water rapidly dries to leave a deposit of barium metaborate and titania adhering to the lumber by the paraffin wax binder. The white titania pigment gives the coating the appearance of a very dilute "white wash" coating. The titania pigment is used so the treated areas could be distinguished from the untreated areas.

The trainload of pine lumber travels a distance of 2,000 miles in exposed condition in the open flatcar over a 2- to 3-week period. At the end of the journey, no stain is visible on the coated pine lumber while the pine lumber that had not received the coating is very dark brown on the exposed surface. The surface pH on the treated area of the lumber is observed to be about 10 to 11 by testing with moist pH paper.

When Example 2 is repeated except that borax or calcium oxide or magnesium oxide are substituted for the barium metaborate as the base, similar results are obtained.

Similar results are obtained when Example 2 is repeated using a 10% by weight aqueous emulsion of polyolefin wax such as an emulsifiable polyethylene wax having a melting point of 213° to 221° F. and an Acid Number of 14 to 17 sold by Allied Chemical under the name AC polyethylene 629 in place of the emulsified paraffin wax as the binder.

Similar results are also obtained when a butadiene-styrene latex such as Latex S12R by Dow Chemical containing 40% solids; or a vinyl chloride latex containing 50% solids; or a polystyrene latex containing 40% solids on a polyvinyl acetate latex containing 50% solids such as Gelva S-55 sold by Shawinigan; are substituted on an equivalent solids basis for the paraffin wax binder in the procedure of Example 2.

EXAMPLE 3

The coating concentrate composition of Example 1 is diluted with water in the ratio of 12 parts of water to 1 part of concentrate and is applied to the surface of 2" x 4" pine lumber loaded for shipment by rail as in Example 2. Upon shipment of 1,000 miles over a period of 1 to 2 weeks, no discoloration is observed on the treated pine lumber while the untreated pine lumber has a dark brown surface stain. The surface pH on the treated areas of the lumber is observed to be about 10.

Examples 2 and 3 show that the amount of particulate base adhered to the lumber is increased as the duration of exposure to the element increases so as to provide sufficient base to slowly leach during the journey to maintain the surface pH of the lumber above about 10. If insufficient particulate base is employed, there may be some slight staining near the end of the journey. The actual amount and solubility characteristics of the base employed will depend upon the season, climate and specific weather conditions with more base being required for more severe conditions of wind and rain.

EXAMPLE 4

Freshly cut hemlock lumber is transported by rail to a North American port where it is secured with steel chains to the open deck of an ocean freighter for shipment to Europe. Part of the hemlock lumber is located with the diluted coating composition of Example 2 by the spray method of Example 2 and part of the lumber left untreated. The lumber is then shipped as open deck cargo to Europe. At the end of the voyage, the treated portion of the lumber is only slightly stained while the untreated part of the lumber has a dark brown stain.

EXAMPLE 5

A coating composition for direct application to spruce lumber is prepared by thoroughly blending the following ingredients in an agitated vessel at a temperature between 80° to 100° F. until a stable dispersion is formed. This coating composition is ready for direct application to the spruce lumber as is, and requires no further dilution at the point of application. Furthermore, this coating composition is adapted for use at very low temperatures below the freezing point of water in that the carrier is an organic solvent (mineral spirits), so freezing is not a problem.

EXAMPLE 5		
Ingredient	Parts	Percent by weight (approximate)
Particulate base and pigment:		
Lime (calcium oxide having a particle size of 100% passing 35 mesh and 79% passing 350 mesh).....	9	2.5
Barium metaborate pigment (same as used in Example 1).....	13	3.5
Rutile titania pigment (same as used in Example 1).....	2	0.5
Binders; petroleum hydrocarbon wax (a paraffinic petroleum-based hydrocarbon distillate wax having a molecular weight of about 500 to 1,000, a melting point of about 125° to 175° F., such as obtained by dewaxing petroleum-based lubricating oils).....		
Wetting agent; aluminum stearate.....	0.3	2.5
Carrier; mineral spirits (a light hydrocarbon liquid having a distillation range of about 300° F. to 400° F., an API gravity of 45 to 49.5, a specific gravity of about 0.8).....	346	91
Total.....	379.3	100

During the blending, the petroleum hydrocarbon wax disperses in the mineral spirits to yield a coating com-

position having a specific gravity of about 0.85 containing about 9% by weight of non-volatile materials.

The coating composition is sprayed with a spray-gun type applicator onto the exposed surface of freshly cut spruce lumber loaded for rail shipment in an open flatcar of steel construction in a train of similarly loaded flatcars. The coating composition is sprayed at the rate of 0.005 to 0.004 U.S. gallon/foot² of exposed lumber surface at ambient outdoor temperature of about 20° F. Upon standing the solvent dries to leave a deposit of lime, barium metaborate and white titania pigment adhering to the spruce lumber by the petroleum wax binder. The white titania pigment gives the coating an appearance of a very dilute whitewash coating. The titania pigment is used so that the treated areas can be distinguished from the untreated areas.

The trainload of spruce lumber travels a distance of 2,000 miles in exposed condition in the open flatcar over a 2- to 3-week period. At the end of the journey, transit stain is not visible on the coated spruce lumber while the spruce lumber that has not received the coating has a dark brown stain on the exposed surface. The surface pH on the treated spruce lumber is tested by moist pH paper and is observed to be between about 10 and 11. This example shows the combination of lime and barium metaborate are effective as the particulate base in retarding transit stain.

EXAMPLE 6

The coating composition for direct application to cedar lumber is prepared by thoroughly blending the following ingredients in an agitated vessel at a temperature of 80° F. until a stable dispersion is formed. This coating composition is ready for direct application to the cedar lumber as is, and requires no further dilution at the point of application. The coating composition is adapted for use at low temperatures below the freezing point of water in that the carrier is an organic solvent. The coating can be used at temperatures above freezing if desired, however.

EXAMPLE 6		
Ingredient	Parts	Percent by weight (approximate)
Particulate base and pigment:		
Lime (calcium oxide as in Example 5).....	16	2.5
Barium metaborate pigment (same as in Example 1).....	25	3.9
Red iron oxide pigment (Fe ₂ O ₃).....	7	1.1
Binders; petroleum hydrocarbon wax (same as in Example 5).....		
Wetting agent; aluminum stearate.....	0.3	2.6
Carrier; mineral spirits (same as in Example 5).....	580	89.9
Total.....	645.3	100.0

During the blending, the petroleum hydrocarbon wax dispersed the base particles and pigment in the mineral spirits to form a coating composition.

The coating composition is sprayed with a spray-gun type applicator onto the exposed surfaces of cedar lumber loaded for rail shipment in an open flatcar of steel construction in a train of similarly loaded flatcars of cedar lumber. The coating is sprayed at the rate of about 0.005 U.S. gallon/foot² of exposed surface. The solvent dries to leave a deposit of barium metaborate, calcium oxide and iron oxide adhering to the lumber by the petroleum wax binder. The iron oxide pigment gives the coating a reddish cast to simulate the reddish coloration of the cedar lumber.

The trainload of cedar lumber travels in exposed condition for a period of two to three weeks. At the end of

the journey, no stain is visible on the coated cedar lumber while the cedar lumber that has not received the coating has a dark stain. The surface pH of the coated areas of the coated lumber is observed to be about 10 to 11 when tested with moist pH paper.

Similar results are obtained when a urea-formaldehyde resin or a phenol-formaldehyde resin or a melamine-formaldehyde resin is substituted on an equivalents solids basis for the petroleum hydrocarbon wax binder in the above process.

EXAMPLE 7

A coating concentrate adapted for dilution at the point of application for fir lumber is prepared by thoroughly blending the following ingredients in an agitated vessel at a temperature of 80° to 100° F. until a stable dispersion is formed. The coating composition can then be shipped in the concentrated state and then can be diluted at the point of application to the lumber.

EXAMPLE 7

Ingredient	Parts	Percent by weight (approximate)
Particulate base and pigment:		
Lime (calcium oxide as in Example 5).....	160	17.6
Barium metaborate pigment (as in Example 1).....	250	27.5
Rutile titania pigment (as in Example 1).....	5	0.6
Yellow pigment (Fe ₂ O ₃ monohydrate pigment).....	1	
Binders; petroleum hydrocarbon wax (as in Example 5).....	166	18.3
Wetting agent; aluminum stearate.....	4	0.4
Carrier; mineral spirits (as in Example 5).....	323	35.6
Total.....	909	100.0

During the blending, the petroleum hydrocarbon wax disperses the base particles and pigment in the mineral spirits to form a stable coating concentrate composition.

The above coating concentrate composition is diluted with 10 parts of mineral spirits to 1 part of coating concentrate and is then applied with a spray-gun type applicator at the rate of 0.003 to 0.004 U.S. gallon/foot² on the exposed surfaces of freshly cut fir lumber loaded for rail shipment in an open flatcar of steel construction in a train of similar flatcars loaded with fir lumber. The coating is sprayed at ambient outdoor temperature of about 30° F. The solvent dries to leave a deposit of barium metaborate, lime, iron oxide pigment and titania adhering to the lumber by the petroleum wax binder. The combined coloration from the titania pigment and the yellow iron oxide pigment gives the coating the coloration closely simulating the natural coloration of the fir lumber and the coating is practically invisible.

The trainload of lumber travels in exposed condition in open flatcars over a period of two of three weeks. At the end of the journey, no stain is visible on the coated fir lumber while the fir lumber that has not received the coating has a dark brown surface stain. The surface pH on the treated area of the lumber is observed to be about 10 to 11 by test with moist pH paper.

EXAMPLE 8

A coating concentrate is prepared by thoroughly blending the following ingredients in an agitated vessel at a temperature of about 90° F. until a stable dispersion is formed.

During the blending, the emulsified paraffin wax disperses the base particles and pigment to form a coating concentrate suitable for use in coating hemlock lumber.

The coating is sprayed with a spray-gun type applicator onto the exposed surface of freshly cut hemlock lumber

loaded for rail shipment in one open flatcar of steel construction in a train of similarly loaded flatcars. The coating is sprayed at the rate of about 0.004 U.S. gallon/foot² of exposed lumber surface at ambient outdoor temperature of 80° F. The water rapidly dries to leave a deposit of borax, barium metaborate and pigment adhering to the lumber by the paraffin wax binder. The pigment tints the coating to approach the color of the hemlock lumber so that the coating is barely visible.

The trainload of lumber travels in exposed condition in the open flatcars for two or three weeks. At the end of the journey, no stain is visible on the coated hemlock lumber while the hemlock lumber that had not received the coating is very dark brown on the exposed surface.

The surface pH on the treated area of the lumber is observed to be about 10 to 11 by testing with moist pH paper.

EXAMPLE 8

Ingredient	Parts	Percent by weight (approximate)
25 Particulate base and pigment:		
Borax (Na ₂ B ₄ O ₇ ·10 H ₂ O).....	440	0.6
Barium metaborate (as in Example 1).....	3,200	4.5
Yellow iron oxide pigment (Fe ₂ O ₃ monohydrate yellow pigment).....	88	0.6
Red iron oxide pigment (Fe ₂ O ₃).....	6	
30 Binders; emulsified paraffin wax having a melting point of 125° to 135° F. having an average particle size of 1 to 2 microns.....	12,752	3.9
Wetting agents and thickeners:		
Ethylene glycol.....	240	0.8
Hydroxyethyl cellulose thickener.....	100	
Anionic polyelectrolyte dispersing agent.....	160	
Silicone anti-foam agent.....	16	
35 Lubricating oil.....	16	90.2
Ammonium hydroxide (28% NH ₃ solution).....	32	
Carrier; water.....	63,512	
Total.....	70,562	100

¹ Wax solids.

Having thus described the invention, what is claimed is:

1. The method for reducing the tendency for discoloration of exposed surfaces of lumber during transit, wherein said lumber has a tendency for transit staining by metallic iron, the method permitting unwrapped transit of lumber, comprising:

applying to said exposed surfaces a suspension containing about 0.1 to about 10% by weight of a relatively water-insoluble particulate base, a binder and a carrier therefor wherein the weight ratio of binder to base particles plus pigment, if any, is in the range of about 1 part binder per 1 to 10 parts base particles plus pigment,

curing said binder after application to produce a binder-starved layer on said surfaces from which said particulate base is slowly leachable by water,

said base particles being atinctorial and present on said surfaces in an amount to maintain said surfaces at a pH above about 10 for the period of transit, said suspension being applied to the surfaces of the lumber in the proportion of about 0.001 to about 0.01 U.S. gallon per foot²,

said base having a solubility in water of at least about 0.001% but less than 10% at 32° F.

2. The improvement of claim 1 wherein said base is an alkaline-earth base selected from the group consisting of oxides, carbonates, phosphates, hydroxides, borates, borosilicates and hydrates thereof, of magnesium, calcium and barium.

3. The improvement of claim 1 wherein said coating composition contains about 0.1% to about 5% by weight of said base particles.

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4. The improvement of claim 1 wherein the weight ratio of binder to base particles plus pigment is in the range of about 1 part binder per 1 to 6 parts of base particles plus pigment.

5. The method of claim 1 wherein said suspension is applied to the surfaces of the lumber in the proportion of about 0.003 to about 0.006 U.S. gallons per foot².

6. The method of claim 1 wherein said base has a solubility in water of at least about .001% to about 0.5% at 32° F.

7. The method of claim 1 wherein said suspension is prepared from a concentrate of the base particles in binder and carrier, said concentrate containing about 2% to about 75% by weight base particles.

8. The product prepared by the method of claim 1.

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