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WOOD PRESERVATIVE COMPOSITION

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This invention relates to wood preservative compositions suitable for treating wood poles, e.g. electric power lines or telephone wood poles to provide protection against insects, fungus, rot, etc. Particularly, the invention relates to a wood preservative composition comprising mineral oil thickened to a grease-like consistency with a finely divided silica and containing one or more wood preservatives.

The grease-like compositions of the invention can be brushed, or applied with a trowel, to poles already in place. The grease-like consistency of the composition holds the composition in place on the pole while the oil and wood preservative components gradually seep into the wood pole to provide the required protection.

Generally about 0.15 to 0.5 inch penetration of the wood pole by the wood preservative is desired. If the penetration is less than this, then the number of years of effective protection is greatly decreased as the pole ages. Thus, as time passes, the treated pole surface gradually loses the preservative composition through weathering, leaching of preservative from the pole by rain water, and the effect of sunlight in providing oxidation in the portion above ground level.

The desired degree of penetration can generally be obtained by coating the poles with a coating about $\frac{1}{4}$ " thick, of the compositions of the invention. Then over a period of about one to four days, the oil, carrying the dissolved or dispersed wood preservative components, will bleed into the wood to give the desired degree of penetration. The coating of the invention can be applied either before or after the poles are set in their permanent position. However, the composition is easier to apply after the pole is set in its hole, but before the hole is filled in with earth. Frequently, new unset poles will be treated to coat their underground portion and a short portion extending above the ground.

Certain low viscosity mineral oil fractions, preferably aromatic, such as low viscosity highly aromatic gas oil will give the desired amount of penetration into the wood so as to carry the dissolved wood preservative the desired distance into the wood. By thickening the dispersion or solution of preservative in low viscosity oil, with a silica thickener, the desired grease-like consistency and structure stability can be obtained so that the composition will not unduly slump or run off when applied to a pole. At the same time, the silica thickeners of the invention do not unduly interfere with the wood penetration, and only relatively small proportions of said silica thickeners are required to thicken the oil solution to the desired consistency. On the other hand, if the gas oil solution of preservative is thickened with more conventional thickeners such as soap, e.g. aluminum stearate, the soap will unduly dissolve in the aromatic oil fraction. Thus, because of its higher oil solubility, larger amounts of soap thickener would be required to obtain the desired grease-like consistency. Also structural stability is very poor with soap-thickened low viscosity oils. Attempts to thicken the oil solution of preservative to a grease consistency with various waxes was unsuccessful since the wax tends to fill the pores of the wood to thereby prevent penetration by the oily component carrying the preservative. Thickening the oil solution of preservative with

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clays, generally results in a blend which is very difficult to manufacture since coupling agents, wetting agents and milling is usually required. Also, relatively large concentrations of the clay thickener (e.g. 10 wt. percent and more) are generally required since the particle size of most commercial clays, e.g. bentonite type clays such as Baragel, is about 0.8 micron. Furthermore, the usual needle-shaped particles of many clays are believed to behave somewhat as wax crystals in blocking the pores of the wood, thereby making wood penetration more difficult by the oil solution of the wood preservative.

The preferred mineral oil fraction used to form the compositions of the invention is gas oil, which is generally derived by distillation of cracked petroleum crude. Gas oils are low viscosity oils boiling within the range of about 350° to 750° F. and can be thought of as the fraction between kerosene and lubricating oil. The preferred gas oils will have viscosities of about 20 to 40 SSU, preferably 30 to 38 SSU at 100° F. Gas oils high in aromatics, e.g. 80 to 100 wt. percent aromatic, are especially preferred because of their higher solvency power for the conventional aromatic type of wood preservatives, e.g. chlorinated phenols or chlorinated aromatics. However, it is frequently desired that the oil component have a slightly higher viscosity than the less viscous of the gas oils. It has been found that petroleum tars or asphalts can be used to slightly thicken the lower viscosity gas oils to the desired final oil viscosity. Furthermore, such petroleum tars and asphalts have many components which are similar to the components of coal tar creosote and which are believed to have wood preservative properties in themselves. The final oil will generally have a viscosity of 30 to 40, preferably 32 to 38, SSU at 100° F. and can be obtained by using gas oil having a viscosity in the desired range or by using gas oil with 1 to 25 wt. percent of asphalt or tar.

The silica thickening agent of the invention will consist of finely divide silica particles having particle sizes of about 0.01 to .050, preferably 0.015 and 0.030 micron. These finely divided silicas can be obtained by condensation of silica fumes obtained by burning SiCl_4 as described in a paper by Kenneth A. Loftman which was presented to the Division of Colloid Chemistry at the 13th National Meeting of the American Chemical Society, April 14, 1960. This method is carried out as follows: Essentially pure silicon tetrachloride is vaporized and transported to a furnace in which a hydrogen flame burns (1100° C.). The water vapor produced on combustion reacts with the SiCl_4 to give SiO_2 and HCl . The adsorbed HCl is driven off by heat and steam in a calciner and the finely divided SiO_2 is recovered. A particular silica produced by the aforesaid method and used in the working examples of the invention is commercially available from Godfrey L. Cabot Inc. of Boston, Massachusetts under the name of Cab-O-Sil. This silica has particle sizes ranging from about 0.02 to 0.025 micron, and a bulk density of about 4.5 to 5.0 lbs./cu. ft.

The wood preservative can be any of a large number of well known oil-soluble wood preservatives. The most common wood preservatives are highly chlorinated aromatic hydrocarbons and phenols, such as pentachlorophenol. Other common wood preservatives include coal tar creosote, petroleum oil creosote, wood creosote, petroleum tars, copper naphthenate, etc. Also, finely divided oil-insoluble materials can be used, such as borax, as supplementary wood preservatives.

The finished wood preservative compositions of the invention will comprise a major amount of low viscosity oil, a grease thickening amount of such a 4 to 8 wt. percent of a finely divided silica, and a wood preserving amount such as about 5 to 35 wt. percent of the wood

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preservative. Preferred compositions will comprise about 5 to 7 wt. percent of a silica and about 10 to 25 wt. percent of wood preservative. Especially preferred compositions will have a wood preservative comprising pentachlorophenol and steam cracked tar.

The compositions of the invention are readily made by simple mixing of the silica thickening and the wood preservative into the oil medium to form a grease-like mass, which can subsequently be applied by brushing or by spatula to the wood pole.

EXAMPLE I

A series of compositions were prepared using various blends of a steam cracked gas oil and a steam cracked petroleum tar. The physical characteristics of these two materials are summarized in Table I which follows:

Table I

	Gas Oil	Tar
Gravity, ° API.....	14.5	-4.7
Flash, C.O.C., ° F.....	150	-----
Visc. at 100° F., SUS.....	32.3	-----
Visc. at 210° F., SUS.....	-----	250
FIA Aromatics, vol. percent.....	85-93	90
FIA Olefins, vol. percent.....	7-10	-----
Pour Point, ° F.....	-70	-----
ASTM Distillation, ° F.:		
IBP.....	340	528
5%.....	417	574
10%.....	429	595
20%.....	444	627
30%.....	455	660
40%.....	464	694
50%.....	473	744
60%.....	483	827
70%.....	493	-----
80%.....	506	-----
90%.....	525	-----
95%.....	552	-----
FBP.....	555	-----

Various blends of the above gas oil and tar in varying proportions, which were prepared by simple mixing at 150° F., were tested for wood penetration characteristics.

The wood penetration was carried out by immersing $\frac{3}{4}$ " square stakes of jack pine sapwood for four days into the test oil blend, then removing the stake, wiping off the oil from the wood surface, then sawing the stake in half and measuring the extent of oil penetration. A penetration of $\frac{3}{8}$ " from all sides is reported as 100% penetration or complete penetration.

The specific compositions tested and the results obtained are summarized in Table II which follows:

Table II

EFFECT OF OIL VISCOSITY ON WOOD PENETRATION CHARACTERISTICS

Formula, percent by wt.:	30	50	60	70	80	90	95
Steam Cracked Gas Oil.....	70	50	40	30	20	10	5
Steam Cracked Tar.....	-----	-----	-----	-----	-----	-----	-----
Inspections:							
Visc. at 100° F., SSU.....	400	85	56	44	38	34.5	33.3
Penetration of Wood, percent.....	<5	<5	<5	50	100	100	100

The preceding table illustrates the importance of a low viscosity of the oil in order to obtain good penetration. In general, viscosities at 100° F. of 32 to 38 SUS. will give the desired degree of wood penetration.

A series of compositions, A to D, representing the invention were prepared using the aforesaid gas oil and cracked tar with Cab-O-Sil as the silica thickener. The compositions were prepared by stirring the gas oil, tar and pentachlorophenol while heating at 175° F. The mixture was then allowed to cool to about 100° F., where the Cab-O-Sil was stirred in to form a thickened mixture. Then, finely divided borax was added to the thickened mixture. The borax was added last to prevent settling since it is insoluble in the composition.

The resulting compositions were tested for slumping by coating the upper half of a wood panel measuring 75

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2 $\frac{3}{4}$ " x 6" x $\frac{1}{4}$ " with a $\frac{1}{4}$ " thick layer of the test compound. The panel is then held vertically at room temperature (77° F.) for about 15 hours. Slumping of the test compound during the 15 hour period of more than a fourth of an inch indicates failure. Penetration was measured by coating $\frac{3}{4}$ " x $\frac{3}{4}$ " sq. sticks of jack pine sapwood with a $\frac{1}{4}$ " layer of the test composition, then leaving the treated wood panel set for 4 days at room temperature. Next, the outer surface of test compound is removed and the panel is sawed in half to determine the extent of penetration. The penetration is reported in percent penetration. Thus 50% penetration indicates $\frac{3}{16}$ inch penetration; 75% penetration indicates $\frac{3}{32}$ inch penetration and 100% penetration is $\frac{3}{8}$ inch penetration from the outer surface.

For comparison, compositions E to G consisting of gas oil, cracked tar and Cab-O-Sil were also prepared.

The compositions tested and the results obtained are summarized in Table III, which follows:

Table III

Formula, percent by wt.	Composition						
	A	B	C	D	E	F	G
25 Steam Cracked Gas Oil.....	56	60	63	66.5	57	66	75.2
Steam Cracked Tar.....	14	10	7	3.5	39	28.5	18.8
Cab-O-Sil.....	6	6	6	6	5	5.5	6
Pentachlorophenol.....	10	10	10	10	-----	-----	-----
Borax.....	14	14	14	14	-----	-----	-----
30 Inspection:							
Viscosity of oil portion at 100° F., SSU.....	38	36	34.5	33.3	56	44	38
Slump Test.....	pass	pass	pass	pass	pass	pass	pass
Penetration of Wood, Percent.....	50-75	50-75	90	90	<5	50-75	100

As seen by Table III, compositions A to D of the invention were satisfactory with regard to slumping and penetration, although compositions C and D were particularly satisfactory because of their higher penetration. Thus, composition A showed penetration ranging from $\frac{3}{16}$ to $\frac{3}{32}$ inch, i.e. 50 to 75% penetration. While 100% penetration is of course the most desired, lesser penetrations are acceptable since the slower penetration can generally be offset by letting the composition remain on the wood surface a longer length of time and/or by using a heavier coating of the composition on the wood surface. These compositions all had consistencies similar to that of a soft grease. For example, composition C had an ASTM cone penetration measured in a grease penetrometer of 330 mm./10 at 77° F.

Compositions E to G contained no wood preservative and are presented primarily for the purpose of demonstrating the necessity for the final oily portion to have a relatively low viscosity in order to obtain good penetration.

What is claimed is:

1. A grease-like wood preservative composition consisting of a major amount of an oil blend having a viscosity of 30 to 40 SSU at 100° F., which consists of gas oil containing in excess of 80 wt. percent aromatics and having a viscosity of 20 to 38 SSU at 100° F., and steam-cracked petroleum tar; 4 to 8 wt. percent of silica having particle size of 0.015 to 0.030 micron; and 5 to 35 wt. percent of a wood preservative.

2. A composition according to claim 1, wherein said wood preservative consists of about 10 wt. percent pentachlorophenol and about 14 wt. percent borax.

3. A grease-like wood preservative composition consisting essentially of a major proportion of a mineral oil having a viscosity of about 30 to 40 SSU at 100° F., selected from the group consisting of gas oil and mixtures of gas oil and 1 to 25 wt. percent of asphalt, about 4 to 8 wt. percent of finely divided silica having a particle size of about 0.01 to 0.50 micron, and about 5 to 35 wt. percent of a wood preservative.

4. A method of preserving wood which comprises applying to the surface of said wood the composition of claim 3.

5. A composition according to claim 3, wherein said wood preservative is pentachlorophenol.

6. A composition according to claim 3, wherein said wood preservative is powdered borax.

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