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ALKYL SUBSTITUTED ARYL METAL HYDROXYLATE AND METHOD OF MAKING IT

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This invention relates to the production of certain new chemical compounds or compositions which may be generally designated as wax-substituted aryl metal oxides or wax-substituted aryl metal hydroxylates. Although the invention is broadly concerned with chemical compounds or compositions coming within the above-designated general classification, it contemplates as a preferred group within such general classification those compounds or compositions which are soluble or miscible with mineral oil.

My invention is based upon the discovery that the oil-miscible wax-substituted aryl metal oxides are of multifunctional activity when blended with viscous mineral oil fractions in that they effect improvement of several unrelated and related properties of the oil. For example, this preferred oil-miscible group of compounds or compositions coming within the general field of invention contemplated herein are effective, when blended in a minor proportion with mineral oil fractions of the lubricant type, to depress the pour point, improve the viscosity index (V. I.), and inhibit oxidation of the oil. By inhibiting oxidation these oil-miscible substituted aryl metal oxides act to retard the formation of sludge and acidic products of oxidation. They also have a peptizing action on such sludge as may eventually be formed. Thus, any one of these preferred oil-miscible compounds or compositions may, for example, be used in internal combustion engine lubricants to retard or prevent the sticking of piston rings or prevent the corrosion of bearings, particularly those formed of alloy metals normally susceptible to corrosion, etc., and at the same time they will act to depress the pour point and improve the viscosity index of the oil. Through a proper choice of metal substituent (lead, copper, tin, or zinc, for example) the load-carrying capacity or "lubricity" of the oil may also be improved.

It should be understood that the use of these preferred oil-miscible compounds or compositions is not confined to lubricating oils, but they may be employed in any mineral oil fractions where one or more of the improved properties recited above is desired. In this regard it is to be further understood that the present invention is not concerned with mineral oil compositions containing these preferred oil-miscible aryl metal hydroxylates, such oil compositions forming the subject matter of my copending application 206,683, filed May 7, 1938 (now Patent 2,197,833), to which reference is made for further details in the composition of these compounds.

It is also to be understood that while my invention contemplates oil-miscible compounds or compositions of the type above referred to as a preferred class or group within the general field of invention, the invention is not limited to such oil-miscible compounds or compositions, since this whole class of new materials is possessed of valuable properties irrespective of oil-miscibility. For example, these compounds or compositions may be used as intermediaries in the production of resins, resin-like materials, rubber substitutes, etc. Certain of the compounds or compositions are possessed of valuable pharmaceutical, insecticidal, or similar properties, such, for example, as those derived from the presence of a particular metal or metal-oxy group. Numerous other uses and applications of the compounds or compositions contemplated herein will be readily apparent to those skilled in the art from the following description of their compositions and preferred methods of synthesis.

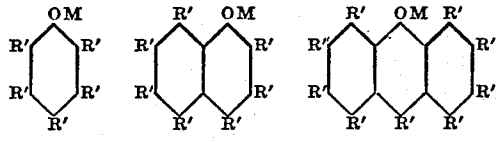
As has been previously pointed out, the compounds or compositions contemplated by this invention may be broadly designated as wax-substituted aryl metal oxides or aryl metal hydroxylates. All of the "wax"-aryl metal oxides or "wax"-phenates contemplated by this invention are characterized by the presence of an aromatic nucleus in which at least one nuclear hydrogen is substituted with an hydroxyl group having its hydroxyl hydrogen replaced with its equivalent weight of metal, sometimes referred to herein as a metal-oxy group.

The compounds or compositions contemplated by this invention are further characterized by the fact that at least one replaceable hydrogen of the aromatic nucleus is substituted with an aliphatic hydrocarbon radical or group characteristic of an aliphatic hydrocarbon of high molecular weight, which I may term a heavy alkyl group or a "wax" group. For obtaining the preferred group of compounds or compositions which are miscible with mineral oil and which possess the multifunctional oil-improving properties, I have found that this "heavy alkyl" substituent in the substituted aryl metal oxides under discussion must be derived from a predominantly straight chain aliphatic hydrocarbon of at least twenty carbon atoms such as characterize crystalline petroleum wax. As a matter of fact, paraffin wax is considered to be a preferred source of the "heavy alkyl" substituent and it is for that reason that the compounds or compositions described herein are referred to as "wax-substituted." It is to be understood, however, that the term "wax" as used herein is applied in a broad

sense and is intended to include any pure compound or mixture of compounds predominantly aliphatic in nature and containing at least twenty carbon atoms which is susceptible of attachment to an aromatic nucleus to provide a substituent which, in the proper proportions, will impart to the aforesaid characterizing nuclear group the multifunctional oil-improving properties referred to.

It will also be understood that when a mixture of aliphatic hydrocarbon compounds, such as petroleum wax, for example, is used as the source of the heavy alkyl substituent, the resulting composition will be an intimate mixture of compounds or alkyl-substituted aryl metal oxides (alkyl-substituted hydroxyaromatic compounds in which the hydroxyl hydrogen is substituted with metal), which compounds differ from each other with respect to the nature of the alkyl substituent. In other words, where alkylation of the aryl nucleus has been effected with a mixture of aliphatic hydrocarbons of at least twenty carbon atoms, the resulting product will likewise be a mixture of compounds, differing with respect to the alkyl substituent but having in common the characterizing nuclear group discussed above.

In addition to the heavy alkyl substituent and the metaloxy substituent, the characterizing aryl nucleus may have all or part of its replaceable hydrogen substituted with a radical selected from the group consisting of: aliphatic hydrocarbon groups having less than twenty carbon atoms, alkoxy, aroxy, aralkyl, alkaryl, chlorine, nitro, and amino radicals or groups. Typical compounds of the type contemplated herein having mono-, di-, and tri-cyclic nuclei are illustrated by the following formulae:



in which at least one of the R's represents an aliphatic radical or group containing at least twenty carbon atoms and in which the remaining R's represent residual hydrogen which may be replaced with: aliphatic groups containing less than twenty carbon atoms, hydroxy, alkoxy, aroxy, alkaryl, aralkyl, aryl, chlorine, nitro, and amino radicals or groups.

In the preferred class of compounds or reaction products contemplated for use as oil-improving agents, it is important that the aryl nucleus of the aryl metal hydroxylate be substituted with the heavy alkyl groups to an extent such that this heavy alkyl substituent comprise a sufficient proportion of the composition as a whole to render the same miscible with the mineral oil fraction in which it is to be used so as to form a solution or colloidal suspension which will remain stable under normal conditions of handling and use. It appears that there is a critical range of heavy alkyl- or "wax"-substitution of the compounds or compositions contemplated herein below which the wax-substituted hydroxylates will not satisfy the requirements for oil-miscibility. The critical range in the degree of heavy alkyl- or "wax"- substitution of the aryl nucleus in the compounds contemplated herein as oil-improving agents may vary with: (*a*) the mineral oil fraction in which the improving agent is to be used; (*b*) the character of the aryl nucleus (mono- or poly-cyclic and mono- or poly-hydric); (*c*) mono- or poly-substitution of the aryl nucleus; and (*d*) other substituents on the nucleus which may be of positive or negative or neutral mineral oil-solubilizing activity.

In view of the foregoing variables it would be impracticable to attempt to give an expression and figure which would indicate accurately the proper ratio of aryl hydroxide constituent to the "wax"-substituted aryl hydroxide which would express a degree of aliphatic (wax)-substitution satisfying all cases taking these variables into account. In general, however, it may be said that in this preferred group of compounds the ratio by weight of hydroxy-aromatic component in the product to the corresponding wax-substituted hydroxyaromatic component therein should not be greater than about seventeen parts by weight of the former to about 100 parts by weight of the latter or about 17 per cent, when the hydroxyaromatic nucleus or component is expressed in terms of its chemically equivalent weight of phenol. This ratio, which may be termed the "phenolic ratio," does not take into account any other substituents in the nucleus than the heavy alkyl group or groups and the hydroxy group; but since the heavy alkyl group is primarily relied upon in these preferred compositions, it is believed that the foregoing expression and limit will serve as a working guide for their preparation.

The general procedure for preparing the compounds contemplated herein involves alkylation of an aryl hydroxide or hydroxyaromatic compound with heavy alkyl groups (of at least 20 carbon atoms) and then substitution of the hydroxyl hydrogen in the alkylated material with a metal.

Typical aryl hydroxides which may be used as the starting material for the alkylation reaction are: phenol, resorcinol, hydroquinone, catechol, cresol, xylenol, hydroxydiphenyl, benzylphenol, phenyl-ethyl-phenol, phenol resins, methyl-hydroxydiphenyl, guaiacol, alpha and beta naphthol, alpha and beta methyl naphthol, tolyl naphthol, xylyl naphthol, benzyl naphthol, anthranol, phenyl methyl naphthol, phenanthrol, anisole, diphenyl ether, beta naphthyl methyl ether, chlorphenol, and the like. Preference in general is to the monohydroxy phenols otherwise unsubstituted, particular preference being given to phenol and alpha and beta naphthol.

The alkylation of the aryl hydroxide may be accomplished in various ways, such as by a Friedel-Crafts synthesis, using a halogenated high molecular weight aliphatic hydrocarbon compound of at least 20 carbon atoms or a mixture, such as chlorinated paraffin wax, predominantly comprised of such compounds. The alkylation may also be effected by reaction of the aryl hydroxide with unsaturated high molecular weight aliphatic hydrocarbons or higher alcohols in the presence of H_2SO_4 as a catalyst.

Substitution of the hydroxyl hydrogen with metal may be effected in various ways to be hereinafter detailed. For example, the alkylated aryl hydroxide may be reacted with elementary alkali metals in finely divided form, or it may be reacted with an alcoholate of the desired metal. Other procedures may also be employed, as will hereinafter appear. My invention contemplates the use of any metal as the substituent in the hydroxyl group, and for general illustration the metals may be broadly classified as those belonging to the silver, copper, tin, aluminum, iron, alkali and alkaline earth analytical groups, which include: silver, mercury, lead, and thallium;

bismuth, copper, and cadmium; arsenic, antimony, and tin; iron, cobalt, nickel, and manganese; barium, calcium, strontium, and magnesium; and sodium, potassium, and lithium, respectively. Other desirable metals include: titanium, cerium, thorium, vanadium, molybdenum, tungsten, uranium, and platinum.

If it is desired to obtain an alkylated aryl hydroxylate containing an alkoxy group as an additional substituent on the aryl nucleus, it is preferable that the alkylation be effected with a hydroxyaromatic compound containing such alkoxy or aroxy group as a substituent and a high molecular weight unsaturated aliphatic hydrocarbon of chain length of at least twenty carbons (such as eicosylene, cerotene, melene, etc.) or a higher alcohol (such as myricyl alcohol, ceryl alcohol, etc.) using H_2SO_4 as a catalyst. By this procedure, the hydroxyaromatic ether can be alkylated without substantial rearrangement taking place. As an alternative procedure, polyhydric phenols can be alkylated by reaction with higher alcohols or high molecular weight unsaturates or by Friedel-Crafts reaction followed by substitution of one hydroxy with a low molecular weight alkyl group. In carrying out this latter procedure, the alkylated polyhydric phenol is treated with an alkali alcoholate to introduce alkali metal into one OH group, followed by treating with the desired alkyl halide, whereby the substitution is effected.

When it is desired to obtain a nitro or amino group as a substituent in the characterizing aryl nucleus, the hydroxyaromatic compounds are alkylated or wax-substituted when free of nitro or amino groups, and such alkylation is followed by nitration of the alkylated compound to introduce the nitro substituent. The amino group can be obtained by reduction of the nitro group.

The following description illustrates certain preferred procedures which may be followed in synthesizing the wax-substituted aryl metal oxides or hydroxylates contemplated by this invention. The compounds or products obtained from the procedures described below fall into that class or group of compositions hereinabove referred to as "preferred" because of their oil-solubility and their multifunctional activity when blended with mineral oil fractions. As will be apparent to those skilled in the art, compounds or compositions having a combined phenol content in excess of that necessary for oil-miscibility may be readily obtained by using a chlorinated wax having a chlorine content substantially higher than that given in the example below or by changing the ratio of the reactants (chlorwax and phenolic compound).

PREPARATION OF WAX-SUBSTITUTED PHENYL METAL OXIDE (METAL PHENATES)

(1) Alkylation of Phenol

A paraffin wax melting at approximately 120° F. and predominantly comprised of compounds having at least twenty carbon atoms in their molecules is melted and heated to about 200° F., after which chlorine is bubbled therethrough until the wax has absorbed about sixteen per cent of chlorine, such product having an average composition between a monochlor wax and a dichlor wax. Preferably the chlorination is continued until about one-sixth the weight of the "chlorwax" formed is chlorine. A quantity of chlorwax thus obtained, containing three atomic proportions of chlorine, is heated to a temperature varying from just above its melting point to not over 150° F., and one mole of phenol (C_6H_5OH) is admixed therewith. The mixture is heated to about 150° F., and a quantity of anhydrous aluminum chloride corresponding to about three per cent of the weight of chlorwax in the mixture is slowly added to the mixture with active stirring. The rate of addition of the aluminum chloride should be sufficiently slow to avoid violent foaming, and during such addition the temperature should be held at about 150° F. After the aluminum chloride has been added, the temperature of the mixture may be increased slowly over a period of from fifteen to twenty-five minutes to a temperature of about 250° F. and then should be more slowly increased to about 350° F. To control the evolution of HCl gas the temperature of the mixture is preferably raised from 250° F. to 350° F. at a rate of approximately one degree per minute, the whole heating operation occupying approximately two hours from the time of adding the aluminum chloride. If the emission of HCl gas has not ceased when the final temperature is reached, the mixture may be held at 350° F. for a short time to allow completion of the reaction. But, to avoid possible cracking of the wax, the mixture should not be heated appreciably above 350° F., nor should it be held at that temperature for any extended length of time.

In forming the oil-miscible compounds or compositions it is important that all unreacted or non-alkylated hydroxyaromatic material (phenol) remaining after the alkylation reaction be removed. Such removal can be effected generally by water-washing, but it is preferable to treat the water-washed product with superheated steam, thereby insuring complete removal of the unreacted material and accomplishing the drying of the product in the same operation.

A wax-substituted phenol prepared according to the above procedure, in which a quantity of chlorwax containing three atomic proportions of chlorine (sixteen per cent chlorine in the chlorwax) is reacted with one mole of phenol, may, for brevity herein, be designated as "wax-phenol (3–16)." Parenthetical expressions of this type (A–B) will be used hereinafter in connection with the alkylated hydroxyaromatic compounds to designate (A) the number of atomic proportions of chlorine in chloraliphatic material (chlorwax) reacted with one mole of hydroxyaromatic compound in the Friedel-Crafts reaction, and (B) the chlorine content of the chloraliphatic material. In the above example A=3 and B=16. This same designation will also apply to the heavy alkyl-substituted aryl metal oxides or wax-aryl metal phenates derived from these alkylated hydroxyaromatic compounds.

Wax-phenol (3–16) as obtained by the above procedure had a phenol content or a "phenolic ratio" of about thirteen per cent. My research indicates that this phenolic ratio of thirteen per cent may be considered as representing about the maximum for satisfactory miscibility in viscous oils of the alkyl-substituted aryl metal oxides in which the alkyl substituent is derived from petroleum wax and the hydroxyaromatic constituent is derived from phenol (C_6H_5OH). Compounds or compositions of the type derived from phenol may be termed wax-substituted metal phenates or wax-substituted phenyl metal oxides.

(2) Formation of Wax-Substituted Metal Phenates (Alkylated Aryl Metal Oxides)

The substitution of the hydroxyl hydrogen of the alkylated hydroxyaromatic compound or product with its equivalent weight of metal may be effected in various ways, of which the following are illustrative examples.

Example A

The wax-substituted aryl alkali metal oxides can be prepared by the reaction of a wax-hydroxyaromatic compound with finely divided alkali metal at elevated temperatures and in the presence of a non-oxidizing gas. The reaction is carried out with rapid stirring of the mixture to maintain the alkali metal in a fine state of subdivision, thereby accelerating the reaction. When using metallic sodium the reaction mixture may be heated to 500° F. for a two-hour period, and the potassium oxides can be formed by heating the reaction mixture to 400° F. for a one-hour period. Examples of reacting proportions are as follows:

	Parts by weight
(*a*) Wax-phenol (13.2% combined phenol)	500
Sodium or equivalent amount of potassium	16
(*b*) Wax-naphthol (15.7% combined naphthol)	500
Sodium or equivalent amount of potassium	12½

Example B

Wax(alkyl)-substituted aryl oxides of the alkali and alkaline earth metals and metals from the silver, copper, aluminum, tin and iron analytical groups can be readily prepared by the reaction of the wax-hydroxyaromatic compound with the desired alkyl metal oxide (metal alcoholate). The reaction mixture is heated to about 300° F. during a one-hour period, allowing the alcohol released to distill off, thereby obtaining an alkyl-substituted aryl metal oxide as the finished product. Anhydrous methyl and ethyl alcohols are considered preferable for preparing the alcoholates for use in this reaction. Illustrative reacting proportions are:

	Parts by weight
(*a*) Wax-phenol (13.2% combined phenol)	500
Alkyl sodium oxide; or equivalent amount of other alkali alcoholate	16
(*b*) Wax-phenol (13.2% combined phenol)	500
Calcium in form of alkyl calcium oxide or equivalent amount of other alkaline earth metal alcoholate	14

In forming the alkyl-substituted aryl oxides of the metals other than alkali metals through the use of alcoholates of such metals, the preferred procedure is to first form the alkyl oxides (alcoholates) of such metals by double decomposition of alkyl sodium oxide with an alcohol-soluble salt (such as a chloride) of the desired metal. The alkyl(wax)-substituted hydroxyaromatic compound is then added to the alkyl metal oxide mixture without separating the pure alkyl oxide of the desired metal from the alkali salt, and the mixture is heated during one hour at 300° F., allowing the alcohol to distill to complete the formation of the alkyl-substituted aryl oxide of the desired metal. The reaction product is then purified by diluting the mixture with a light mineral oil to aid the separation of the alkali salt, which is removed by settling, filtering, or centrifuging, after which the diluent is distilled to obtain the finished product.

Example C

The wax-aryl lead oxide can be readily prepared by reacting a wax-substituted hydroxyaromatic compound, such as wax-substituted phenol, with litharge in the presence of a non-oxidizing gas and heating the mixture with stirring to a temperature of about 500° F. during a period of one hour. The reaction product may then be diluted with a light mineral oil, such as Stoddard Solvent, after which the unreacted litharge can be settled out and separated. The refined product is obtained by removing the diluent by distillation. The proportions used in this reaction should be substantially as follows:

	Grams
Wax-phenol of 13.2% combined phenol content	500
Litharge	78.3

Example D

The alkyl(wax)-substituted aluminum oxide may be formed by a modification of the Friedel-Crafts reaction which is employed in the formation of the alkyl(wax)-substituted hydroxyaromatic compound described hereinabove, using the theoretical amount of anhydrous aluminum chloride required to convert completely the hydroxyaromatic compound to the aryl metal oxide, carrying out the reaction as described in connection with the formation of wax phenol except that the mixture is heated to only 200° F. to complete the reaction and form wax-substituted aluminum aryl oxide as the end product. The product is not water-washed but purified by removing the hydrogen chloride gas under vacuum or by blowing the product with a non-oxidizing gas, such as nitrogen. The purification step can be aided by use of a diluent, such as Stoddard Solvent, whereby any non-alkyl-substituted aluminum oxide can be settled out. The diluent is removed by distillation to give the finished product. For the preparation of a wax-substituted aluminum phenate according to this procedure the following proportions of reactants may be used:

	Parts by weight
Chlorwax of sixteen per cent chlorine content	500
Phenol	70.6
Anhydrous aluminum chloride	33.4

WAX-SUBSTITUTED METAL NAPHTHOLATES

In addition to the wax-phenyl metal oxides just discussed above I have, by following the same procedure, prepared metal oxides from wax-substituted naphthol (wax-substituted metal naphtholates or wax-naphthyl metal oxides). A wax-naphthol (3–14) was obtained from the alkylation reaction. This product and the corresponding metal oxides obtained therefrom had a combined naphthol content of sixteen per cent and an equivalent phenol content or "phenolic ratio" of 9.7 per cent.

The wax-substituted aryl metal oxides or wax-substituted aryl metal hydroxylates obtained by the exemplary procedures described above are, as the result of their relatively low "phenolic

ratio" or combined phenol content, all oil-miscible or oil-soluble products. Although products of this type are designated herein as preferred, because of their multifunctional oil-improving properties, it is again emphasized that the invention is not limited to wax-substituted aryl metal oxides which are oil-soluble but is inclusive of this entire field of products irrespective of oil-solubility. As has been previously stated, this entire class of compounds or compositions possesses valuable properties outside of the petroleum industry as, for example, intermediaries in the production of resins. Furthermore, as the phenol content is increased beyond the limits necessary for mineral oil-miscibility, the products become rubber-like in character and show definite promise as rubber substitutes without any substantial amount of additional treatment.

Compounds or compositions of both the oil-miscible and non-miscible types have been prepared, and of the oil-miscible products synthesized all have been tested as additive ingredients for viscous mineral oils and have been found to be of multifunctional activity, improving the pour point, improving the V. I., and inhibiting oxidation of viscous mineral oil fractions. The following list is illustrative of the various oil-miscible wax-substituted aryl metal oxides which I have prepared and tested to demonstrate their value as additive agents for viscous mineral oils:

Wax-cupric phenate (3–16)
Wax-stannous phenate (3–16)
Wax-aluminum phenate (3–16)
Wax-zinc phenate (3–16)
Wax-ferric phenate (3–16)
Wax-cobaltous phenate (3–16)
Wax-calcium phenate (3–16)
Wax-magnesium phenate (3–16)
Wax-potassium phenate (3–16)
Wax-sodium phenate (3–16)
Wax-sodium beta naphtholate (3–14)

It is to be understood that while I have described certain preferred procedures for synthesizing the products contemplated by this invention and have listed a number of illustrative products or compositions, the invention is not limited to the particular procedures or products described but includes within its scope such changes and modifications as fairly come within the spirit of the appended claims.

This application is a continuation in part of my copending applications Serial Number 51,969, filed November 27, 1935, and Serial Number 133,270, filed March 26, 1937.

I claim:

1. An alkyl-substituted aryl metal hydroxylate in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus.

2. An alkyl-substituted aryl metal hydroxylate in which the alkyl substituent contains at least twenty carbon atoms and is attached to the aryl nucleus, said composition being miscible with mineral oil and possessing the property of improving the pour point and viscosity index and inhibiting oxidation of a viscous mineral oil fraction when admixed therewith.

3. An alkyl-substituted metal phenolate in which the alkyl substituent contains at least twenty carbon atoms and is attached to the phenyl nucleus.

4. An alkyl-substituted metal phenolate in which the alkyl substituent contains at least twenty carbon atoms and is attached to the phenyl nucleus, said composition being miscible with mineral oil and possessing the property of improving the pour point and viscosity index and inhibiting oxidation of a viscous mineral oil fraction when admixed therewith.

5. An alkyl-substituted metal naphtholate in which the alkyl substituent contains at least twenty carbon atoms and is attached to the naphthyl nucleus.

6. An alkyl-substituted metal naphtholate in which the alkyl substituent contains at least twenty carbon atoms and is attached to the naphthyl nucleus, said composition being miscible with mineral oil and possessing the property of improving the pour point and viscosity index and inhibiting oxidation of a viscous mineral oil fraction when admixed therewith.

7. A product obtained by condensing an aryl hydroxide with chlorinated paraffin wax in proportions such that the aryl hydroxide constituent in the resulting wax-substituted aryl hydroxide comprises a substantially smaller proportion of said product than the wax substituent; and substituting the hydroxyl hydrogen of said wax-substituted aryl hydroxide with a metal.

8. A product obtained by condensing an aryl hydroxide with chlorinated paraffin wax to form a wax-substituted aryl hydroxide; and then reacting said wax-substituted aryl hydroxide with an alkyl metal oxide to form a wax-substituted aryl metal hydroxylate.

9. A product obtained by condensing phenol with chlorinated paraffin wax in proportions such that the wax-phenol formed has a combined phenol content not to exceed seventeen per cent; and replacing the hydroxyl hydrogen of the phenol with a metal to form a wax-substituted metal phenolate.

10. The method of preparing an alkali metal hydroxylate of a wax-substituted aryl hydroxide which comprises: condensing a chlorinated paraffin wax with an aryl hydroxide in the presence of aluminum chloride to form a wax-substituted aryl hydroxide; and reacting said wax-substituted aryl hydroxide with a finely divided alkali metal in the presence of a non-oxidizing gas at an elevated temperature with rapid stirring to form a wax-substituted alkali metal aryl hydroxylate.

11. The method of preparing a metal hydroxylate of a wax-substituted aryl hydroxide which comprises: condensing a chlorinated paraffin wax with an aryl hydroxide in the presence of aluminum chloride to form a wax-substituted aryl hydroxide; reacting the wax-substituted aryl hydroxide at an elevated temperature with an alcoholate of a metal selected from the group consisting of copper, tin, zinc, iron, and cobalt to form the wax-substituted aryl hydroxylate of said metal.

12. As a composition of matter, an intimate mixture of alkyl-substituted hydroxyaromatic compounds wherein the hydroxyl hydrogen atoms in said compounds are substituted with the same metal and wherein the alkyl substituents in said compounds are attached to the aryl nuclei and consist essentially of aliphatic hydrocarbon radicals corresponding substantially to the different aliphatic hydrocarbons contained in paraffin wax.

13. As a composition of matter, an intimate mixture of alkyl-substituted hydroxyaromatic compounds wherein the hydroxyl hydrogen atoms in said compounds are substituted with the same

metal and wherein the alkyl substituents in said compounds are attached to the aryl nuclei and consist essentially of aliphatic hydrocarbon radicals corresponding substantially to the different aliphatic hydrocarbons contained in paraffin wax; said alkyl substituents comprising a sufficient proportion of said composition to render same miscible with mineral oil and said composition possessing the property of improving the pour point and viscosity index of viscous mineral oil fractions when added thereto.

14. As a composition of matter, an intimate mixture of alkyl-substituted hydroxyaromatic compounds wherein the hydroxyl hydrogen atoms in said compounds are substituted with the same metal, selected from the group consisting of copper, tin, zinc, iron, and cobalt, and wherein the alkyl substituents in said compounds are attached to the aryl nuclei and consist essentially of aliphatic hydrocarbon radicals corresponding substantially to the different aliphatic hydrocarbons contained in paraffin wax.

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