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LUBRICATING OIL

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It is among the objects of the present invention to provide improved hydrocarbon oils and particularly to provide improved lubricating oils of a hydrocarbon nature which may be derived from petroleum.

It is among the objects of the present invention to provide improved lubricating oils which will have a decreased tendency toward sludge formation and which will have lessened tendency to cause corrosion of metallic surfaces with which such lubricating oils may come in contact.

Still further objects and advantages will appear from the more detailed description set forth below, it being understood, however, that this more detailed description is given by way of illustration and explanation only, and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

It has now been found that small amounts of substantially crude soya oil and less preferably crude corn or crude cottonseed oil when added to lubricating oils or other hydrocarbon mixtures in amounts less than 5% and preferably in an amount of 0.01% to 2% will markedly stabilize these lubricating oils or similar mixtures against sludge formation, oxidative deterioration and corrosion of metallic surfaces.

The crude soya oil is obtained either by solvent extraction from the soya bean as by the use of hexane or by expeller or hydraulic expression. The crude oil may where desired be filtered or clarified but is desirably not subjected to a caustic soda or other refinement treatment prior to use in accordance with the present invention. For example, the soya bean may be ground to from 10 to 25 mesh with the addition of a small amount of water such as up to about 10% to 20% of water against the weight of the soya beans and then placed in a screw type expeller and expressed at a temperature of about 125° F. and under high pressure whereby between about 13% and 17% of oil will be expressed from the soya beans.

The soya beans may also be subjected to a high pressure treatment such as to an explosion whereby they are placed in a chamber under an elevated temperature and pressure which is suddenly released, followed by expression or extraction of the crude soya oil as indicated above.

The crude soya oil may, where desired, be subjected to an elevated temperature treatment such as to between about 250° F. and 500° F. for a short period of time such as for between about 5 minutes and 1 hour in order to enhance the value of the soya bean oil for the purposes of

the present invention. When the soya bean oil is subjected to this elevated temperature treatment, it should be done preferably in the absence of air or oxygen in order to avoid any oxidative decomposition during the heating treatment.

This crude soya oil is most effective when combined with relatively small amounts of various organic compounds and particularly hydroxylated and/or aminated organic compounds containing one or more amino and/or hydroxy groups substituted in the benzene or naphthalene rings of the aromatic compound.

Although it is preferred to use the polyhydroxy, polyamino, alkylhydroxy, alkylamino and hydroxyamino arane compounds, it also has been found satisfactory to use poly-nuclear monohydroxy or monoamino arane compounds.

Among the preferred compounds that may be employed in combination with the crude soya oil for addition to the lubricating oil followed by an elevated temperature treatment are compounds generally included in the groups of the alkyl phenols, alkyl naphthols, di-substituted hydroxylated or aminated benzenes or naphthalenes, alkoxy phenols or naphthols, di and poly phenyl, toluyl, naphthyl or other aryl amines, amino phenols, alkylated or alkoxyated or hydroxylated toluenes or xylenes. Less preferably there may be employed poly nuclear aromatic hydrocarbons or their derivatives, such hydrocarbons containing at least 3 nuclei or even hydrocarbons of the nature of the naphthenes or terpenes or their various carboxylated, hydroxylated, alkylated or alkoxyated derivatives. The preferred compounds are, however, hydroquinone, pyrogallol, ethyl or butyl pyrogallol, guaiacol, quinone, phloroglucinol, catechol or pyrocatechin, tributyl catechol, triamyl catechol, eugenol, vanillin, carvacrol, thymol, tannins, gallic acid, gallo-tannin, tannic acid, alphanaphthol, betanaphthol, ortho or para cresol, naphthoquinones, phenylbetanaphthylamine, alpha or beta naphthylamines, p-aminophenol, p-aminosaligenin, 2,4-di-aminophenol, monobenzyl-p-aminophenol, diphenylethylenediamine, benzyl-m-phenylenediamine, p-aminodimethylaniline, m-toluidine, diphenylhydrazine and tyrosine. These various materials are included in the expression "substituted aranes."

Less preferably, aromatic acids may be utilized, particularly aromatic carboxy acids containing one or more amino groups or hydroxy groups either in the nucleus or in aliphatic side chains, such as cinnamic, benzoic, salicylic or phthalic acids.

It is, of course, possible to use derivatives of the above identified compounds in which one or more of the hydrogen atoms in the benzene or naphthalene nucleus or in the aliphatic side chain or in the amino or hydroxy groups, is or are replaced by alkyl, aryl, hydroxy, amino, alkoxy, keto, aldo or nitro groups although this is usually not preferred.

This crude soya oil preferably should be added to or combined with the aromatic compounds in amounts varying from 1 to 20 parts of the oil for each part of the aromatic compound.

This combination of crude soya oil and less preferably crude cottonseed or corn oil and the aromatic compound, with or without heating before addition, is mixed with the lubricating oil and thoroughly dispersed therethrough, the lubricating oil during the addition or after the addition being heated with agitation to a temperature in excess of 350° F. and desirably to between 400° F. and 600° F.

It has been found that the interaction of the lubricating oil, crude soya oil and the aromatic compound is not most satisfactorily obtained unless the high heat treatment is applied to the lubricating oil after or during addition of the combination of crude soya oil and the aromatic compound, and it has been particularly found desirable that such heat treatment should be conducted with substantial agitation for a period of at least 10 minutes and the treatment may be conveniently continued for as long as several hours or more.

This is quite surprising due to the fact, that normally lubricating oils, as well as glyceride oils, are decomposed or broken down and rendered more subject to deterioration as a result of being subjected to such elevated temperatures. In accordance with this invention it is necessary for the lubricating oil to be subjected to the elevated temperature in excess of 350° F. together with and after having had thoroughly admixed therein the combination of the crude soya oil and the aromatic compound in order to develop the desired effect upon the lubricating oil.

It is not known whether the heat treatment of the lubricating oil containing the crude soya oil and the aromatic compound results in a chemical action between the oil and aromatic compound or the lubricating oil or whether a special kind of catalytic action takes place, but the heat treatment is necessary in order to obtain the desired effect upon the lubricating oil to retard sludge formation and corrosive tendencies of the oil.

It has been found most satisfactory to add the combination of crude soya oil and the aromatic compound in amounts varying from 0.75% to as much as 1.5% although generally between 0.3% and 1.5% are sufficient to show a marked effect upon the lubricating oil that is treated at the elevated temperature with the combination of crude soya oil and the aromatic compound.

Preferably a mixture of 4 parts of the crude soya oil and 1 part of the aromatic compound by weight is employed rather than other proportions as it has generally been found that where this mixture is prepared and added to the lubricating oil during or followed by the elevated temperature treatment, the most desirable effect on the lubricating oil is obtained.

Although it has been found that polyhydroxy, polyamino, and/or aminohydroxy compounds of mono-nuclear or poly-nuclear nature or mono-amino or monohydroxy compounds of poly-nuclear nature are most satisfactorily employed, it

is also possible to use in combination with or in lieu of such compounds with the crude soya oil the following compounds.

(a) Monohydroxy-aryl compounds such as phenol and its derivatives;

(b) Monoamino-aryl compounds such as aniline, diphenylamine, acetanilide, acetalaniline, dimethylaniline, amino-diphenyl, benzidine and their derivatives;

(c) Amine condensation products with aldehydes and ketones, such as benzalanilines, formylalphanaphthylamine, butyraldehyde-aniline, aldol-aniline and their derivatives;

(d) Nitrogen or oxygen ring compounds, such as furfural, furfuryl alcohol, furoic acid, diphenylguanidine, p - dimethylamino - phenyl-p-phenetidyl-guanidine, pyridine, acridine, triazine, piperidine, quinoline, uric acid, urea, morpholine and their derivatives;

(e) Sulphur compounds, such as thiodiphenylamine, methyl, ethyl, benzyl or phenyl sulphides or mercaptans, phenyl disulphide, benzyl sulphide and their derivatives;

(f) Cyanide compounds such as ethyl, butyl, benzyl or phenyl cyanides and cyanogen and their derivatives;

(g) Aliphatic amines such as dimethylamine, glutamic acid, glycine, triamylamine, n-butyl-diamylamine, benzyldiethylamine and their derivatives;

(h) Aliphatic oxygen compounds, such as lauryl alcohol, oleyl alcohol, linoleyl alcohol, myricyl alcohol, octadecyl alcohol, and trioxymethylene, eleostearic acid, oleic acid, stearic acid, linoleic acid and their mono, di and tri glycerides or glycidates and their sulfurized, halogenated or other derivatives.

(i) Small amounts of crude petroleum and preferably a crude petroleum with a naphthenic base, or such fractions or portions of crude petroleum as may be obtained by distillation or solvent extraction which will be high in non-saturated or non-hydrocarbon components, such as, for example, extracts which may be obtained with chlorinated or nitrated aliphatic or aromatic hydrocarbons such as nitrobenzene, chlorinated ethane, chlorinated ethyl ether or low boiling point aliphatic hydrocarbons such as liquefied propane or butane, liquefied sulfur dioxide, phenol, furfural, etc. Extracts may also be made to obtain similar compositions from coal tar or asphaltic or bituminous materials or residues, the preferred compound in such extracts or fraction preferably consisting of normally liquid yet relatively high molecular weight unsaturated ring compounds.

(j) Boric acid and phosphoric acid esters of aliphatic alcohols such as butyl, propyl, allyl or benzyl phosphates, or phosphates of aromatic alcohols such as tri-phenyl-phosphate and tri-cresyl-phosphate, naphthyl phosphates, etc.

(k) Terpenes or lignin materials such as terpine, pinene, abietic acid or various crude mixtures containing the same such as tallol, pine oil, rosin oil or their derivatives.

The stabilizing procedures of the present invention are most applicable to non-volatile high molecular weight aliphatic hydrocarbons, and these procedures may also be utilized with high boiling liquid hydrocarbon mixtures derived from other sources than petroleum and even in some instances they may be used with solid high molecular weight hydrocarbon mixtures.

Less preferably, these stabilizing procedures may be employed with non-aliphatic hydrocar-

bons of high boiling point and still less preferably with high molecular weight glyceride oils, particularly the triglycerides of high molecular weight fatty acids having 12 to 36 carbon atoms, which acids may contain if desired one or more double bonds or hydroxy groups.

The invention is not as desirably applicable to hydrocarbons of vegetative origin such as rubber or latex or to hydrocarbon compounds of volatile nature or having a boiling point less than about 200° F. to 250° F.

Together with or in lieu of the crude soya oil, cottonseed oil or corn oil, other crude glyceride oils, desirably of vegetative origin, may be employed in combination with the organic compound and for addition to lubricating and similar hydrocarbon oils. Among these other crude fatty glyceride oils are included particularly those extracted or expelled from the oil containing seeds and nuts, which are referred to herein under the term "seeds."

It has also been found that instead of using crude soya oil it is possible to filter lubricating oils and similar hydrocarbon mixtures through a cake or meal or press cake of soya beans or through a cake or meal of corn, cottonseed or other seed.

This has been found particularly desirable where the oil already contains as an added material or is subsequently treated with an aromatic compound, particularly the polyhydroxy, poly-amino, alkylamino, alkylhydroxy and hydroxy-amino arane compounds and followed by the elevated temperature treatment. As little as from 1% to 5% of the finely divided soya may be added to the lubricating oil and subsequently filtered therefrom to produce desirable stabilizing results, particularly where an elevated temperature treatment of at least 300° F. to 350° F. is employed. The present application is a continuation in part of application, Serial No. 304,945, filed November 17, 1939, now Patent No. 2,216,711, issued October 1, 1940.

Having described my invention, what I claim is:

1. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal surfaces which comprises treating the entire body of such oil with a relatively small amount of a combination of a crude unrefined glyceride oil and an aromatic compound selected from the group consisting of the alkylated hydroxylated aranes, alkylated amino aranes, polyhydroxy aranes, polyamino aranes, aminohydroxy aranes, monoamino-poly-nuclear aranes and monohydroxy-poly-nuclear aranes at an elevated temperature in excess of 350° F.

2. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal surfaces which comprises treating the entire body of such oil with a relatively small amount of a combination of a crude unrefined seed oil and an alkylated hydroxylated benzene.

3. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal surfaces which comprises treating the entire body of such oil with a relatively small amount of a combination of a crude unrefined soya oil and an alkylated hydroxylated benzene.

4. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal sur-

faces which comprises treating the entire body of such oil with a relatively small amount of a combination of a crude unrefined glyceride oil and an aminohydroxy benzene.

5. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal surfaces which comprises treating the entire body of such oil with a relatively small amount of a combination of a crude unrefined seed oil and an aromatic compound selected from the group consisting of alkylated hydroxylated aranes, alkylated amino aranes, polyhydroxy aranes, poly-amino aranes, aminohydroxy aranes, monoamino-poly-nuclear aranes and monohydroxy-poly-nuclear aranes.

6. A substantially stabilized lubricating oil resistant to sludge formation and having a decreased tendency toward corrosion of metal surfaces containing the heat reaction products of the entire body of the lubricating oil with a small amount of a combination of a crude unrefined glyceride oil and an aromatic compound selected from the group consisting of the alkylated hydroxylated aranes, alkylated amino aranes, polyhydroxy aranes, polyamino aranes, aminohydroxy aranes, monoamino-poly-nuclear aranes and monohydroxy-poly-nuclear aranes, said reaction products having been formed in the lubricating oil at a temperature in excess of 350° F.

7. A substantially stabilized lubricating oil resistant to sludge formation and having a decreased tendency toward corrosion of metal surfaces containing the heat reaction products of the entire body of the lubricating oil with a small amount of a combination of a crude unrefined seed oil and an alkylated hydroxylated benzene, said reaction products having been formed in the lubricating oil at a temperature in excess of 350° F.

8. A substantially stabilized lubricating oil resistant to sludge formation and having a decreased tendency toward corrosion of metal surfaces containing the heat reaction products of the entire body of the lubricating oil with a small amount of a combination of a crude unrefined glyceride oil and an aminohydroxy benzene, said reaction products having been formed in the lubricating oil at a temperature in excess of 350° F.

9. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal surfaces which comprises treating the entire body of such oil with a relatively small amount of a crude unrefined soya oil.

10. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal surfaces which comprises treating the entire body of such oil with a relatively small amount of a crude unrefined soya oil and also a relatively small amount of a hydroxy aryl compound.

11. A process of improving lubricating oils to decrease sludge formation and also to decrease their tendency to cause corrosion of metal surfaces which comprises treating the entire body of such oil with a relatively small amount of a crude unrefined soya oil and also a relatively small amount of an amino aryl compound.

12. A process of stabilizing a lubricating oil which comprises adding to the lubricating oil a small amount of a mixture of crude unrefined soya oil and hydroquinone in an amount ranging from 0.075% to 1.5% and then heating the oil to a temperature of between 400° F. and 600° F.

13. A process of stabilizing a lubricating oil

which comprises adding to the lubricating oil a small amount of a mixture of crude unrefined soya bean oil and tri butyl catechol in an amount varying from 0.075% to 1.5% and then heating to a temperature ranging between 400° F. and 600° F.

14. An improved lubricating oil having decreased tendency toward sludge formation and also having decreased tendency to cause corrosion of metal surfaces, said lubricating oil comprising a combination of a relatively small amount of a crude unrefined soya oil and a hydroxy aryl compound.

15. An improved lubricating oil having decreased tendency toward sludge formation and also having decreased tendency to cause corro-

sion of metal surfaces, said lubricating oil comprising a combination of a relatively small amount of a crude unrefined soya oil and an amino aryl compound.

5 16. A stabilized lubricating oil, resistant to the development of sludge and metal corrosion characteristics, said lubricating oil comprising a small amount of a mixture of crude unrefined soya oil and an aminohydroxy benzene.

10 17. A stabilized lubricating oil resistant to the development of sludge and oxidation corrosion characteristics, said lubricating oil comprising a small amount of crude unrefined soya oil and p-aminophenol.

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