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MODIFIED HYDROCARBON COMPOSITIONS AND PETROLEUM DISTILLATES

Sol Shappirio, Washington, D. C.

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This invention relates to hydrocarbon distillates and fractions such as lubricating oils and motor fuels, and particularly to such products and compositions containing the same which include agents that have a beneficial effect on such compositions either as antioxidants or in other ways, and methods of making such products and compositions.

Among the objects of the present invention is the production of such hydrocarbon containing fractions which include extracts particularly of bacteria to protect such fractions against oxidative deterioration and also for other purposes.

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.

In accordance with the present invention, metabolic products elaborated or produced by bacterial organisms are utilized as a source of beneficiating agent such as antioxidant. While various types of bacterial organisms may be utilized as the source of such antioxidants or other beneficiating agent, it is more desirable to utilize the non-pathogenic organisms as the source of such products, and particularly among the non-pathogenic organisms the acid-fast type may be employed although other organisms may be utilized. The utilization of such bacterial organisms as a source of beneficiating agent such as antioxidants offers a number of advantages. In the first place, the bacteria can be grown on synthetic or artificial media in relatively small quarters, so that no elaborate field or plant production is necessary, but substantial quantities of such antioxidants can be readily produced under very moderate facilities. More importantly, the antioxygenic substances obtained from such bacterial organisms are unique in character, and differ very markedly in a number of characteristics, both chemically and biologically and physically from antioxygenic substances derived from vegetative or animal sources. The differentiations chemically can be readily demonstrated in that the phosphatides, fats, waxes, proteins, and carbohydrates, and various cleavage products including fatty alcohols, pigments, alcohols, etc., obtained from such bacterial sources are quite different in character from those obtained from other living matter. And in fact, many of the substances obtainable in this way from bacterial sources are unique and are not obtainable and are not found in the products of other life processes. Thus it may be pointed out that the phosphatides and wax-like materials present in these products from bacterial organisms are complexes including carbohydrates or polysaccharides of unique and peculiar characteristics differing from those obtained from other life processes, with the result that such phosphatides and wax-like materials give unique reactions and characteristics, different from that produced from other living sources. These features will be more particularly explained below. Illustrating the use of non-pathogenic bacteria as a source of antioxygenic substances, reference may be made to various types of non-pathogenic organisms which may be utilized in this way, the non-pathogenic organisms being preferably used as against pathogenic organisms for reasons pointed out above. As illustrative of the non-pathogenic organisms, there may be mentioned lactic acid bacteria, the aceto-butylicum type of bacteria, and more particularly the acid-fast type of bacteria, particularly the timothy grass bacillus. In illustrating features of invention set forth herein particularly, the timothy grass bacillus will be utilized to illustrate the acid-fast non-pathogenic bacteria, but such use of timothy grass is not intended to be limiting except insofar as peculiar results are obtainable with the timothy grass bacillus and products derived therefrom; reference to the timothy grass, however, being made to illustrate generally the use of bacteria as a source of antioxygenic substances.

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The bacterial products and derivatives utilized for antioxygenic purposes in accordance with the present invention may be applied in any desired way to the selected material in order to exhibit antioxygenic activity. Where the substances to be protected are in the form of readily disintegrable or powdered materials, the antioxygenic substance, if in solid condition, may be admixed intimately with such powdered or disintegrated substance to protect the latter. If the

antioxygenic substance is in the form of a liquid, it may be intermixed with the solid material. If in the form of an extract in a volatile solvent, the volatile solvent may first be removed and the antioxygenic residue utilized for admixture with the substance to be protected, or the solvent extract may be intermixed with the substance to be protected, and the solvent then evaporated. If the substance to be protected against oxidative change in the form of a solid mass of material, then the antioxygenic substance may be applied as a coating over such solid mass. Thus a dust or powder of the antioxygenic substance may be applied over the solid mass, or a solution or solvent extract of the antioxygenic substance may be applied, and where a volatile solvent is employed, the latter evaporated. Where the substance to be protected is a liquid, the antioxygenic substance may be incorporated into the liquid, either as such, or in the form of a solution or in a volatile solvent, and the solvent subsequently evaporated. Or the substance to be protected if a liquid, may be subjected to direct incorporation with the bacterial material itself to produce an extract in situ in the liquid as, for example, when a hydrocarbon fraction is to be protected, the latter may be incorporated with bacterial substances in accordance with the present invention, and extracted directly into the hydrocarbon fraction produced, and the bacterial residues then either removed or permitted to remain. More desirably they are filtered off, so that a hydrocarbon fraction containing the extracted antioxygenic substances is directly obtained. Necessarily the method of utilization of the antioxygenic substance will depend on the characteristics of the substance to be protected, and the form of the antioxygenic substance, as just explained.

The amounts of antioxygenic substances or beneficiating agents derived from the bacterial origins that may be utilized, depend in part on the antioxygenic content of the particular material when used for antioxidant purposes, as well as on the substance to be protected. It should be kept in mind, however, that only very small amounts of antioxygenic substances, for example, produced in accordance with the present invention, need be utilized for direct incorporation or contact with the material being protected. While fractions of a percent up to 5 and even 10% may be utilized, only the smaller amounts are necessary and from ½% to 1% of antioxygenic substance, for example, derived from bacterial sources need be employed for incorporation into a hydrocarbon lubricating oil or motor fuel or similar hydrocarbon fractions to give satisfactory and substantial beneficiating effect.

Where wax-type materials or waxed paper, or wax-containing compositions, etc. are to be protected against oxidative deterioration, one may desirably utilize the wax-like substances obtained in accordance with the present invention from bacterial sources, and which exhibit antioxygenic activity. Such wax-like substances may be incorporated into the wax materials which are applied as coatings to the paper, or may be applied to the waxed paper after the latter has been incorporated. An advantage of the utilization of such wax-type materials as antioxygenic substances in accordance with waxed paper, etc., following the teachings of the present invention, resides in the fact that such inclusion of the wax-like antioxygenic substances of the present invention, does not substantially affect the water-proofing character of such waxed papers. Many prior art types of materials which have been suggested for use with the waxed papers actually result in an increase in porosity and moisture penetration of such wax-protected papers. The utilization of antioxidants of the present type avoid those difficulties.

Oil-soluble antioxygenic and other beneficiating substances produced in accordance with the present invention may be utilized in connection with the hydrocarbon types of materials, such as oils and fuels, waxes, etc., and such products employed for their usual purposes being beneficiated and protected by the incorporated materials. Various methods of applying the present invention will be illustrated below in connection with the utilization as an illustrative feature of antioxygenic substances derived from the acid-fast non-pathogenic timothy grass type bacillus.

Illustrating the invention by the utilization of the timothy grass bacillus, the latter may be incorporated with a hydrocarbon lubricating oil, utilizing for example, about 10% of the bacteria based on the weight of the oil, and warming the materials together at a moderate temperature, if necessary under pressure to avoid volatilization and loss of hydrocarbon material, for about half an hour. Oil-soluble antioxygenic substances will be found to be transferred into the oil. The bacterial residues may desirably be filtered off but they can be permitted to remain in the oil depending on the use to which it is put. After such treatment, the oil will be found to exhibit marked antioxygenic properties, and to be materially protected against oxidative change.

The materials present in the bacterial sources which exhibit antioxygenic activity are believed to be tied up primarily with the lipid components. Phosphatides, fats, and wax-like substances are all present in such bacterial sources, and for the timothy grass type bacillus, it may be shown that there is present approximately 0.59% phosphatides, 2.75% fat, and 4.98% crude wax substances. In view of the fact that antioxygenic activity is tied up with such components, extracts of the bacterial substances can be utilized as the antioxygenic material, rather than the utilization of the bacterial substances per se. Water extracts yield very low contents of antioxygenic substances, and consequently it is preferred to utilize solvent extracts from the bacterial sources produced by the utilization of organic solvents, particularly volatile organic solvents, and there may be specifically mentioned such organic solvents as ether, alcohol, chloroform, etc., acid-containing extraction media being desirable in some instances as illustrated below in isolating desired substances. The following methods of utilizing organic solvents in producing antioxygenic extracts are exemplary.

The bacilli utilized are more desirably those which have attained maximum growth or pellicle formation, which with the timothy grass type bacillus takes about six to eight weeks of incubation. Any desirable synthetic medium may be utilized on which to grow such bacilli, a satisfactory medium for this purpose containing asparagin, ammonium citrate, potassium acid phosphate, sodium carbonate, sodium chloride, magnesium sulphate, ferric ammonium citrate, glycerol, and water in the proportions usually employed as media for the growth of bacteria. For the extraction of the bacterial lipids, the cultures after they have attained the maximum growth as indicated above, are desirably filtered, washed

with water, and extracted with alcohol and ether, for example. For this purpose, the washed culture is immediately introduced into a mixture of equal parts of alcohol and ether, the latter having desirably been saturated with carbon dioxide, and the extraction being carried out, desirably in an atmosphere of carbon dioxide to avoid contamination. The extraction is exhaustably carried out, as for example, at room temperature. The alcohol ether medium extracts most of the fat and phosphatide content of the bacterial substances with a small amount of wax, or rather wax-like substance. The extract may be concentrated under reduced pressure and at a low temperature. After the alcohol ether extraction referred to, the residues may be subjected to extraction with chloroform, which chloroform extract on concentration to dryness yields a crude wax-type material. The bacterial residues after the extractions referred to above are substantially free from lipids soluble in neutral solvents. However, they still contain a substantial amount of lipid materials firmly bound in the cellular structure. Such firmly bound lipids can be removed by treating the bacterial residues with a mixture of alcohol and ether containing a small amount such as 1% of hydrochloric acid, followed by extraction with ether or chloroform. These several extracts thus obtained will be further elaborated below in illustrating their character and utilization. The order of utilization of the solvent extracts referred to above is exemplary. The bacterial material may be subjected to direct contact with any of the stated extraction media directly, and only a single extraction produced, and such extracts employed in either concentrated or other condition as a source of antioxygenic activity. However, several fractions may be produced by successive utlization of solvent extraction as illustrated above.

These several fractions or any of the extracts produced may be utilized as such, either removing the extracting solvent after incorporation with the substance to be protected against oxidative deterioration or prior to such incorporation; or the extracts may be concentrated by removal of some or all of the solvent, and ultimately a substantially dry product produced free from solvents, in which substantially dry condition the material may be used in any manner as set forth above. The substances from any of the extracts are complex in character, and while they may be as indicated, depending on the particular type of solvent employed, largely phosphatide in character, or largely fat in character, or largely wax-like material, it is not intended to mean that no other substances are present in such complexes, since the separations produced by particular solvent extractions are not quantitative.

Where glyceride oils or fats are utilized for addition to hydrocarbon fractions to improve their properties, as for example, in such oil additions to lubricating oils, the glyceride oil may be utilized to produce an extract of the bacterial material as set forth in prior application Serial No. 414,377, entitled Edible oils and fats, now Patent No. 2,338,207, dated January 4, 1944, of which the present application is a continuation-in-part, and such glyceride oil carrying the extracts of the bacterial material, may then be incorporated with the hydrocarbon fraction.

Thus the alcohol ether extract containing fats and phosphatide material may be added to a substance like a hydrocarbon fraction to be protected against oxidative deterioration incorporating a fraction of a percent such as .25% into the hydrocarbon fraction. Or the alcohol ether extract containing fats and phosphatides may be evaporated desirably under reduced pressure and at a low temperature to produce a concentrate, either partially or completely free of extracting solvent, and the antioxygenic residues employed in any manner set forth above, as for example, for incorporation into the hydrocarbon fraction. Similarly the wax-type materials extracted by chloroform from the residues after extraction with the alcohol ether combined solvent may be employed as an antioxygenic material desirably after removal of the chloroform extracting medium, and such material may desirably be employed particularly in connection with wax-type materials, such as paraffin or other wax-type substances used for coating papers, etc. where an antioxygenic substance is desirably present. For such purpose 1 to 10% of the wax-like material may be incorporated into the paraffin bath in which the paper is treated, or the wax coated paper, particularly with the wax in softened or liquid condition may be subjected to treatment with the antioxygenic substance and the wax then permitted to harden, so that the antioxygenic substance is carried in the wax coating on the paper.

Instead of using the extracts per se as obtained above, the extracts may be subjected to further treatment in order to segregate groups of materials therefrom. Thus the alcohol-ether extract produced as set forth above from the timothy grass bacillus, may be treated to separate the phosphatides from the fats. For this purpose the alcohol-ether extract may be treated with acetone to precipitate the phosphatide from fat and other ether-soluble constituents present, and the phosphatide obtained after removal of the acetone precipitant and other solvent components in the form of a substantially powdered material, which disperses readily in water forming colloidal solutions. Such materials as this phosphatide substance which is complex in character, may be utilized as an antioxygenic material in any of the manners set forth above, they may be utilized in connection with any hydrocarbon fraction or petroleum distillate such as in the lubricating oil range or in motor fuels, petroleum distillates boiling above kerosene being particularly valuable for beneficiation in accordance with the present invention.

After precipitation of the phosphatide substances by acetone, the residues containing fat and other ether-soluble constituents present in the solvent may be utilized as an antioxygenic substance analogous to the utilization of other such fractions as set forth above. Materials soluble in ice cold acetone may be obtained upon evaporation of the solvent, and are generally in the form of a soft fat-like mass. It is a complex mixture of substance that may be utilized as an antioxygenic material for incorporation with hydrocarbon fractions and other substances, and particularly lends itself to utilization as an antioxygenic material, being employed desirably only as a fraction of a percent based on the weight of the substance to be protected.

The crude wax-like material obtained above by chloroform extraction after the alcohol-ether extraction may be subjected to separation of ingredients, as for example, the material may be purified by precipitation from the ether solution

by treatment with acetone or methyl alcohol, and a substantially amorphous powder obtained in this way. From the mother liquors a second fraction may also be obtained which is usually more complex and cruder in character than the precipitated powder referred to immediately above. The latter or second fraction is usually softer in character.

Some further comments may be given in connection with the type of antioxygenic materials which are thus separated by treatment of the several extracts. The chemical composition of the phosphatides, as obtained, for example, from the acid-fast bacteria differ very decidedly from that of phosphatides of plant or animal origin. This is shown in a number of respects, and particularly is emphasized by the fact that whereas the phosphatides from animal or plant origins exhibit substantial percentages of nitrogen in their constitution, the bacterial phosphatides contain very small amounts only of nitrogen, and in some cases scarcely more than a trace. In addition, on hydrolysis the bacterial phosphatides yield a substantial amount of carbohydrates which distinguishes them from the phosphatides obtained from plant or animal origins. The presence of the carbohydrate in combination in the phosphatide materials obtained from bacterial origin is particularly important in influencing the antioxygenic properties of these substances. The carbohydrates obtained are also different in character from those normally present in many animal and vegetable materials. The bacterial phosphatides may thus be distinguished from animal and vegetable phosphatides by (1) their low nitrogen (less than 1%) characteristic, (2) the presence of liquid saturated fatty acids of high molecular weight, (3) the special type of carbohydrate or polysaccharide present which on hydrolysis with dilute acids, for example, gives inosite, mannose and glucose.

The phosphatides as obtained herein may be utilized as such, or they may be subjected to further treatment. For example, they may be saponified with alcoholic potassium hydroxide to produce cleavage products, which are quite different from those obtained from the phosphatides of animal and vegetable origin. When saponified in this way, complexes are produced which include alcohol insoluble carbohydrate complexes that contain phosphorus. In other words, the fatty acids are split off from the phosphatide leaving the residual molecular substances, and these may also be utilized as a source of antioxygenic substance quite different from anything available from animal or plant origin. The important characteristic of the phosphatide showing great affinity for water inducing colloidal solutions has been referred to above, and is important in connection with a utilization in various types of substances, and particularly aqueous emulsions or water-containing materials as the antioxygenic substance.

The portion of the bacterial lipids soluble in ice cold acetone referred to above has been identified as acetone-soluble fat. It is generally of a soft, or semi-solid character, containing much of the pigmenting material, and may, therefore, be reddish in character, and having a characteristic odor. It is usually composed of a mixture of neutral fat and free fatty acids, the neutral fat differing markedly from ordinary fat in that the fat is not so much as glyceride as it is made up of complex esters of fatty acids with carbohydrates, such as a disaccharide, trehalose. These characteristics including the presence of liquid saturated fatty acids of high molecular weight, distinguish bacterial fats and lipids from any materials obtained from non-bacterial sources.

Some of the acids present, or which may be obtained by saponification from such fats, are unique in character, and differ materially from those available upon saponification of other acids. Some of the acids thus obtained are liquid in character and unsaturated. Lead salts or soaps of these acids can be produced, and their solubility in ether and hydrocarbon materials lend them particularly to use in connection with hydrocarbon motor fuels, lubricating oils, etc., as antioxidants.

The wax-like materials identified above which may be obtained, as for example, from the chloroform extraction are important quantitatively because they constitute the bulk of the ether-soluble constituents of the acid-fast bacteria, for example. They are not true waxes, since they are generally esters of higher hydroxy fatty acids with carbohydrates and with certain higher alcohols. The complex mixtures of materials exhibit antioxygenic activity and may be utilized as such in any of the manners set forth above. These wax-like substances include higher alcohols, which are peculiar to the bacterial substances and are not found elsewhere in nature. They appear to be specific metabolic products of the bacilli, and further characterize the unique substances produced herein and utilized for antioxygenic substances.

The firmly bound lipid type materials obtained as referred to above may be utilized as such as antioxygenic substances, or may be subjected to treatment to produce fractions therefrom. These firmly bound lipids are rather crude in character as first produced and represent a complex mixture of various substances. They are generally quite soluble in ether or chloroform. They may be purified for example, by precipitation by addition of alcohol to the etherial solution to produce an amorphous powder melting with decomposition. These lipid fractions may be subjected to saponification to yield ether-soluble and water-soluble components, both of which are complex, the water-soluble components including polysaccharides, and either of which fractions, either the ether soluble or water-soluble components may be utilized as antioxygenic substances.

The unsaponifiable matter obtained after the bacterial fats have been saponified is usually in the form of a dark colored plastic mass. It is very complex in character, and may be utilized as such for antioxygenic purposes in any of the manners set forth above.

The phosphatidinous fractions of bacterial origin may be modified in any desirable way for utilization in connection with the petroleum distillates or other hydrocarbon fractions. Such phosphatidinous fractions and other acid fractions obtained from bacterial sources may be neutralized by any desired neutralizing agents including inorganic and organic materials, amines and amino derivatives such as the alkylol amines being particularly useful for that purpose. For such neutralization the organic amines need merely be heated with the phosphatidinous material at a temperature, for example, of from 90° F. to 300° F. Or the phosphatidinous or other fractions which are unsaturated and obtained from bacterial sources may be hydrogenated if desired, using any of the ordinary techniques for hydrogenation to produce modified products for

incorporation into the hydrocarbon fractions such as petroleum distillate. Any of these modification expedients including neutralization and hydrogenation, may be carried out on the bacterial extracts and fractions either before or after their incorporation with the hydrocarbon fractions or petroleum distillate.

The phosphatidinous type material obtained from the bacterial sources may be generally said to have a formula $(R.COO)_nX.PO_3.OH.Y$, where R.COO is a fatty acid residue, X is a polyhydroxy alcohol residue, Y is a sugar residue, and n is an integer such that $n+1$ is equal to the number of hydroxy groups in the polyhydroxy alcohol.

In accordance with the present invention, therefore, products of bacterial metabolism are utilized as a source of antioxygenic material, preferably utilizing extracts produced from the bacteria themselves for this purpose. As indicated, the organic solvent extracts are most desirable and may be utilized in small quantities to produce and exert markedly improved characteristics of antioxygenic character. The unique character of products obtained from bacterial sources stamp them as distinguished from the antioxygenic materials heretofore available in the art and derived from animal and vegetable or chemical sources. Furthermore, the fact that such materials can be produced under carefully controlled conditions where the bacteria are grown on artificial media enable them to be produced readily in any quantities desired within absolute control of the manipulator. Antioxygenic substances are obtainable in this way which are not capable of being produced in any other manner.

Many of the extracts and fractions produced from the bacterial origins for the purposes herein set forth can be improved in their operation by heat treating such materials either by themselves or in the presence of other materials. The petroleum distillates carrying such bacterial extracts may be subjected to the heat treatment, using pressure if necessary to avoid undue vaporization from the petroleum distillate or other hydrocarbon fraction. Or the bacterial extracts or fractions may be subjected to a heat treating operation before their incorporation into the petroleum distillate or other hydrocarbon fraction. Such heat treatment may take place at moderate temperatures or elevated temperatures, any temperatures employed being those which are insufficient to produce any undesirable effect or decomposition on the petroleum materials if those products are present. Temperatures for example, up to the boiling point of water may desirably be utilized for this purpose.

The phosphatidinous type material has been characterized structurally by the formula

$$(R.COO)_nX.PO_3.OH.Y$$

When this phosphatidinous material is derived from the bacterial source, the fatty acid residue R.COO, the polyhydroxy alcohol residue X, and the sugar residue Y, are of course, the residues from the naturally occurring substances present in the bacteria. Thus the fatty acid, the polyhydroxy alcohol and the sugar would be bacterially occurring fatty acids, alcohols, sugars. Where, however, such compounds are produced synthetically any of the desired fatty acids, polyhydroxy alcohols and sugars may be employed. Thus the fatty acids may be any of the fatty acids occurring in animal or vegetable glycerides and particularly fatty acids having more than

eight carbon atoms, such fatty acids including those derived from glyceride oils, among which there may be mentioned almond oil yielding oleic, palmitic, linoleic, etc. acids, butterfat yielding butyric, caproic, capric, palmitic, stearic, oleic, etc. acids, cacao butter giving palmitic, oleic, stearic, myristic, etc. acids, castor oil giving ricinoleic, stearic, oleic acids, etc., cocoanut oil yielding caproic, caprylic, capric, lauric, etc. acids, codliver oil giving oleic, myristic, palmitic, stearic, etc. acids, cottonseed oil giving oleic, stearic, palmitic, linoleic, etc. acids, hemp oil giving isolinolenic, oleic, etc. acids, lard giving stearic, palmitic, oleic, linoleic, etc. acids, linseed oil yielding linoleic, linolenic, oleic, palmitic, myristic, etc. acids, maize oil giving arachidic, stearic, palmitic, oleic, etc. acids, menhaden oil giving palmitic, myristic, oleic, stearic, and other unsaturated acids, etc., mustard oil yielding erucic, arachidic, stearic, oleic, etc. acids, neat's-foot oil giving palmitic, stearic, oleic acids, etc. complexes, olive oil yielding linoleic, oleic, arachidic, etc. acids, palm oil giving palmitic, lauric, oleic, etc. acids, peanut oil yielding arachidic, linoleic, hypogoeic, palmitic, etc. acids, poppy oil giving linoleic, isolinolenic, palmitic, stearic, etc. acids, rape oil yielding erucic, arachidic, stearic acids, etc., sperm oil giving oleic, palmitic, etc. acids, tallow yielding stearic, palmitic, oleic acid complexes, and whale oil yielding linoleic, isolinolenic, etc. acids. The complex acid mixtures obtained from any of the above oils may be utilized, or the individual acids or any desired mixtures thereof may be employed in producing the bacterial derivatives desirably employed in accordance with the present invention.

The polyhydroxy alcohols where synthetic compounds are to be produced may be those obtained from two and three carbon containing compounds including the various glycols, glycerols, polyglycols, polyglycerols, the glyco' ethers, the glycerol ethers, higher hydroxy containing compounds such as penta erythritol. The sugars may particularly be the pentoses and hexoses, such as glucose, dextrose, maltose, ribose, arabinose, lixose, xylose. But the polysaccharides like sucrose may be used. As examples of synthetic materials there may be mentioned (*a*) the oleic acid-glycerol-ribose derivative, and (*b*) the palmitic-ethylene glycol-glucose derivative.

While in these synthetically produced phosphatidinous type materials the phosphoric acid derivatives are indicated, other acid forming groups may be used in lieu of the phosphoric acids including organic and inorganic polybasic acids, such as phthalic, maleic, malic, sulphuric, or other sulphur acid, arsenic acid, etc.

Having thus set forth my invention, I claim:

1. A petroleum distillate boiling above kerosene carrying a hydrogenated bacterial extract in an amount to exhibit antioxygenic properties for the distillate.

2. A petroleum distillate boiling above kerosene carrying a neutralized hydrogenated bacterial extract in an amount to exhibit antioxygenic properties for the distillate.

3. A petroleum distillate boiling above kerosene carrying a bacterial extract in an amount to exhibit antioxygenic properties for the distillate, the extract having been neutralized by a heavy metal oxide.

4. The method of beneficiating petroleum distillates for use as lubricating oils which comprises adding to a lubricating oil a bacterial extract in an amount to exhibit antioxygenic prop-

erties for the distillate, and hydrogenating the compounded lubricant.

5. The method which comprises incorporating lubricating oil with non-pathogenic bacteria, heating the mixture, maintaining the substances in contact until antioxygenic substances in an amount of from ½ to 10% are transferred from the bacteria to the oil, and removing the bacterial residues.

SOL SHAPPIRIO.

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