FOOD GRADE ROTARY SCREW COMPRESSOR LUBRICANT

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ABSTRACT
Embodiments of the invention provide a food grade lubricant, such as one of synthetic or mineral oil origin, which can be used for the lubrication of rotary screw compressors. The lubricant composition can include a blend of incidental food contact authorized ester or a distilled, acetylated monoglyceride. The lubricant composition can also include an incidental food contact authorized polyether polyol having an average molecular weight number greater than about 1500. The blend can be compounded with additives including one or more of antioxidants, corrosion inhibitors, metal passivators, and anti-foam agents that are cleared for incidental food contact.
FOOD GRADE ROTARY SCREW COMPRESSOR LUBRICANT

RELATED APPLICATIONS


BACKGROUND

[0002] This invention relates to lubricants and, more particularly, to food grade lubricating oils which are especially useful as compressor oils for equipment in the food service industry. Further, the invention relates to the use of such oils in rotary screw compressors.

[0003] The equipment used in the food processing industry varies by segment with the three largest segments being meat and poultry, beverages, and dairy. While the equipment varies from segment to segment, the majority of manufacturing operations require significant amounts of compressed air. Due to the importance of ensuring and maintaining safeguards and standards of quality for food products, the food industry must comply with the rules and regulations set forth by the United States Department of Agriculture (USDA), originally under The Food Safety and Inspection Service (FSIS), as part of the Federal Food, Drug and Cosmetic Act (FFDCA), which holds responsibility for all programs for the inspection, grading, and standardization of meat, poultry, eggs, dairy products, fruits, and vegetables.

[0004] Under the FFDCA, specifically section 21 CFR 178.3570, lubricants which are susceptible to incidental food contact are considered indirect food additives under USDA regulations. Lubricants classified as “H1” are authorized for incidental food contact. H1 authorized lubricating oil and the term “food grade” will be used interchangeably herein and in the appended claims.

[0005] Several market factors accentuate the need for a superior food grade lubricating oil. Some manufacturers prefer to use only H1 authorized oils to avoid the possibility of noncompliance. Reducing contamination risks and inventory carrying costs associated with stocking multiple inventories of varying viscosity/FDA approval level oils also provides an economic incentive for exclusive use of H1 authorized oils. Furthermore, other firms, reliant upon company image as a marketing resource, may elect to take the conservative approach to health and safety issues and utilize only H1 authorized oils. All of these concerns are addressed by the exclusive use of H1 authorized oils.

[0006] In addition to meeting the requirements for safety set by federal regulatory agencies, the product must be an effective lubricant. Lubricating oils for food processing plants should lubricate machine parts, resist viscosity change, resist oxidation, protect against rusting and corrosion, provide wear protection, prevent foaming, and resist the formation of sludge in service. The product should also perform effectively at various lubrication regimes ranging from hydrodynamic thick film regimes to boundary thin film regimes.

[0007] The oxidation, thermal, and hydrolytic stability characteristics of lubricating oil help predict how effectively an oil will maintain its lubricating properties over time and resist sludge formation. Hydrocarbon oils are partially oxidized when contacted with oxygen at elevated temperatures for prolonged periods of time. The oxidation process produces acidic bodies within the lubricating oil which are corrosive to metals often present in food processing equipment. Many metals present in food processing equipment and in contact with both the oil and the air are effective oxidation catalysts which further increase the rate of oxidation. Oxidation products contribute to the formation of sludge which can clog valves, plug filters, and result in the over-all breakdown of the viscosity characteristics of the lubricant. Under some circumstances, sludge formation can result in plugging, complete loss of oil system flow, and failure or damage to machinery.

[0008] The thermal and hydrolytic stability characteristics of lubricating oil reflect primarily on the stability of the lubricating oil additive package. The stability criteria monitor sludge formation, viscosity change, acidity change, and the corrosion tendencies of the oil. Hydrolytic stability assesses these characteristics in the presence of water. Inferior stability characteristics result in the lubricating oil losing lubricating properties over time and precipitating sludge.

SUMMARY

[0009] In light of the problems discussed above, it is desirable to provide an improved food grade lubricating oil. Some embodiments of the invention provide a food grade lubricant, such as a lubricating oil of synthetic or mineral oil origin, which can be used for the lubrication of rotary screw compressors. The lubricant composition can include a blend of incidental food contact authorized ester or distilled, acetylated monoglyceride. The lubricant composition can also include an incidental food contact authorized polyol having an average molecular weight number greater than about 1500. The blend can be compounded with additives including one or more of antioxidants, corrosion inhibitors, metal passivators, and anti-foam agents that are cleared for incidental food contact.

DETAILED DESCRIPTION

[0010] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details set forth in the following description. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of “including,” “comprising,” and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items.

[0011] The following discussion is presented to enable a person skilled in the art to make and use embodiments of the invention. Various modifications to the embodiments will be readily apparent to those skilled in the art, and the generic principles herein can be applied to other embodiments and applications without departing from embodiments of the invention. Thus, embodiments of the invention are not intended to be limited to embodiments described, but are to be accorded the widest scope consistent with the principles and features disclosed herein. Skilled artisans will recognize the examples provided herein have many useful alternatives and fall within the scope of embodiments of the invention.

[0012] Some embodiments of the invention provide a lubricant, such as one of synthetic or mineral oil origin, which can be used for the lubrication of rotary screw compressors where
enhanced oxidative stability, improved wear protection, corrosion inhibition and varnish control are desired. The lubricant of some embodiments of the invention can provide an excellent balance of these performance properties.

[0013] The lubricant of some embodiments of the invention can be used to replace rotary screw compressor lubricants that do not meet the incidental food contact requirements. The food grade lubricant of some embodiments meets and exceeds all requirements necessary for incidental food contact (111) approval as determined by the FTDDCA. The lubricant of some embodiments can include an incidental food contact authorized synthetic lubricating fluid for use in rotary screw compressor applications that conforms to the requirements for incidental food contact as defined under 21 CFR 178.3570.

[0014] In some embodiments, the lubricant composition can include a blend of incidental food contact authorized esters (e.g., derived from hindered mono/polyhydric alcohols and one or more alkanol acid constituents) or distilled, acetylated monoglyceride. The lubricant composition can also include an incidental food contact authorized polyether polyol having an average molecular weight greater than about 1,500. The blend can be compounded with additives including one or more of antioxidants, corrosion inhibitors, metal passivators, and anti-foam agents that are cleared for incidental food contact.

[0015] Current incidental food contact lubricants utilized in this equipment provide inferior varnish control. Some embodiments of the invention can substantially reduce or eliminate varnishing, extend lubricant drain intervals, and significantly enhance equipment life and operation. The lubricant can provide significant performance improvements in oxidation stability, elastomer compatibility, hydrolytic stability, improved wear protection, corrosion inhibition and varnish control. It can also provide superior protection from sludging, rust and corrosion protection, and foam resistance. In some embodiments, to achieve these objectives, the high performance food grade lubricant can include synthetic food grade base oils and a sufficient amount of an additive package to impart exceptional performance characteristics to the lubricating fluid.

Base Oil

[0016] In some embodiments, the base oils for use in the lubricant composition can include FTDDCA authorized distilled, acetylated monoglyceride, produced by the distillation of mono-diglycerides produced from the esterification between a triglyceride with glycerol, and food grade polyglycols derived from ethylene oxide, propylene oxide, 1,2- or 2,3-butylene oxide. The above oxides can be polymerized alone (i.e., homopolymerized) or in combination. The combined oxides can also be combined in a random or block addition. While some of the above compounds may be of a hydrophobic nature, those of a hydrophobic nature are preferred, such as those derived from propylene oxide, butylene oxides, or combinations thereof. Examples of suitable materials include, but are not limited to, [alpha]-Butyl-omega-hydroxypropyloxy(propylene), minimum molecular weight about 1,500; [alpha]-Butyl-omega-hydroxypropyloxy(oxyethylene) poly(oxypropylene) produced by random condensation of a 1:1 mixture by weight of ethylene oxide and propylene oxide with butanol, minimum molecular weight about 1,500; and [alpha]-Hydro-omega-hydroxypropyloxy(oxyethylene) poly(oxypropylene) produced by random condensation of mixtures of ethylene oxide and propylene oxide containing 25 to 75 percent by weight of ethylene oxide, minimum molecular weight about 1,500. The foregoing polyglycols can have a flash point greater than about 375° F. and preferably greater than about 450° F. They can also have a minimum average molecular weight of about 1500. In some embodiments, the polyglycols can be blended to give a base lubricant composition containing about 5 weight percent to about 95 weight percent of the distillate acetylated monoglycerides and about 95 weight percent to about 5 weight percent of the polyglycols, respectively.

[0017] The lubricant composition when used in a rotary screw air compressor can be selected to have a viscosity in the range of about 15 centistokes to about 100 centistokes at about 40 degrees Celsius and a pour point in the range of about 0 degrees Celsius to about minus 40 degrees Celsius.

Additive Technology

[0018] In some embodiments, the lubricant composition can include effective amounts of one or more of the following additives: antioxidants, corrosion inhibitors, metal deactivators, lubricity additives, dispersants, antifoam agents, and other such additives as may be desired.

Antioxidants

[0019] The antioxidant package for the lubricant composition can include a combination of food grade phenolic and amonic antioxidants. The class of phenolic antioxidants which can be employed include food grade, oil-soluble, sterically hindered phenols and thio-phenols. Included within the definition of foods and thio-phenolic antioxidants are sterically hindered phenolics such as hindered phenols and bis-phenols, hindered 4’,4”-thiobisphenols, hindered 4-hydroxy- and 4-thio-phenolic acid esters and dithio esters, and hindered bis(4-hydroxy- and 4-thiobenzoic acid and dithio acid) alkyl esters. Examples of sterically hindered phenols include 2,6-di-tet-butyl-4-cresol, 2,6-di-tet-aryl-p-cresol, and 2-tetetyl-6-tet-aryl-p-cresol.

[0020] A second group of hindered phenolic antioxidants are the hindered bisphenols. Examples of these compounds include 4,4’-dimethylene bis(2,6-di-tet-butylphenol), 4,4’-dimethylene bis(2,6-di-tet-butylphenol), 4,4’-trimethylene bis(2,2-di-tert-amyl phenol), hexamethylenebis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate), tetraakis[methylene(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)]methane, and 4,4’-trimethylene bis(2,6-di-tet-butyl phenol).

[0021] Additional hindered phenolic antioxidants utilized include a group of hindered thio bis-phenols, (i.e., where the sulfur is connected to another phenolic group). Examples of these compounds include 4,4’-thio bis(2,6-di-sec-butyl phenol), 4,4’-thio bis(2-tet-butyl-6-isopropyl phenol), thiodiethylthiobis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate), and 4,4’-thio bis(2-methyl-6-t-butyl phenol).

[0022] A fourth group of hindered phenolic antioxidants are the alkoxyl phenols. Examples of these compounds include butylated hydroxy anisole (BHA) and butylated hydroxyanisole.

[0023] Suitable food grade, oil-soluble aromatic amine antioxidants include phenyl-[alpha]- and/or phenyl-[beta]-naphthylamines, naphthyl phenyl amines, alkylated phenyl naphthyl amines, and alkylated diphenyl amines. Examples of aromatic amine antioxidants include, N-phenyl-ar(1,1,3,3-tetramethylbutyl)-1-naphthalamine, N-phenyl-alpha-
naphthylamine, N-p-methyl-phenyl-alpha-naphthylamine, N-phenylbenzamine, reaction products with 2,4,4-trimethylpentene and the diphenylamines such as diethylidiphenylamine, and diocetyl diphenylamine.

[0024] The phenolic and aromatic amine combination can range in ratio by weight from about 20:1 to about 1:20, although the preferred ratio ranges from about 4:1 to about 1:1. Treat rates can range from about 0.25% to about 2.0% by weight of the lubricating fluid. Oxidation stability performance is superior and fairly consistent over the preferred ratio range. Additional performance increase is made available by the utilization of tris(2,4-di-tert-butylphenyl)phosphate as a secondary peroxide decomposer.

Corrosion Inhibitors

[0025] The anti-rust additive package for the lubricant composition can include a combination of food grade surface active anti-rust ingredients. Anti-rust lubricating additives which can be employed include food grade phosphoric acid, mono- and dihexyl ester compounds with tetramethyl nonyl amines. Examples include phosphoric acid, mono- and diisooctyl esters, reacted with tert-alkyl and (C<sub>12</sub>-C<sub>16</sub>) primary amines and phosphoric acid, mono- and dihexyl esters compounded with tetramethyl-nonylamines and (C<sub>12</sub>-C<sub>14</sub>) alkyl amines.

[0026] Additional corrosion inhibition is provided by utilization of 2-(8-Heptadecenyl)-4,5-di-hydro-III-imidazole-1-ethanol alone or in synergistic combination with N-Methyl-N-(1-oxo-9-octadecenyl)glycine. In some embodiments, the food grade anti-rust additives can include about 0.05% to about 2.0% by weight of the lubricating oil.

[0027] Additional performance benefits can be obtained by the addition of N,N-Bis(2-ethylhexyl)-ar-methyl-III-benzotriazole-1-methanamine, a cuprous metal deactivator, at about 0.10% by weight of the lubricating oil.

Anti-Wear Additives

[0028] Anti-wear additives for the lubricant composition can include food grade oil-soluble sulfur and/or phosphorus containing compounds. Compounds meeting this criteria include triphenyl phosphorothionate, tris(2 or 4)-C<sub>9</sub>-C<sub>17</sub>-branched alkylyphenylphosphorothionate and phosphorothioic acid, O,O,O-triphenyl ester, tert-butyl derivatives, alone or in combination, including about 0.25% to about 0.5% by weight of the lubricating fluid.

Anti-Foam

[0029] A dimethylpolysiloxane (viscosity greater than 300 centistokes (cSt)) for use in the lubricant composition can provide antifoam performance at treat rates ranging from about 20 to about 100 parts per million (PPM).

[0030] In some embodiments, effective amounts of the foregoing additives for use in a rotary screw air compressor is generally in the range from about 0.1 to about 3 weight percent for the antioxidants, about 0.05 to about 1.5 weight percent for the corrosion inhibitors, and about 0.05 to about 0.1 weight percent for the metal deactivators. Antiwear additization can be generally in the range of about 0.25 to about 0.50 weight percent. These weight percentages are based on the total weight of the lubricating fluid. More of less of the additives can be used depending upon the circumstances for which the final compositions are to be used.

Example 1

[0031] The following examples illustrate the practice of specific embodiments of the invention and comparison cases. These examples should not be interpreted as limitations of the scope of the invention.

Example 2

[0032] A food grade compressor fluid was prepared in a beaker by adding:

<table>
<thead>
<tr>
<th>% by weight</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.67%</td>
<td>acetylated monoglyceride with a viscosity of 15 cSt at 40°C and 88.73% by weight of a food grade polyglycol base fluid with a viscosity of 100.3 cSt at 40°C;</td>
</tr>
<tr>
<td>0.50%</td>
<td>Hexamethylenbism(3,5-di-tert-butyl-4-hydroxyhydrocinnamate);</td>
</tr>
<tr>
<td>0.50%</td>
<td>N-phenylbenzamine, reaction products with 2,4,4-trimethylpentene;</td>
</tr>
<tr>
<td>0.50%</td>
<td>THIODYETHYLNEBENZIANIMINE, reaction products with 2,4,4-trimethylpentene;</td>
</tr>
<tr>
<td>40 PPM</td>
<td>dimethylpolysiloxane.</td>
</tr>
</tbody>
</table>

Viscometrics of the sample were:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Viscosity (cSt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°C</td>
<td>18.3</td>
</tr>
<tr>
<td>40°C</td>
<td>91.5</td>
</tr>
<tr>
<td>Viscosity Index</td>
<td>222</td>
</tr>
</tbody>
</table>

Example 2

[0048] A food grade compressor fluid was prepared in a beaker by adding:

<table>
<thead>
<tr>
<th>% by weight</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.18%</td>
<td>acetylated monoglyceride with a viscosity of 15 cSt at 40°C and 74.72% by weight of a food grade polyglycol base fluid with a viscosity of 100.3 cSt at 40°C;</td>
</tr>
<tr>
<td>0.50%</td>
<td>Hexamethylenbism(3,5-di-tert-butyl-4-hydroxyhydrocinnamate);</td>
</tr>
<tr>
<td>0.50%</td>
<td>N-phenylbenzamine, reaction products with 2,4,4-trimethylpentene;</td>
</tr>
<tr>
<td>0.50%</td>
<td>THIODYETHYLNEBENZIANIMINE, reaction products with 2,4,4-trimethylpentene;</td>
</tr>
<tr>
<td>40 PPM</td>
<td>dimethylpolysiloxane.</td>
</tr>
</tbody>
</table>
[0053] e) 0.50% by weight of Tetrakis[methylene(3,5-di-t-butyl-4-hydroxyhydrocinnamate)]methane;
[0054] f) 0.50% by weight of N-phenyl-ar-(1,1,3,3-tetramethylbutyl)-1-naphthalenamine;
[0055] g) 0.50% by weight of BHT (butylated hydroxyl toluene, 2,6-di-t-butyl-p-cresol);
[0056] h) 0.50% by weight of BHA (butylated hydroxy anisole);
[0057] i) 0.50% by weight of phosphoric acid, mono- and diisoctyl esters, reacted with tert-alkyl and (C12-C14) primary amines;
[0058] j) 0.50% by weight of phosphoric acid, mono- and dihexyl esters compounded with tetramethylnonylarnines and (C12-C14) alkyl amines;
[0059] k) 0.25% by weight of Tri[2(or 4)-C9-C10-branched alkylphenyl]phosphorothioate;
[0060] l) 0.50% by weight of 2-(8-Heptadecenyl)-4,5-dihydro-1H-imidazole-1-ethanol;
[0061] m) 0.25% by weight of N-Methyl-N-(1-oxo-9-octadeconyl)glycine;
[0062] n) 0.10% by weight of N,N-Bis(2-ethylhexyl)-ar- methyl-1H-benzotriaiole-1-methylamine; and
[0063] o) 40 Parts Per Million (PPM) of a dimethylpolysiloxane. Viscometrics of the sample were:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Viscosity (cSt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°C</td>
<td>13.9</td>
</tr>
<tr>
<td>40°C</td>
<td>68.7</td>
</tr>
<tr>
<td>Viscosity Index</td>
<td>212.</td>
</tr>
</tbody>
</table>

Example 3

[0064] A food grade compressor fluid was prepared in a beaker by adding:
[0065] a) 37.86% by weight of a distilled, acetylated monoglyceride with a viscosity of 15 cSt at 40°C, and 56.04% by weight of a food grade polyglycol base fluid with a viscosity of 100.3 cSt at 40°C;
[0066] b) 0.50% by weight of Hexamethylenenebis(3,5-di-tbutyl-4-hydroxyhydrocinamate);
[0067] c) 0.50% by weight of N-phenylbenzenamine, reaction products with 2,4,4-trimethylpentene;
[0068] d) 0.50% by weight of Thiadiethylenebis(3,5-di-t-butyl-4-hydroxyhydrocinamate);
[0069] e) 0.50% by weight of Tetrakis[methylene(3,5-di-t-butyl-4-hydroxyhydrocinamate)]methane;
[0070] f) 0.50% by weight of N-phenyl-ar-(1,1,3,3-tetramethylbutyl)-1-naphthalenamine;
[0071] g) 0.25% by weight of BHT (butylated hydroxyl toluene, 2,6-di-t-butyl-p-cresol);
[0072] h) 0.50% by weight of BHA (butylated hydroxy anisole);
[0073] i) 0.50% by weight of phosphoric acid, mono- and diisoctyl esters, reacted with tert-alkyl and (C12-C14) primary amines;
[0074] j) 0.50% by weight of phosphoric acid, mono- and dihexyl esters compounded with tetramethylnonylarnines and (C12-C14) alkyl amines;
[0075] k) 0.25% by weight of Phosphorothioic acid, O,O-tri-n-pentyl ester, tert-derivatives;
[0076] l) 0.50% by weight of 2-(8-Heptadecenyl)-4,5-dihydro-1H-imidazole-1-ethanol;

Viscometrics of the sample were:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Viscosity (cSt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°C</td>
<td>6.7</td>
</tr>
<tr>
<td>40°C</td>
<td>32.2</td>
</tr>
<tr>
<td>Viscosity Index</td>
<td>173.</td>
</tr>
</tbody>
</table>

Example 4

[0080] A food grade compressor fluid was prepared in a beaker by adding:
[0081] a) 56.94% by weight of a distilled, acetylated monoglyceride with a viscosity of 15 cSt at 40°C, and 38.36% by weight of a food grade polyglycol base fluid with a viscosity of 100.3 cSt at 40°C;
[0082] b) 0.50% by weight of Hexamethylenenebis(3,5-di-tbutyl-4-hydroxyhydrocinamate);
[0083] c) 0.50% by weight of N-phenylbenzenamine, reaction products with 2,4,4-trimethylpentene;
[0084] d) 0.50% by weight of Thiadiethylenebis(3,5-di-t-butyl-4-hydroxyhydrocinamate);
[0085] e) 0.50% by weight of Tetrakis[methylene(3,5-di-t-butyl-4-hydroxyhydrocinamate)]methane;
[0086] f) 0.50% by weight of N-phenyl-ar-(1,1,3,3-tetramethylbutyl)-1-naphthalenamine;
[0087] g) 0.50% by weight of BHT (butylated hydroxyl toluene, 2,6-di-t-butyl-p-cresol);
[0088] h) 0.50% by weight of BHA (butylated hydroxy anisole);
[0089] i) 0.50% by weight of phosphoric acid, mono- and diisoctyl esters, reacted with tert-alkyl and (C12-C14) primary amines;
[0090] j) 0.10% by weight of phosphoric acid, mono- and dihexyl esters compounded with tetramethylnonylarnines and (C12-C14) alkyl amines;
[0091] k) 0.10% by weight of N,N-Bis(2-ethylhexyl)-ar- methyl-1H-benzotriaiole-1-methylamine; and
[0092] l) 40 Parts Per Million (PPM) of a dimethylpolysiloxane. Viscometrics of the sample were:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Viscosity (cSt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°C</td>
<td>6.7</td>
</tr>
<tr>
<td>40°C</td>
<td>32.2</td>
</tr>
<tr>
<td>Viscosity Index</td>
<td>173.</td>
</tr>
</tbody>
</table>

Example 5

[0093] A food grade compressor fluid was prepared in a beaker by adding:
[0094] a) 75.92% by weight of a distilled, acetylated monoglyceride with a viscosity of 15 cSt at 40°C, and 18.98% by weight of a food grade polyglycol base fluid with a viscosity of 100.3 cSt at 40°C;
[0095] b) 0.50% by weight of Hexamethylenenebis(3,5-di-t-butyl-4-hydroxyhydrocinamate);
c) 0.50% by weight of N-phenylbenzenamine, reaction products with 2,4,4-trimethylpentene;

d) 0.50% by weight of Thiodiethylenebis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate);

e) 0.50% by weight of Tetrak[s][methylene(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)]methane;

f) 0.50% by weight of N-phenyl-ar-(1,1,3,3-tetramethylbutyl)-1-naphthalenamine;

g) 0.50% by weight of BHT (butylated hydroxytoluene, 2,6-di-tert-butyl-p-cresol);

h) 0.50% by weight of BHA (butylated hydroxyanisole);

i) 0.50% by weight of phosphoric acid, mono- and diisooctyl esters, reacted with tert-alkyl and (C_{12}-C_{14}) primary amines;

j) 0.50% by weight of phosphoric acid, mono- and dihexyl esters compounded with tetramethylnonolamines and (C_{12}-C_{14}) alkyl amines;

k) 0.10% by weight of NN-Bis(2-ethylhexyl)-armethyl-111-benzo-triazole-1-methanamine; and

l) 40 Parts Per Million (PPM) of a dimethylpolysiloxane.

Viscometrics of the sample were:

| Viscosity 100°C | 4.7 centistokes (cSt); |
| Viscosity 40°C  | 22.0 centistokes (cSt); and |
| Viscosity Index | 132. |

Example 6

A food grade compressor fluid was prepared in a beaker by adding:

a) 90.16% by weight of a distilled, acetylated monoglyceride with a viscosity of 15 cSt at 40°C and 4.75% by weight of a food grade polyglycol base fluid with a viscosity of 100.3 cSt at 40°C;

b) 0.50% by weight of Hexamethylenebis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate);

c) 0.50% by weight of N-phenylbenzenamine, reaction products with 2,4,4-trimethylpentene;

d) 0.50% by weight of Thiodiethylenebis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate);

e) 0.50% by weight of Tetrak[s][methylene(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)]methane;

f) 0.50% by weight of N-phenyl-ar-(1,1,3,3-tetramethylbutyl)-1-naphthalenamine;

g) 0.50% by weight of BHT (butylated hydroxytoluene, 2,6-di-tert-butyl-p-cresol);

h) 0.50% by weight of BHA (butylated hydroxyanisole);

i) 0.50% by weight of phosphoric acid, mono- and diisooctyl esters, reacted with tert-alkyl and (C_{12}-C_{14}) primary amines;

j) 0.50% by weight of phosphoric acid, mono- and dihexyl esters compounded with tetramethylnonolamines and (C_{12}-C_{14}) alkyl amines;

k) 0.10% by weight of NN-Bis(2-ethylhexyl)-armethyl-111-benzo-triazole-1-methanamine; and

l) 40 Parts Per Million (PPM) of a dimethylpolysiloxane.

Viscometrics of the sample were:

| Viscosity 100°C | 3.6 centistokes (cSt); |
| Viscosity 40°C  | 16.3 centistokes (cSt); and |
| Viscosity Index | 88. |

It will be appreciated by those skilled in the art that while the invention has been described above in connection with particular embodiments and examples, the invention is not necessarily so limited, and that numerous other embodiments, examples, uses, modifications and departures from the embodiments, examples and uses are intended to be encompassed by the claims attached hereto. The entire disclosure of each patent and publication cited herein is incorporated by reference, as if each such patent or publication were individually incorporated by reference herein. Various features and advantages of the invention are set forth in the following claims.

1. A food grade lubricant composition for use with a rotary screw compressor, the lubricant composition comprising: about 5 to about 95 weight percent of a distilled, acetylated monoglyceride; and

2. The lubricant composition of claim 1 wherein the [alpha]-Butyl-omega-hydroxypropoxy(oxypropylene) poly(oxypropylene) is produced by random condensation of an approximately 1:1 mixture by weight of ethylene oxide and propylene oxide with butanol.

3. The lubricant composition of claim 1 wherein the [alpha]-Hydro-omega-hydroxypoly(oxyethylene) poly(oxypropylene) is produced by random condensation of mixtures of ethylene oxide and propylene oxide including about 25 to about 75 percent by weight of ethylene oxide.

4. The lubricant composition of claim 1 wherein any polyalkylalkylene glycols include homopolymers.

5. The lubricant composition of claim 1 wherein any polyalkylalkylene glycols include random copolymers.

6. The lubricant composition of claim 1 wherein any polyalkylalkylene glycols include block copolymers.

7. The lubricant composition of claim 1 and further comprising at least one of:

   a) an effective amount of at least one antioxidant; and

   b) an effective amount of at least one ferrous metal corrosion inhibitor.

8. The lubricant composition of claim 1 and further comprising at least one of:

   a) a cuprous deactivator; and

   b) a ferrous metal corrosion inhibitor;
about 0.05% to about 0.10% weight percent of a cuprous metal deactivator;
about 0.25% to about 0.50% weight percent of at least one anti-wear and lubricity additive; and
about 20 parts per million to about 100 parts per million of a dimethylpolysiloxane antifoam additive.

9. A method of lubricating a rotary screw air compressor wherein the compressor is continuously run for long time intervals without changing out the lubricant which comprises using as the lubricant the composition of claim 7.

10. A method of lubricating a rotary screw air compressor wherein the compressor is continuously run for long time intervals without changing out the lubricant which comprises using as the lubricant the composition of claim 8.

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