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TRANSLUCENCY OF LUBRICATING OILS

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This invention relates to the improvement of the translucency of lubricating oils.

Lubricating oils generally contain undesirable constituents which render the oils darker and more opaque to light. This is considered a disadvantage from the sales point of view and, up to now, many oils have been treated to render them more translucent and hence of an improved appearance. The main method has been to pass the oil through a filter bed containing absorbent material which removes the bulk of these undesirable constituents. This method has the disadvantage of involving considerable extra plant and some loss of oil in the filter bed.

It is an object of the present invention to provide a simpler method which avoids the said disadvantages and achieves its purpose by oxidation of the undesirable constituents. Oxidation has never to our knowledge been previously suggested for the simple reason that lubricating oils are sensitive to and are deteriorated by oxidation. In fact, it is a prime object of the indutsry to inhibit oxidation reactions in lubricating oil and many oils actually contan oxidation inhibitors.

It is a further object of the present invention to give the oils a further treatment, after the oxidation, whereby their translucency may be improved to subtsantial transparency and even to water whiteness. This will provide the possibility of preparing from ordinary lubricating oil a water white oil which will be acceptable to the public as a medicinal oil and which will be more economical to produce.

The oxidation, according to the present invention, has been made practicable by the discovery that, in the presence of an oxidation inhibitor, oxidising agents react preferentially with the undesirable constituents and have no appreciable reaction with the oil itself.

According to the present invention, therefore, the method comprises positively treating a lubricating oil with an oxidising agent in the presence of an oxidation inhibitor.

By the term "oxidation inhibitor," we mean any compound which will inhibit or reduce the rate of the oxidation of lubricating oils, generally or of any given lubricating oil whose translucency is required to be improved by the present invention. Many such compounds are at present in commercial use and the term is well understood in the art. The inhibitors which are preferred for use with the present invention, however, are positive metals; salts of highly positive metals with weak acids; and oxides, peroxides and hydroxides of highly positive metals. These prefered inhibitors are hereinafter referred to collectively by the term "highly positive metal inhibitors."

By the term "highly positive metals" is meant magnesium and those metals of more positive potential than magnesium in the electromotive series. By the term "weak acids" is meant those acids having a dissociation constant of 1×10^{-2} (at 20° C.) or less.

Of the highly positive metal inhibitors, the salts of highly positive metals with inorganic weak acids have

been found particularly useful in their inhibiting action, e. g. the borates and phosphates, though the acetates and benzoates have also shown good results. Sodium metal is also particularly useful.

Many of the highly positive metal inhibitors are themselves oxidising agents and could be used alone in the treatment of the present invention so as to oxidise the undesirable constituents at the same time as inhibit oxidation of the oil. The mere use of a single inhibitor is not, however, part of the present application and would, in any event, be an expensive method of oxidation.

The preferred oxidising agent for use with the present invention is air or oxygen since these would be relatively economical, but hydrogen peroxide is equally efficacious in oxidising action.

As regards the proportions of treating agents, these will depend to a large extent on the type of oil treated. We have found that the proportion of inhibitor used is preferably not less than ½% by weight of the oil treated and that good results are obtained using a proportion of 2%. The amount of oxidising agent cannot be definitely stated in the case of using air or oxygen since these gases will normally be bubbled through the oil until the required translucency is obtained. In the case of hydrogen peroxide, 5% of this agent by weight of the oil treated has been found to give useful results.

The treatment of the lubricating oil with an oxidising agent is essentially of a positive nature and the present invention thus excludes the effecting of this treatment by such slow and incidental oxidation which occurs when lubricating oil is circulated in an engine in the course of its normal use.

We have found that the oxidation is preferably effected at 100–200° C. for at least five minutes, though the invention is useful at temperatures outside this range.

When the oxidation is performed in the presence of one of the highly positive metal inhibitors, the resultant bleached oil is found to be somewhat cloudy due to the presence of a colloidal material whose nature is uncertain but which appears to be of a soap-like nature. Moreover, the resultant bleached oil showed a reduced resistance to further oxidation when not protected by an oxidation inhibitor.

We have found that this resultant bleached oil may be given improved translucency, even to the point of complete transparency in some cases, and improved oxidation resistance by coagulating and removing the said colloidal material, in the preferred method, the coagulation is effected by adding to the bleached oil a hydrocarbon-insoluble polar liquid and the coagulated material is removed by centrifuging or, less preferably, by filtration or settling. Alternatively, the coagulation could be effected electrically.

By these further steps of coagulating and removing the colloidal material, complete transparency or water whiteness of the oil can be obtained in many cases and this oil product may even be used as medicinal oil. The latter may thus be produced by a more economical method than has heretofore been commercialy practised.

Examples of such polar liquids which may be used for coagulation in the manner described are water, methyl or ethyl alcohol, and glycerol. Glycerol promotes more rapid settling but water will generally be preferred for economy.

The amount of coagulant does not appear to be critical provided sufficient is used to effect the coagulation desired. The amount of coagulant will generally be between 1% and 12% by weight of the oil treated. Up to 25% has been used successfully but it is uneconomical to use more coagulant than actually necessary to effect the desired coagulation. The minimum necessary to achieve complete coagulation will depend on the amount of colloidal material present which in turn will depend on the amount of impurities originally present in the oil and on the extent of the oxidation treatment given to the oil. Thus a greater amount of coagulant is necessary when treating an oil which has already received substantial use in an engine.

The transparency achieved as described above may even be of the degree of water whiteness and acceptable to the public as a medicinal oil. To achieve maximum water whiteness, it may be useful to combine the treatment of the present invention with one of the prior art decolourising methods, e. g. a clay treatment. The latter would preferably follow the treatment of the present invention. Whereas a clay treatment is wasteful of oil and relatively uneconomical for merely improving the translucency of lubricating oils, as described above, such waste can be tolerated for the more expensive and refined product of medicinal oil.

The invention is illustrated by the following examples in which percentages are by weight of the oil treated:

Example 1

The following experimental results were obtained by treating in accordance with the invention an oil of the type sold under the registered trademark Marvelube 30 but which has not previously been treated to render it translucent. The translucency obtained in this oil is expressed as a percentage of the translucency of the oil sold under the registered trademark Marrvelube 10 as already treated with clay according to prior art methods to render it translucent and ready for salt to the public. A red filter was used.

Treatment	Percent Transmission
No treatment	67
Heated 16 hours at 100° C	54
2% Na_2O_2 added at 130° C. and air bubbled through sample:	
For 3 hours	72
For 13 hours	75
For 100 hours	90
1% sodium metaborate added at 120° C. and air bubbled through sample for 5 hours	96
2% $NaBO_2$ added at 100° C. and O_2 (tank oxygen) bubbled through sample for 10 hours	75
2% $NaBO_2$ added at 130°C. and O_2 (tank oxygen) bubbled through sample for 12 hours	86
2% Sodium acetate and 5% of 30% H_2O_2 added at 100° C. after 2 hours	84
2% Sodium acetate and 5% of 30% H_2O_2 added at 90° C. after 3 hours	76
2% Na_2O_2 and 5% of 30% H_2O_2 added at 90° C. after 3 hours	78
2% Sodium perborate and 5% of 30% H_2O_2 added at 100° C. after 12 hours	82

Other inhibitors used under similar conditions as above and found to be efficacious were calcium hypochlorite, sodium amalgam, sodium thiosulphate, sodium carbonate, and trisodium phosphate.

Example 2

A number of samples of unclayed Marvelube 30 (registered trademark) were bleached by bubbling air through them at different temperatures and for different times in the presence of a highly positive metal inhibitor. The samples of bleached oil, except for two samples, were then given a further treatment by adding different amounts of water to coagulate the colloidal material therein and thereafter centrifuging to remove the coagulated material.

The following table indicates the light transmission values of the final samples calculated as percentages of the light transmission of the white oil sold under the registered trademark Stanolax through both red and green filters. The table also indicates the same values obtained from Marvelube 20 (registered trademark) as already treated with clay according to prior art methods to render it translucent and ready for sale to the public. The table indicates the temperature, time of oxidation, amount and type of inhibitor, and amount of water coagulant used in the treatment of each sample.

Oil	Treatment Temp., ° C.	Time of oxidation (min.)	Inhibitor	Amount of water coagulant, percent	Percent Transmission	
					Red Filter	Green Filter
Stanolax		none			100	100
Marvelube 20		none			85	55
Unclayed Marv. 30		none			66	28
Do	130	30	1% Na	1	89	59
Do	130	60	1% Na	1	92	66
Do	130	120	1% Na	2	94	72
Do	130	240	1% Na	4	99	86
Do	130	480	1% Na	6	95	80
Do	130	720	1% Na	8	99	87
Do	130	[1] 480	1% Na		78	35
Do	130	[1] 720	1% Na		84	42
Do	160	15	1% Na	1	89	62
Do	160	30	1% Na	1	99	87
Do	180	15	1% Na	1	97	84
Do	180	30	1% Na	1	96	76
Do	200	5	1% Na	1	94	72
Do	200	5	5% NaOH	1	93	60

[1] These samples not treated with the water and centrifuged.

Example 3

The oils sold under the names Marvelube 20 (registered trademark) and Canadian Tire Corporation 10, both oils already treated with clay according to prior art methods to render them translucent and ready for sale to the public, were separately used in an automobile engine with no filter for 1500 miles. Samples of the dirty oils were then treated by adding 5% of sodium and bubbling air through the oil at 160° C. for different durations of time. The resultant bleached samples were then further treated by adding 10% of water to coagulate the colloidal material therein and centrifuging to remove the coagulated material.

The transmission values of the final samples are given in the table below as a percentage of the white oil sold under the registered trademark Stanolax, through green, red and blue filters.

	Time of oxidation treatment	Percent Transmission with filters of—		
		Green	Red	Blue
Marvelube 20	untreated	3	29	
Do	30 min	46	85	
Do	3 hr	95	100	
Do	6 hr	[1] 99	100	53
Canadian Tire Corporation 10	9 hr	64	96	

[1] This oil sample was approaching the water whiteness of medicinal oil and the blue filter had to be used to distinguish it from white oil.

Example 4

A sample of unclayed Marvelube 30 (registered trademark) was treated to render it of such water whiteness as to be saleable as medicinal oil. Air was bubbled through the sample for 12 hours at 160° C., 5% of sodium having been added to the sample. 10% of water was then added and the coagulated material was removed by centrifuging. The sample was then further treated by the addition of 7% of the clay sold under the registered trademark Superfiltrol and subsequently filtered to remove the clay with absorbed impurities. The transmission values, as described in Example 3, were found to be as follows with the various coloured filters: Green—100, Red—100, Blue—65. This oil sample was approaching the water whiteness of medicinal oil and the blue filter had to be used to distinguish it from white oil.

The colorimeter used in the above examples for the transmission tests was the type commonly known as a Lumitron Model 400.

It has been found that the present invention serves to refine the oils treated as well as improve their translucency. After treatment according to the present invention, it is found that there is a definite improvement in the viscosity index of the oils.

As a by-product of one aspect of the present invention, it is found that the colloidal material, coagulated and removed from the oil as described above, is useful as a surface active agent.

We claim:

1. A method for improving a lubricating oil comprising adding sodium to the oil; bubbling air through the oil to oxidize impurities; adding water to the oil to coagulate colloidal material therein; and removing the coagulated material from the oil.

2. A method for improving a lubricating oil comprising treating the oil with an oxidising agent in the presence of sodium metal.

3. A method as claimed in claim 2 effected at 100–200° C. for at least five minutes.

4. A method as claimed in claim 2 in which the sodium is in the proportion of 0.5–2.0% by weight of the oil.

5. A method for improving a lubricating oil comprising bubbling air through the oil in the presence of sodium metal at a temperature of at least 120° C.

6. A method as claimed in claim 5 in which the sodium is in the proportion of 0.5–2.0% by weight of the oil.

7. A method for improving a lubricating oil comprising bubbling air through the oil at a temperature of at least 120° C. in the presence of sodium metal; coagulating coloidal material therein; and removing the coagulated material from the oil.

8. A method for improving a lubricating oil comprising bubbling air through the oil at a temperature of at least 120° C. in the presence of sodium metal; adding water to the oil to coagulate colloidal material therein; and removing the coagulated material from the oil.

9. A method for improving a lubricating oil comprising intimately contacting the oil at 100–200° C. with air in the presence of sodium metal, then treating the oil with water to coagulate colloidal material therein and removing the coagulated material therefrom.

10. A method as claimed in claim 9 in which the treatment with air is effected for at least five minutes.

11. A method as claimed in claim 9 in which 1–12% of the water is used by weight of the oil treated.

12. A method as claimed in claim 9 in which the removal of the coagulated material is effected by centrifuging.

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