

# UNITED STATES PATENT OFFICE

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## DIBASIC ACID DRYING OILS

Latimer D. Myers, Cincinnati, and Victor J. Muckerheide, Silverton, Ohio, assignors to Emery Industries, Inc., Cincinnati, Ohio, a corporation of Ohio

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This invention relates to a method of improving the drying properties of oils of the so-called "drying" and "semi-drying" types. It is directed particularly to a method of treating such oils for the purpose of accelerating the speed with which films of the oil dry and harden when exposed to air and heat. It is also an objective of the present invention to improve the characteristics of water resistance and impermeability of films produced from such oils.

The invention, briefly, is based upon a discovery we have made that these desirable results may be obtained by treating the oils at elevated temperature with a di-basic aliphatic acid. In the course of this treatment, speaking generally and with some conjecture, it is believed that the di-basic acid selectively displaces saturated and mono-unsaturated components of the oil; that is, selectively displaces non-drying constituents. At any rate non-drying components of the oil are liberated and these are removed from the oil, as by distillation. The drying and film forming properties are thus improved.

In the past, a variety of methods has been proposed for effecting the non-drying constituents, for example, to remove them or sequester them in such condition that the unsaturated drying components may proceed to dry when exposed in film formation. However, one of the chief difficulties in these methods has been to isolate or modify the non-drying constituents without also adversely affecting the unsaturated compounds to which the oil owes its drying properties. In the present invention the treatment, so far as we have been able to determine, is substantially selective, saturated bodies such as stearic acid, and mono-unsaturated bodies such as oleic acid being displaced from the glyceride compounds from which the oil is made up, while the di-basic acids either enter the reaction to form other compounds which have improved drying characteristics or at least do not impair the drying characteristics of the remaining doubly and triply unsaturated bodies.

In the process of the present invention, therefore, the oil to be improved is heated with the di-basic acid treating reagent to effect reaction of the two. Following this operation, the non-drying components which have been displaced or liberated are removed from the oil and recovered as

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free fatty acids. Thus, a typical procedure of the present invention is as follows:

### EXAMPLE I

#### Linseed oil and azelaic acid

A mixture of

	Parts
Refined linseed oil, I. V. 174.6	600
Azelaic acid	60

is heated rapidly to a temperature of approximately 300° C. in an atmosphere of carbon dioxide. After heating for one hour under atmospheric pressure, the liberated free fatty acids are removed by vacuum distillation. The distillation may continue for about 1½ hours, or continue until the acid value of the still contents is reduced to approximately 8.1. The distillate, which in a typical instance amounted to 20.4% of the starting materials, is soluble in petroleum ether showing freedom from di-basic acids; the modified linseed oil withdrawn from the still had a viscosity of 34 poises and after the addition of drier a film on tin was completely dry in 24 hours, whereas a sample of the same linseed oil which had been bodied and to which the same amount of drier had been added required 72 hours to dry completely.

There are several controls to be observed in the practice of the invention; these are briefly: the di-basic acid selected as treating reagent, the quantity used and the time and temperature of distillation. The process is adapted to be applied to oils of the drying and semi-drying types including linseed oil, soya bean oil, perilla, fish oils such as sardine oil, menhaden and the like. Obviously, these oils differ in composition from one another, even from batch to batch, and the final products, therefore, will also differ in their properties.

As previously indicated, the di-basic acid constituting the treating reagent is caused to react displacing the non-drying components of the oil being treated and these are then taken off by distillation. It is requisite, therefore, that the di-basic acid have a boiling point above that of the displaced bodies; otherwise, the di-basic acids would be volatilized and removed to no useful end. Azelaic acid, sebacic acid, and adipic acid are representative di-basic acids which have this property. All such acids conveniently may be classi-

fied as di-basic aliphatic acids having a vapor pressure below that of the non-drying bodies which they displace upon being heated with a drying or a semi-drying oil. It is to be noted that this classification excludes phthalic acid or its anhydride which, though it is a common di-basic acid, has a vapor pressure so high that it may not be used for the present purpose because of sublimation. However, aromatic di-basic acids may be employed in the practice of the present invention if their boiling point is sufficiently high; this characteristic, for example, may be obtained by the addition of side chains.

The di-basic acids just described may be obtained from any suitable source, sebacic acid, for example, from castor oil, and azelaic by the oxidation of unsaturated fatty glycerides or fatty acids like oleic. In place of adding di-basic acids per se to the oil which is to be treated, di-basic acids found in admixture with other products resulting from the oxidation of predominantly unsaturated fatty glycerides and their acids may be used directly in the present process. For example, one may oxidize oleic acid, remove the oxidizing reagent, and proceed to use the resulting mixture without endeavoring to isolate the resulting di-basic acid, azelaic, from the other mono-basic or di-basic acid constituents which also were formed during oxidation. In this case, the azelaic acid (and other di-basic acids which may be present in smaller proportion) react in the indicated manner with the oil being treated while the presence of the mono-basic and by-product acid compounds not only does not impair the result, but these simultaneously are separated from one another. It is to be observed in this respect that the present process is useful as a means of separating mono-basic and by-product acid compounds. The use of such mixed oxidation products is particularly economical inasmuch as separation costs are avoided and non-drying oils which are abundant in oleic acid may be used to contribute to the manufacture of drying oils of greater value. Further details of these aspects of the present invention are given at a later point in the specification, but it also may be stated here that in place of adding either di-basic acid per se or mixed products containing di-basic acid, the invention also embraces the process in which free di-basic acids are produced, in situ, in the oil to be improved and from a portion of it. For instance, in this case, a part only of the oil which is to be treated is oxidized to form di-basic acids; following this treatment the remainder of the oil is added and the total is subjected to heat during which non-drying components are displaced by the liberated di-basic acids and the latter are then distilled away. This method is particularly useful for semi-drying oils like soya bean oil.

The quantity of di-basic acid employed in the invention is an amount sufficient to displace all, or substantially all of the mono-unsaturated acids as, for example, oleic. We have determined that one part of azelaic acid, which is a representative di-basic acid, will displace substantially 2.9 parts of constituent to be removed, calculated as oleic acid, which is a representative mono-unsaturated non-drying constituent. This relationship, therefore, serves as a useful guide in determining the quantity of di-basic acid to be added to the oil, with appropriate adjustments in this ratio being made on a mol to mol basis where the non-drying constituent to be liberated is other than oleic acid. Thus, the quantity of di-basic acid employed in the practice of the present in-

vention is usually within the range of from approximately 10 to 20% by weight of the oil.

In the step of reacting the di-basic acid body with the oil, the temperature preferably is held in the neighborhood of 300 to 340° C. and usually for a period of about an hour. The rate of heating is not of any great importance except of course that it should not be so rapid that there is a tendency for the oil to become overheated, nor should it be so slow that bodying proceeds beyond a desirable point. There is, also, some tendency of the oil to darken in color when heated for longer periods. A blanket of a non-oxidizing gas such as carbon dioxide or nitrogen employed in the treating chamber helps to exclude air and minimizes this tendency.

The reaction may take place directly in a still pot or a vessel arranged for vacuum distillation. Thus, when the reaction period is ended, a vacuum is drawn and the displaced vapors are cooled and condensed for recovery. The distillate, generally speaking, is free fatty acids and the iodine value of the distillate represents free fatty acids having substantially lower iodine value than the iodine value of the oil being treated; for example, in the case of linseed oil the iodine value of the displaced acids is 30 to 40 points lower than the iodine value of the original oil. Distillation is continued until free fatty acid content of the oil in the still is brought to the desired point, usually between 2 and 5%. When the free fatty acid content of the oil has been reduced sufficiently, the oil is cooled and is then ready for use.

On the other hand, knowing that one part of azelaic acid can displace 2.9 parts of oleic acid from the oil being treated, the quantity of distillate recovered, in relation to the quantity of di-basic acid added, may be used as a general guide to indicate the point at which distillation may be discontinued. In following this technique, however, the nature of the distillate should be determined and compensations should be made on a mol to mol basis if the distillate is other than oleic acid.

In the case where mixed oxidation products are employed as a source of di-basic acids, the pelargonic acid present in the mixed oxidation distills over before the liberated non-drying constituents. Therefore, if the distillate is measured as a means of determining the point at which distillation is to be stopped the pelargonic acid and by-product acids must also be taken into consideration. In any event the main point is to continue distillation until the oil exhibits the desired improved drying properties. If distillation is stopped too soon, free fatty acids displaced by the di-basic acids will still be present in the oil and may impair its drying qualities.

It is not usually desirable to continue distillation until the last traces of free fatty acid are removed because the continued heating will increase the body of the oil beyond the desired point. Generally speaking, distillation is continued until no more appreciable quantities of fatty acid are distilled from the oil being treated and until the residue in the still has the desired acid value.

Other typical examples illustrating the practice of the invention are as follows:

#### EXAMPLE II

##### *Treatment of soya bean oil with azelaic acid*

24 parts of azelaic acid are added to 150 parts of refined soya bean oil contained in a still arranged for vacuum distillation. The mixture is heated to 300° C. for 1 hour in an atmosphere of

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carbon dioxide. Vacuum is then applied gradually until the pressure in the still has dropped to 50 mm. of mercury and at the same time the temperature is gradually raised to 325° C. in order to provide a uniform rate of distillation of the liberated fatty acids.

Distillation is continued until the acid value of the still contents has dropped to 1.0 and the viscosity has reached 30 poises. The distillate which amounts to 28.8% of the total starting materials consists of fatty acids with an average combining weight of 278 and contains less than 1% of azelaic acid.

The oil remaining in the still is a dark straw color and is used to prepare 20 gallon varnish having a viscosity of two poises. This varnish is completely dry in 18 hours compared to 30 hours required for an identical varnish which has been prepared from soya bean oil, which has been bodied but not otherwise treated.

The dried varnish panels are immersed in boiling water for 15 minutes. After this treatment the varnish prepared from the azelaic treated soya bean oil shows only a trace of whitening while the varnish prepared from the untreated soya is completely white.

## EXAMPLE III

*Treatment of sardine oil with azelaic acid*

Azelaic acid, 40 parts and refined sardine oil, 700 parts, are heated in a still to 300° C. in an atmosphere of CO<sub>2</sub> for 45 minutes and then subjected to distillation under a vacuum of 5 mm. of mercury until the acid number of the still content has been reduced to 2.2. The final temperature is 315° C.

The distillate amounts to 14.1% of fatty acids having an iodine value of 97.2. The still residue has a viscosity of 33.0 poises and with the addition of an appropriate amount of drier, becomes completely dry in 24 hours. A comparative test on untreated sardine shows drying is very slow and even after 120 hours the film is slightly tacky.

## EXAMPLE IV

*Treatment of sardine oil with adipic acid*

A mixture of

	Parts
Sardine oil.....	100
Adipic acid.....	20

is distilled under vacuum for a period of 30 minutes and at a final temperature of 340° C. The 36.3 parts of distillate collected contained 24.7 parts of fatty acids and 11.6 parts of adipic acid, indicating that 42% of the adipic acid has reacted.

The residue amounting to 83.7 parts is a heavy viscous oil which dries in 24 hours, compared to over 120 hours for the original oil. The adipic acid in the distillate may be recovered for reuse in succeeding batches.

## EXAMPLE V

*Treatment of sardine oil with sebacic acid*

A mixture of

	Parts
Sardine oil.....	100
Sebacic acid.....	20

is heated in a vacuum still, the temperature being raised from 20° C. to 340° C. in 30 minutes.

The distillate which is obtained contains 22.5 parts of fatty acids having an iodine value of 87.0 and 6.7 parts of sebacic acid, indicating that

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approximately  $\frac{2}{3}$  of the sebacic acid used has reacted with the sardine oil.

The residue amounting to 90.6 parts is a heavy bodied oil which with the addition of drier dried to a hard film in 24 hours, compared to over 120 hours required for untreated oil.

## EXAMPLE VI

*Treatment of linseed oil with mixed oxidation products*

According to this example linseed oil is treated with a mixed oxidation product containing di-basic acid.

The mixed oxidation product is prepared by treating oleic acid with an oxidizing reagent consisting preferably of one part of chromic acid, 2½ parts of concentrated sulphuric acid and 4 parts of water in the proportion of approximately 50 parts of oleic acid to approximately 472 parts of oxidizing reagent. During the oxidation of the oleic acid the temperature is not allowed to exceed approximately 90° C. When the reaction is complete the spent solution is drawn off and the oxidizing mixture then consists of approximately 33-35% of di-basic acids, chiefly pelargonic, 40-45% of mono-basic acids, chiefly pelargonic, and about 20-25% of low iodine fatty acids. This mixture usually is green in color and it is desirable that this green color be removed by acid washing, otherwise the oil resulting from treatment with the product will be very dark. A mixture of 600 parts of refined linseed oil of which the drying properties are to be improved and 150 parts of these mixed oxidation products of oleic acid are heated in a vacuum still for 1 hour at 300° C. in an atmosphere of carbon dioxide. The pressure is gradually reduced to remove low boiling acids, the first distillate amounting to 61.8 parts having a combining weight of 159 is obtained in 1 hour at a final vacuum of 100 mm.

The distillation is continued for 1½ hours, the temperature being raised to 318° C. and the vacuum dropped to 5 mm. and 197.2 parts of distillate having a combining weight of 269.2 collected.

The residue has an acid value of 1.6 and a viscosity of 45 poises. After adding drier, films are formed on tin which dry in 24 hours compared to 72 hours for bodied untreated linseed oil.

## EXAMPLE VII

*Improving drying properties of soya bean oil by partial oxidation*

400 parts of refined soya bean oil (125.1 I. V.) is treated with 1295 parts of a chromic acid solution consisting of 1 part chromic oxide, 2.5 parts of sulfuric acid, and 4 parts of water, at 80-90° C. until the chromic acid is completely reduced as indicated by the green color of the solution.

The mixture is allowed to stand for about 1 hour to obtain a clear separation of the oily top layer amounting to 397 parts. The oily layer is drawn off and heated and agitated with 10 parts of concentrated hydrochloric acid to remove traces of chromic salts and then washed with water until free of mineral acidity.

The 371 parts of partially oxidized oil which are recovered is heated to 300° C. for 1 hour in an atmosphere of CO<sub>2</sub>. A small quantity of low boiling acids are condensed during this treatment. The still is then gradually evacuated and the temperature raised slowly until a vacuum of 2 mm. of mercury and a temperature of 325° F. is reached. After about 3 and ½ hours, the vis-

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cosity of the oil remaining in the still has increased to 29 poises and the acid number has dropped to 1.0. The distillate consists of fatty acids having an iodine value of 92.9 and represents 18.4% of the original oil.

.1% lead and .01% cobalt (as naphthenates) are added to the residual oil which then dries completely in 42 hours while bodied soya bean oil, 27 poises, containing the same percentages of driers, is still quite tacky after 72 hours.

#### EXAMPLE VIII

##### *Improving drying of cottonseed oil*

Of a total batch of 380 parts of cottonseed oil, 115 parts thereof are oxidized with 1854 parts of chromic acid solution; the spent oxidizing solution and traces of chromic salts are removed, as described in the preceding example. 106 parts of mixed oxidating products are recovered from this treatment and these mixed oxidating products are added to the 265 parts remaining from the original batch of cottonseed oil. This admixture is heated to 300° C. for 45 minutes under atmospheric pressure. Vacuum is then gradually applied and the temperature raised slowly until after 2 and ½ hours the temperature has been increased to 325° C. and the pressure reduced to 5 mm. 104.8 parts of distillate consisting of fatty acids having an iodine value of 77.6 is obtained. The residue in the still which has an acid number of .5, although not possessing as good drying properties as other oils processed in the same manner, still dries in 30 hours to yield a fairly good film, while the untreated oil shows scarcely any signs of drying even after days and could hardly be considered usable in even the cheapest paints.

#### EXAMPLE IX

##### *Improving the drying properties of soya bean by oxidizing part*

To improve the drying properties of 450 parts of soya bean oil, 100 parts are treated with 2061 parts of chromic acid solution containing 1 part chromic oxide, 2.5 parts concentrated sulfuric acid and 4 parts of water until no further reaction takes place. The oxidized oily layer is drawn off and treated with concentrated sulfuric acid to remove chromic salts and the traces of mineral acidity removed by neutralization with alkali, 87.6 parts are recovered.

The oxidized portion and the 350 parts of untreated oil are heated to 300° C. for 1 hour and then the free fatty acids distilled at 25 mm. during a period of 2 and ½ hours until the oily residue in the still has been reduced to 2.2 acid value and has bodied to 21.0 poises.

With the addition of .1% lead and .01% cobalt, this oil dries in 24 hours while bodied soya bean oil with the same amount of drier is still quite tacky after 72 hours.

Having described our invention, we desire to be limited only by the substance of the claims which follow:

1. The method of liberating non-drying constituents from an oil in the class consisting of drying and semi-drying oils for the purpose of improving its drying properties, which method comprises treating the oil at elevated temperature with an aliphatic di-carboxylic acid to displace non-drying constituents from the oil and which itself has a vapor pressure lower than the vapor pressure of the displaced constituents, and then

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liberating the non-drying constituents by distilling them from the oil.

2. The method of improving the drying properties of linseed oil which comprises treating the linseed oil with azelaic acid at an elevated temperature sufficiently high to permit the azelaic acid to displace non-drying constituents of the linseed oil, and removing the displaced constituents from the oil by distillation.

3. The process of improving the drying properties of linseed oil which comprises treating linseed oil at elevated temperature with an aliphatic dicarboxylic acid to displace non-drying constituents from the linseed oil and which itself has a vapor pressure lower than the vapor pressure of the displaced constituents, and then removing the displaced constituents by vacuum distillation.

4. The process of improving the drying properties of linseed oil which comprises treating linseed oil at a temperature above approximately 300° C. with azelaic acid to effect displacement of non-drying constituents of the linseed oil by the azelaic acid in such proportions that one molecular part of azelaic acid is present for substantially each 2.9 parts of non-drying constituent to be removed, calculated as oleic, and then distilling the displaced non-drying constituents from the oil.

5. The process of improving the drying properties of linseed oil which comprises treating linseed oil at a temperature above approximately 300° C. with azelaic acid and in an atmosphere of an inert gas to effect displacement of non-drying constituents of the linseed oil by the azelaic acid, in such proportions that one molecular part of azelaic acid is present for substantially each 2.9 parts of non-drying constituent to be removed, and then distilling the displaced non-drying constituents from the oil.

6. The process of liberating mono-unsaturated non-drying constituents from oils of the class of drying and semi-drying oils for the purpose of improving their drying properties, which process comprises subjecting the oil at elevated temperature to a treating reagent comprising an aliphatic di-carboxylic acid to displace mono-unsaturated non-drying constituents from the oil at elevated temperature and having a boiling point above the elevated temperature at which the mono-unsaturated non-drying constituents are displaced, and then removing the displaced constituents.

7. The process of improving the drying properties of soybean oil which comprises treating the soybean oil with azelaic acid at an elevated temperature which is sufficiently high to enable the azelaic acid to displace non-drying constituents from the soybean oil but which elevated temperature is below the boiling point of azelaic acid, and then removing the displaced constituents by vacuum distillation.

8. The process of improving the drying properties of soybean oil which comprises treating soybean oil with azelaic acid in the proportion of approximately 24 parts of azelaic acid to each 150 parts of soybean oil at a temperature of at least approximately 300° C. but below the boiling point of azelaic acid, thereby effecting displacement of non-drying constituents from the soybean oil by the azelaic acid, and then liberating the displaced non-drying constituents from the soybean oil by distillation.

9. The method of improving the drying properties of fish oil which method comprises treating the fish oil with azelaic acid at an elevated

temperature and under an inert atmosphere, the said temperature being sufficiently high to enable the azelaic acid to displace non-drying constituents from the fish oil, and being below the boiling point of the azelaic acid, and then liberating the displaced constituents from the fish oil by vacuum distillation.

10. A method of improving the drying properties of sardine oil which comprises treating sardine oil with azelaic acid in the proportion of approximately 700 parts of soybean oil to about each 40 parts of azelaic acid at an elevated temperature which is sufficiently high to enable the azelaic acid to displace non-drying constituents from the fish oil but which is below the boiling point of the azelaic acid for a period of time sufficient for the azelaic acid to displace non-drying constituents from the fish oil, and then separating the displaced components from the sardine oil by vacuum distillation.

11. The method of improving the drying properties of fish oil which method comprises treating the oil to be improved with a di-basic aliphatic acid at an elevated temperature, the said di-basic acid being a member selected from the group comprising azelaic acid, sebaccic acid and adipic acid and the temperature of the treatment being sufficiently high to enable the di-basic acid to displace non-drying constituents from the oil but also being below the boiling point of the di-basic acid and removing the non-drying constituents after they have been displaced, by vacuum distillation.

12. A method of liberating non-drying constituents from sardine oil which method comprises treating the sardine oil with adipic acid in the proportion of approximately 20 parts of adipic acid to each 100 parts of sardine oil at a temperature elevated to enable the adipic acid to displace non-drying constituents from the sardine oil but at a temperature below the boiling point of adipic acid and for a period of time sufficient for the adipic acid to displace non-drying components from the sardine oil, and then separating displaced non-drying constituents from the sardine oil by vacuum distillation.

13. A method of liberating non-drying constituents from an oil of the class consisting of drying and semi-drying oils, which method comprises treating the oil with sebaccic acid at an elevated temperature which is below the boiling point of sebaccic acid and for a period of time sufficient for the sebaccic acid to displace non-drying constituents from the oil, and then separating the displaced constituents from the oil by distillation.

14. The process of improving the drying properties of an oil selected from the class consisting of drying and semi-drying oils, which method comprises subjecting a portion of the oil to an oxidizing reagent capable of oxidizing unsaturated compounds in said portion to cleave the double bond and form di-basic acids, removing spent and unspent portions of the oxidizing reagent from the oxidized oil and then mixing the oxidized portion of the oil with the unoxidized remainder of the oil and heating the two together at an elevated temperature for a period of time sufficient for di-basic acids present in the oxidized oil to displace non-drying constituents from the unoxidized portion of the oil, whereby the drying properties of the unoxidized portion of the oil are improved.

15. A method of improving the drying properties of a batch of soybean oil which comprises

subjecting a portion only of the total batch of soybean oil with an oxidizing reagent capable of oxidizing unsaturated compounds in said portion to cleave the double bond and form di-basic acids, separating spent and unspent oxidizing reagent from the oil which has been subjected to oxidation, and then adding this oil to the remainder of the batch of soybean oil and heating the two together at an elevated temperature sufficient for the di-basic acids contained in the oxidized portions of the oil to displace mono-unsaturated constituents from the unoxidized portion of the batch whereby the drying properties of it are improved.

16. A method of improving the drying properties of an oil selected from the class consisting of drying and semi-drying oils, which method comprises subjecting an oil containing doubly and triply unsaturated glycerides to an oxidizing agent capable of oxidizing unsaturated compounds to cleave the double bond and form di-basic acids in admixture with mono-basic and by-product acids, adding said mixed oxidation products including said di-basic acids to said oil which is to be improved and heating the two together at an elevated temperature for a period of time sufficient for the di-basic acids contained in said mixed oxidation products to displace from the oil being treated mono-unsaturated non-drying constituents, and then separating said displaced constituents thereby obtaining a treated oil having improved drying properties.

17. The process of improving the drying properties of an oil selected from the class consisting of drying and semi-drying oils, which method comprises subjecting a portion of the oil to an aqueous chromic acid solution to oxidize unsaturated compounds in said portion to cleave the double bond and form di-basic acids, removing spent and unspent portions of the aqueous chromic acid from the oxidized oil and then mixing the oxidized portion of the oil with the unoxidized remainder of the oil and heating the two together at an elevated temperature for a period of time sufficient for di-basic acids present in the unoxidized oil to displace non-drying constituents from the unoxidized portion of the oil, whereby the drying properties of the unoxidized portion of the oil are improved.

18. A method of improving the drying properties of a batch of soybean oil which comprises subjecting a portion only of the total batch of soybean oil to an aqueous chromic acid oxidizing reagent to oxidize unsaturated compounds in said portion to cleave the double bond and form di-basic acids, separating spent and unspent oxidizing reagent from the oil which has been subjected to oxidation, and then adding this oil to the remainder of the batch of soybean oil and heating the two together at an elevated temperature sufficient for the di-basic acids contained in the oxidized portion of the oil to displace mono-unsaturated constituents from the unoxidized portion of the batch whereby the drying properties of it are improved.

19. A method of improving the drying properties of an oil selected from the class consisting of drying and semi-drying oils, which method comprises subjecting an oil containing doubly and triply unsaturated glycerides to an aqueous chromic oxide oxidizing agent to oxidize unsaturated compounds to cleave the double bond and form di-basic acids in admixture with mono-basic and by-product acids, adding said mixed oxidation products including said di-basic acids

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to said oil which is to be improved and heating the two together at an elevated temperature for a period of time sufficient for the di-basic acids contained in said mixed oxidation products to displace from the oil being treated mono-unsaturated nondrying constituents, and then separating said displaced constituents thereby obtaining a treated oil having improved drying properties.

20. As a new product, a drying oil which comprises an oil selected from the class consisting of drying and semi-drying oils in which non-drying constituents are replaced by an aliphatic di-carboxylic acid having a vapor pressure lower than the vapor pressure of the replaced non-drying constituents.

21. As a new product, a drying oil which comprises linseed oil in which non-drying constituents are replaced by an aliphatic di-carboxylic acid having a vapor pressure lower than the vapor pressure of the replaced non-drying constituents.

22. As a new product, a drying oil which comprises soybean oil in which non-drying constituents are replaced by an aliphatic di-carboxylic acid having a vapor pressure lower than the

vapor pressure of the replaced non-drying constituents.

23. As a new product, a drying oil which comprises fish oil in which non-drying constituents are replaced by an aliphatic di-carboxylic acid having a vapor pressure lower than the vapor pressure of the replaced non-drying constituents.

LATIMER D. MYERS.  
VICTOR J. MUCKERHEIDE.

## REFERENCES CITED

The following references are of record in the file of this patent:

## UNITED STATES PATENTS

Number	Name	Date
1,873,513	Van Loon	Aug. 23, 1932
2,040,461	Bonney	May 12, 1936
2,050,930	De Groote	Aug. 11, 1936
2,178,374	Hervey	Nov. 7, 1939
2,182,332	Barsky	Dec. 5, 1939
2,203,680	Ellingboe	June 11, 1940
2,292,950	Loder	Aug. 11, 1942
2,319,507	Krumbhaar	May 18, 1943