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EUROPEAN PATENT APPLICATION

21 Application number: 84300145.4

51 Int. Cl.³: **C 11 B 3/06**
C 11 B 3/00

22 Date of filing: 10.01.84

30 Priority: 10.01.83 US 456668

43 Date of publication of application:
22.08.84 Bulletin 84/34

84 Designated Contracting States:
AT BE CH DE FR GB IT LI NL SE

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54 **Purification of natural oils with alkali metal borohydrides.**

57 This invention relates to an improved alkali refining process for purifying natural oils such as the triglyceride oils. In accordance with the present invention, it has been found that the color, color stability, odor and/or flavor of the refined oil is improved by refining the oil in the presence of an alkali metal borohydride. In addition, a reduction in the peroxide content of the refined oils has also been observed. Use levels of the alkali metal borohydride typically range from about 50 to about 2000 ppm, based on the weight of the oil.

PURIFICATION OF NATURAL OILS WITH
ALKALI METAL BOROHYDRIDES

1 The present invention relates to an improved process
for the purification and/or decolorization of natural oils such
as the edible vegetable oils. It particularly relates to an
improved process for alkali refining triglyceride oils into
5 refined oils having improved color, color stability, odor and/or
flavor.

Crude vegetable glyceride oils, as they are obtained
from their natural sources by conventional extraction or pressing
methods, normally contain various non-glyceride impurities.

10 These non-glyceride substances include gross material from the
source of the oil, such as xanthophyll or chlorophyll; products
obtained by the breakdown of the glyceride oil during treatment
such as free fatty acids and other derivatives of the glycerides
such as phosphatides, sterols, aldehydes and ketones; peroxides;
15 as well as various other impurities such as metal cations, metal
complexes, various disulfides and related impurities. In
addition, many vegetable oils normally contain natural waxes from
the crushing of the coat of the oilseeds employed. Some of these
impurities are desirable in that they help to protect the oil
20 from oxidation or other adverse processes, but by far the greater
amount of these substances must be removed during processing for
edible purposes because they are deleterious to the appearance,
taste, stability and other properties of the oil. It has
therefore been conventional practice to subject the triglyceride
25 oils to an extensive purification. Typically, this purification
has involved a complex multi-step procedure including degumming,
refining, bleaching, deodorization, and optionally hydrogenation
and/or selected crystallization (winterizing).

1 One technique for refining triglyceride oils heretofore
developed by the prior art is alkali refining. In this tech-
nique, the oil is treated with an aqueous solution of sodium
hydroxide or some other strong alkali in an amount slightly in
5: excess of the amount of the free fatty acids present in the oil
to produce a refined oil and an impurity-containing soapstock.
Typical alkali refining techniques which have previously been
employed to refine triglyceride oils are described in U.S. Patent
Nos. 2,702,813; 3,629,307; 3,943,155; 4,150,045 and 4,280,962; as
10 well as in Sullivan, Journal Agricultural and Oil Chemists
Society, page 845A (November 1980).

While the alkali refining techniques of the prior art
have been adequate when employed in combination with the various
other procedures mentioned above to produce triglyceride oils of
15 acceptable purity, many of the various attempts to improve the
basic alkali refining technique described above are somewhat
complicated in nature which has discouraged their commercial
exploitation. In the alkali refining procedure of U.S. Patent
No. 3,629,307, for example, following treatment of the oil with
20 alkali to produce an oil-water-soapstock admixture, the admixture
must be first dehydrated to a water content of no more than 3% by
weight, and then simultaneously rehydrated and centrifuged in a
pressurizing centrifuge in order to obtain the refined oil.
Similarly, in U.S. Patent No. 4,280,962, the alkali extracted oil
25 must be treated with an aqueous solution of acid before the
refined oil can be separated from the insoluble materials formed
during refining.

While the prior art has also developed less complicated
variations of the conventional alkali refining procedure such as

1 the cold refining technique described in the aforementioned
article by Sullivan, cold refining has in practice resulted in
unsatisfactory refining losses which have likewise discouraged
the commercial use of this procedure.

5 In addition, it has also previously been known in the
prior art that the odor and color of mink oil (a non-triglyceride
oil) may be improved by treating the mink oil with NaBH_4
subsequent to the conventional neutralization and bleaching steps
employed for the purification thereof. The high cost attendant
10 to the use of such extra process steps, including material and
equipment costs, however, renders the use of such separate NaBH_4
post-treatment procedures impractical for use in the refining of
triglyceride oils.

The use of alkali metal borohydrides in order to
15 improve the color and odor of soap has also been suggested in
U.S. Patent No. 3,542,823. As described therein, the alkali
metal borohydride treatment is preferably conducted by treating
the saponified soap charge immediately after leaving the washing
unit with the alkali metal borohydride at a pH of at least 9.5.
20 Use of such a treatment in the purification of triglyceride oils
is undesirable, however, since this procedure requires the
addition of a further expensive step to the already complicated
triglyceride oil purification process.

Accordingly, it is an object of the present invention
25 to provide an improved process for the purification of natural
oils such as the triglyceride oils which obviates the need for
complex refining procedures or undesirable extra steps.

1 It is a particular object of the present invention to
provide an improved alkali refining procedure which improves the
color, color stability, odor and/or flavor of natural oils, as
well as the production efficiency of the overall purification
5 procedure.

 In accomplishing the foregoing and other objects, there
has been provided in accordance with the present invention an
improved process for alkali refining natural oils, such as for
example the triglyceride oils, wherein the efficiency of the
10 refining process is improved by extracting the oil with alkali
while in the presence of an alkali metal borohydride. The alkali
metal borohydride is generally employed during the alkali extrac-
tion treatment in an amount sufficient to effect the desired
improvement in the quality of the triglyceride oil. Typically,
15 from about 50 to about 2000 ppm of alkali metal borohydride
(based on the weight of oil) are sufficient for most purposes.

 Oils of superior color and purity may be obtained by
employing the alkali refining treatment of this invention in
conjunction with a degumming pretreatment step and a bleaching
20 step. If required, the bleaching treatment may be followed by a
deodorization treatment as well as by any of the various other
treatment steps conventional in the art. In a preferred
embodiment, the present invention thus also provides a process
for the purification of natural oils, such as the triglyceride
25 oils, which comprises the steps of degumming a crude oil to
produce a degummed oil; extracting the degummed oil with alkali
while in the presence of an alkali metal borohydride to produce a
refined oil and a soapstock; bleaching the refined oil; and, if

1 required, deodorizing, winterizing, hydrogenating and/or
crystallizing the oil.

Through the use of the inventive concepts of this invention, oils of excellent purity and color may readily be
5 obtained by a relatively simple procedure without the requirement for costly extra steps and the attendant capital investment outlays required therefor. Vegetable triglyceride oils exhibiting a Lovibond color characterized by a yellow value of 10 or less and a red value of 1 or less, a bland taste, a lack of any
10 perceptible odor, and a significantly reduced peroxide content, for example, may readily be obtained through the use of the process improvements of this invention. In addition, oils subjected to the alkali metal borohydride/alkali extraction of this invention have also been found to exhibit enhanced heat
15 stability. Moreover, as a result of the enhanced purification achieved by the alkali refining procedure of this invention, with some oils it is possible to reduce the amount of bleaching earth required and/or to reduce the time required for deodorization, accruing thereby a significant increase in purification
20 efficiency.

Other objects, advantages and features, as well as the preferred modes of operation of the present invention, will be apparent to those skilled in the art from the following detailed description of the preferred embodiments.

25 The process improvements of this invention may be successfully utilized with any of the natural oils well known to those skilled in the art, such as the triglyceride oils. Of the

1 triglyceride oils, the edible vegetable oils are particularly
amenable to processing according to this invention, examples of
which include soybean oil, corn oil, cottonseed oil, peanut oil,
sesame oil, rapeseed oil, canola oil, among others. As is well
5 known to those skilled in the art, such oils are frequently
employed as salad oils, cooking oils, margarine constituents, and
as constituents in various other food applications, and accord-
ingly must meet stringent requirements in terms of color, flavor,
odor and purity. Industry specifications for the edible
10 vegetable oils generally require that the purified oil exhibit a
color, as evaluated by the Lovibond Color system, characterized
by a yellow value of 10 or less and a red value of 1.0 or less.
In addition, the edible vegetable oils must also desirably have a
bland taste, a lack of any perceptible odor, and a peroxide value
15 of 0 as determined by standard A.O.C.S. test Cd 8-53.

The alkali metal borohydride treatment of this
invention, as discussed above, is preferably conducted during
alkali refining of the triglyceride or other natural oil. While
the alkali metal borohydride treatment may be conducted at other
20 points in the overall oil purification process, the low stability
of the alkali metal borohydrides in non-alkaline environments
requires that the alkali metal borohydride treatment be performed
during the alkali refining step, or as a separate post-treatment
step. While this latter type of treatment procedure is within
25 the purview of this invention and is desirable for use in the
purification of e.g., spoiled refined vegetable oils, it has been
unexpectedly found that utilization of the alkali metal
borohydride treatment during the alkali refining step reduces

1 peroxide build-up in the oil during subsequent treatment.
Moreover, utilization of the alkali metal borohydride treatment during the alkali refining step avoids the addition of a further costly purification step to the overall purification process, and
5 further, provides a desirable alkaline environment which enhances the activity of the alkali metal borohydride. Accordingly, it is preferred that the alkali metal borohydride treatment be performed simultaneously with alkali refining.

The triglyceride oils or other natural oils utilized in
10 the improved alkali refining procedure of this invention may comprise a crude oil or a pretreated oil, i.e., a degummed oil. Degumming of the oil may be accomplished by any of the various degumming procedures well known to those skilled in the art. The degumming process is primarily carried out at the extraction
15 mill, where alkali refining may or may not be carried out. To a much lesser extent, degumming may be done by the refiner at another location. In general, degumming is accomplished by hydration of the mucilaginous product impurities contained in the vegetable oil with from about 1 to about 3% by weight water
20 at elevated temperatures. Typically, a small amount of a degumming agent, such as for example acetic acid, acetic anhydride or phosphoric acid is employed during the degumming step in order to improve the efficiency thereof. As a matter of convenience, the degumming agents are most easily employed by
25 simply adding them to the crude vegetable oil prior to the addition of the hydrating water. The resulting admixture is thereafter introduced into a continuous centrifuge in which it is heated and caused to circulate continuously whereby the mucilaginous products are completely hydrated and the aqueous phase

1 containing the precipitated hydrated mucilaginous products are separated from the oil.

The alkali refining step is conducted according to conventional procedures with the exception that extraction of the oil with the alkali is performed in the presence of the alkali metal borohydride. Any of the various art recognized alkali refining procedures well known to those skilled in the art, including any of the various procedures described in U.S. Patent Nos. 2,702,813; 3,629,307; 3,943,155; 4,150,045; and 4,280,962; 10 as well as in Sullivan, Journal Agricultural and Oil Chemists Society, page 845A (November 1980), may thus be employed in conjunction with the alkali metal borohydride treatment of this invention. The particular operating procedures of this step will usually vary according to the particular type of oil to be 15 refined, and the facilities and equipment wherein the oil is refined. In general, the oil is refined by contacting the same with an aqueous solution of a suitable alkali, such as for example but not limited to sodium hydroxide, at temperatures which range from as low as 5°C to temperatures as high as about 20 100°C for an interval of from several seconds to several hours. The amount of alkali employed during the refining operation is preferably added in an amount which is only slightly in excess of that theoretically required (the stoichiometric amount) for neutralization of the free fatty acids in the oil, an excess of 25 0.01% to 0.5%, and preferably from 0.01 to 0.3%, of alkali being preferred.

The alkali metal borohydride may be added to the system by a variety of procedures. Typically, the alkali metal borohydride is added with the addition of the alkali solution to the

1 oil. In this embodiment, the alkali metal borohydride may be
employed in powdered form, or alternatively may be employed in
the form of an alkaline aqueous alkali metal borohydride
solution. Alkali metal borohydride solutions of this type are
5 readily available commercially, for example, from the Morton-
Thiokol Corporation under the trade designation SWS[®]. If an
aqueous alkali metal borohydride solution is employed, it is
necessary of course to adjust the amount of alkali admixed with
the oil to compensate for the alkali present in the alkali metal
10 borohydride solution.

In an alternative embodiment, the alkali may be divided
into two portions with a first and larger portion being admixed
with the oil. The alkali metal borohydride, either in powdered
form or in the form of an aqueous alkali metal borohydride
15 solution, is admixed with the remaining portion of alkali, and
the combined mixture thereafter added to the alkali deficient
oil-alkali mixture.

As is well known to those skilled in the art, the
reaction of the alkali with the oil during refining neutralizes
20 the free fatty acids present in the oil and purifies and improves
the flavor, odor and color of the same. This action of the
alkali is enhanced by the alkali metal borohydride treatment of
this invention. While not wishing to be bound by any particular
theory or explanation, it is believed that the alkali metal
25 borohydride reduces various impurities in the oil which are
resistant to reduction with alkali, thereby improving the color,
color stability, odor, and/or flavor of the refined oil. Such
impurities comprise, for example, the various aldehydes, ketones,
metal cations, metal complexes, disulfides, and related

1 impurities present in the oil which are resistant to alkali
attack. Reduction of these various impurities has been found to
not only improve the quality of the refined oil, but in addition
to retard the build-up of peroxides and other decomposition
5 products during subsequent processing.

The alkali metal borohydride may be, for example,
lithium, potassium, or sodium borohydride. Of the alkali metal
borohydrides, the sodium derivative is commercially readily
available. The alkali metal borohydride may be added to the
10 refining process of this invention either in solid form, or as
discussed above, as an aqueous solution. If desired, the alkali
metal borohydride may also be formed in situ from other
borohydrides.

The alkali metal borohydride is generally employed
15 during the alkali refining step in an amount sufficient to effect
the desired improvement in the quality of the purified oil. The
exact amount required for this purpose varies with the particular
vegetable oil being refined and with the particular characteris-
tics of the oil which require improvement, e.g., color, flavor,
20 odor, taste, etc. Typically, from about 50 to about 2000 ppm of
alkali metal borohydride are sufficient for most purposes, with
preferred amounts ranging from about 250 to 1000 ppm, and most
preferably from about 250 to 500 ppm of alkali metal borohydride,
based on the weight of the oil. In processing the edible
25 vegetable triglyceride oils, it is particularly preferred that
the amount of alkali metal borohydride employed be sufficient to
produce a purified oil having Lovibond color characterized by a
yellow value of 10 or less and a red value of 1 or less, as
measured by a Lovibond Tintometer using a 5 1/4" cell at ambient

1 temperature; a bland taste; a lack of any preceptible odor; and a
peroxide value of 0.0 as measured by AOCS Standard Analytical
Method Cd 8-53. For the purposes of the present invention, these
characteristics are based on the purified oil, i.e., after it has
5 been degummed, refined, bleached, and if required deodorized and
and/or winterized, dewaxed, etc.

Following completion of the combined alkali-alkali
metal borohydride treatment of the improved alkali refining
procedure of this invention, the refined and purified oil is
10 separated from the resulting soapstock by conventional separation
procedures, such as for example, by centrifugation. In accord-
ance with conventional practice, the refined oil is thereafter
typically washed with water to remove any residual traces of soap
and then dried to remove any dissolved or emulsified water which
15 may be present.

Frequently, the production of a purified oil having an
acceptable color requires the use of a bleaching process in order
to remove pigments remaining in the oil after the refining step,
such as various carotenoids and chlorophyll, among others.
20 Typically, the bleaching step is carried out under vacuum at a
moderate temperature in the range of from about 50 to about 120°C
in the presence of a bleaching clay. After bleaching, the oil is
then filtered to remove the bleaching clay and pigment products
adsorbed thereon.

25 If required, the oil may be thereafter subjected to a
deodorization process, winterizing process, dewaxing process,
etc. by conventional techniques well known to those skilled in
the art in order to further improve the quality of the oil. Some
oils may also require hydrogenation in order to reduce the

1 polyunsaturates. These various additional processing techniques,
however, are well known to those skilled in the art and do not
require detailed discussion.

5 The invention is additionally illustrated in connection
with the following examples which are to be considered as illus-
trative of the present invention. It should be understood,
however, that the invention is not limited to the specific
examples.

EXAMPLE I

10 A degummed soybean oil was alkali refined in accordance
with the present invention. In the runs of this example,
refining was carried out in the presence of 250 - 770 ppm of
NaBH₄, which was utilized in the form of an aqueous sodium
borohydride solution comprising approximately 12% NaBH₄ and 40%
15 by weight sodium hydroxide (SWS[®] brand, available from the
Morton-Thiokol Corporation) and in the presence of 1000 ppm NaBH₄
which was utilized in the form of a dry powder. As a control, a
further run was conducted by an identical procedure, but without
the use of NaBH₄ during refining.

20 In each of these runs, 500 g of oil was first cooled to
10°C and then refining was performed by adding a sodium hydroxide
solution to the oil with agitation in a commercial blender. Each
sample was thereafter agitated for two four-minute periods at a
temperature maintained below 54.4°C (130°F). Where used, the
25 NaBH₄ was added to the sample after the first four-minute
agitation and prior to the second. In the run employing NaBH₄
powder, a portion of the alkali was retained and used for NaBH₄
addition by admixture therewith. The total NaOH employed was in

1 an amount sufficient to provide a slight excess of NaOH relative to the free fatty acid concentration of the oil (0.2% excess).

At the end of the second four-minute agitation period, each sample was allowed to sit overnight and then filtered
5 through diatomaceous earth. All samples were then stirred for two hours with molecular sieve to remove any remaining water. Each of the resulting samples was then evaluated for peroxide value (A.O.C.S. method Cd 8-53), free fatty acids, FFA, (A.O.C.S. standard method Ca 5a 40, Ca 9a 52, B.3), odor, color (Lovibond
10 system using a Lovibond Tintometer with a 5 1/4 inch cell at ambient temperature) and heat stability. The heat stability test comprised an accelerated heat aging process wherein the oil was heated for 2 hours at 205°C in air and then analyzed for color, peroxide value and FFA.

15 300 grams of each of the refined soybean oil samples described above were thereafter bleached by agitating the oil with 1% by weight of a standard bleaching clay (Filtrol 105) at 110°C under a 5 mm Hg vacuum for one hour. The resulting bleached samples were then cooled to 40°C and filtered through
20 Whatman #4 filter paper and diatomaceous earth, after which an analysis for peroxides, color, and heat stability was performed as described above.

The results of these experiments are set forth in Tables Ia-Ib. As can be seen therefrom, vegetable oils alkali
25 refined in accordance with the present invention possess improved heat stability, color and reduced peroxide build-up as compared with vegetable oils refined in accordance with the prior art.

TABLE Ia.

Mode of Purification	Color After Refining/Bleaching ^a			Color After Heat Aging (Heat Stability) ^b		
	Yellow	Red	Neutral	Yellow	Red	Neutral
1. Caustic Refined Only	76.0	5.1	1.6	50.0	2.1	0.1
2. 250 ppm NaBH ₄ (SWS) Caustic Refined	40.0	2.0	0.1	20.0	1.4	0.1
3. 500 ppm NaBH ₄ (SWS) Caustic Refined	20.0	1.1	0.2	15.0	1.1	0.6
4. 770 ppm NaBH ₄ (SWS) Caustic Refined	17.0	1.1	0.8	13.0	1.0	0.1
5. 1000 ppm NaBH ₄ Powder Caustic Refined	20.5	1.0	0.1	9.0	0.5	—

^a 1% Filtrol 105 clay/110°C/1hr/vac.

^b 205°C/2hr/air

TABLE Ib.

Mode of Purification	After Refining/Bleaching ^a			After Heat Aging (Heat Stability) ^b		
	Peroxide	%FFA	Boron	Peroxide	%FFA	Boron
1. Caustic Refined Only	5.81	0.22	N.D.	0.91	0.23	N.D.
2. 250 ppm NaBH ₄ (SWS) Caustic Refined	3.58	0.19	N.D.	0.63	0.22	N.D.
3. 500 ppm NaBH ₄ (SWS) Caustic Refined	8.00	0.15	N.D.	0.35	0.35	N.D.
4. 770 ppm NaBH ₄ (SWS) Caustic Refined	1.88	0.15	N.D.	0.17	0.15	N.D.
5. 1000 ppm NaBH ₄ Powder Caustic Refined	1.80	0.18	N.D.	0.31	0.14	N.D.
6. Degummed oil (Untreated)	17.7	0.40	N.D.			

N.D. - None Detected

^a 1% Filtrol 105 clay/110°C/1hr/Vac.

^b 205°C/2hr/air

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EXAMPLE II

This example demonstrates the effect of various NaBH_4 treatment levels during the alkali refining and subsequent bleaching at various bleaching clay levels of a partially degummed crude soybean oil.

1000 gram samples of the partially degummed oil were treated with 0, 250 and 500 ppm of NaBH_4 , based on the weight of oil, by the addition thereto of the required amount of SWS^(R) (Morton-Thiokol Corporation) aqueous NaBH_4 solution to the caustic refining solution. The total NaOH addition was sufficient to achieve a 0.05% excess of NaOH , based on the free fatty acid concentration. Refinement was carried out for 5 minutes in a commercial blender under rapid agitation while maintaining the temperature below 54.4°C (130°F). Each of the refined samples was then allowed to settle overnight, followed by filtering through Whatman #4 filter paper and washing three times with warm deionized distilled water. Following this treatment, the color, free fatty acid (FFA), and peroxides were evaluated as described in Example I.

After refining, 300 grams of each of the oil samples were bleached by agitation with 0.5 to 3% bleaching clay (Filtrol 105) at $100\text{--}110^\circ\text{C}$ for one hour under a 5 mm Hg vacuum. The samples were thereafter cooled to 40°C and filtered through diatomaceous earth and Whatman #4 filter paper. At this point, the color, peroxide value, and free fatty acid concentration were again evaluated as in Example I.

The accelerated heat aging test of Example I was then performed on each sample and an analysis of % FFA, peroxide and color made in order to evaluate to heat stability.

1 The results of these experiments are set forth in
 Tables IIa and IIb. As can be seen from the data of these
 tables, soybean oils refined in accordance with this invention
 exhibit enhanced heat stability as compared with oils refined by
 5 conventional procedures.

TABLE IIa.

Treatments		Color After Bleaching ^a			Color After Heat Aging ^b		
		Yellow	Red	Neutral	Yellow	Red	Neutral
Refining	Bleaching						
10 Untreated Oil		72	6.2	0.1	73	5.2	—
NaOH Only	Unbleached	70.1	7.0	—	70	3.2	—
NaOH Only	0.5%	60.9	3.5	1.1	20	1.0	—
NaOH Only	1.0%	40	2.6	1.0	18	1.1	0.4
NaOH Only	3.0%	20	1.1	0.3	13	1.1	0.4
15 250 ppm NaBH ₄ /NaOH	Unbleached	70	10.0	0.3	71	8.1	0.6
250 ppm NaBH ₄ /NaOH	0.5%	60	3.0	0.8	11.2	1.0	0.3
250 ppm NaBH ₄ /NaOH	1.0%	20	0.9	—	12	1.0	0.1
250 ppm NaBH ₄ /NaOH	3.0%	10.1	1.3	0.8	10.3	1.0	—
20 500 ppm NaBH ₄ /NaOH	Unbleached	70	10.3	0.6	72	10	0.5
500 ppm NaBH ₄ /NaOH	0.5%	50	1.4	—	20	2.0	—
500 ppm NaBH ₄ /NaOH	1.0%	20	1.1	0.3	10.1	1.0	—
500 ppm NaBH ₄ /NaOH	3.0%	10.2	1.0	0.3	10.0	0.9	—

^a 100-110°C/Agit/5 mm Hg vac/1 h

^b 205°C/2 h/air

TABLE IIb.

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<u>Treatments</u>		<u>After Bleaching^a</u>			<u>After Heat Aging^b</u>		
<u>Refining</u>	<u>Bleaching</u>	<u>%FFA</u>	<u>Peroxide (meq.)</u>	<u>Boron (ppm)</u>	<u>%FFA</u>	<u>Peroxide (meq.)</u>	<u>Boron (ppm)</u>
5 Untreated Oil		0.65	2.16	N.D.	0.54	2.01	N.D.
NaOH Only	Unbleached	0.17	2.28	N.D.	0.17	2.19	N.D.
NaOH Only	0.5%	0.16	1.55	N.D.	0.13	1.39	N.D.
NaOH Only	1.0%	0.14	.33	N.D.	0.14	.98	N.D.
NaOH Only	3.0%	0.14	.17	N.D.	0.13	.68	N.D.
10 250 ppm NaBH ₄ /NaOH	Unbleached	0.19	1.84	N.D.	0.21	1.08	N.D.
250 ppm NaBH ₄ /NaOH	0.5%	0.15	1.30	N.D.	0.12	.98	N.D.
250 ppm NaBH ₄ /NaOH	1.0%	0.12	.32	N.D.	0.15	.77	N.D.
250 ppm NaBH ₄ /NaOH	3.0%	0.11	N.D.	N.D.	0.17	.34	N.D.
15 500 ppm NaBH ₄ /NaOH	Unbleached	0.18	2.27	N.D.	0.32	1.73	N.D.
500 ppm NaBH ₄ /NaOH	0.5%	0.13	1.25	N.D.	0.13	1.03	N.D.
500 ppm NaBH ₄ /NaOH	1.0%	0.09	.82	N.D.	0.10	.65	N.D.
500 ppm NaBH ₄ /NaOH	3.0%	0.08	N.D.	N.D.	0.14	.27	N.D.

^a 100-110°C/Agit/5 mm Hg vac/1 h^b 205°C/2 h/air

CLAIMS

1 1. A process for alkali refining a triglyceride oil
by reacting said oil with an alkali solution to produce a refined
oil and a soapstock, characterised by - conducting said
alkali refining step in the presence of an alkali metal borohy-
5 dride in an amount sufficient to improve the purity and/or color
of said oil.

2. The process of claim 1, wherein said alkali metal
borohydride is present during said alkali refining step in an
amount of from about 50 to about 2000 ppm, based on the weight of
10 oil.

3. The process of claim 2, wherein said alkali metal
borohydride is present during said alkali refining step in an
amount of from about 250 to about 1000 ppm, based on the weight
of oil.

5 4. The process of claim 1, 2 or 3, wherein said tri-
glyceride oil is an edible vegetable oil.

5. The process of claim ^{1, 3 or 4}₂, wherein said alkali metal
borohydride is added to said alkali refining step in the form of
a solid powder.

0 6. The process of claim ^{1, 3 or 4}₂, wherein said alkali metal
borohydride is added to said alkali refining step in the form of
an aqueous alkaline alkali metal borohydride solution.

a. degumming a crude triglyceride oil to produce a degummed oil;

5 b. refining the degummed oil of step (a) with an alkali solution containing from about 50 to 2000 ppm of an alkali metal borohydride, based on the weight of oil, to produce a refined oil and a soapstock; and

c. bleaching the refined oil of step (b) to produce a
10 purified/decolorized oil. .

8. The process of claim 7, wherein said triglyceride oil is an edible vegetable oil.

9. The process of claim ^{7 or}8, wherein said alkali metal borohydride is employed in an amount sufficient to produce a
15 purified oil having a color, based on the Lovibond Color System,
characterized by a yellow value in the range of 10 or less and a
red value in the range of 1 or less.

10. The process of claim 9, wherein said alkali metal borohydride comprises from about 250 to about 1000 ppm, based on the weight of oil.