

Description

Title of Invention

METHOD FOR PRODUCING REFINED, BLEACHED, AND DEODORIZED PALM OIL
(RBDPO)

Technical Field

[0001]

The present invention relates to a method for producing refined, bleached, and deodorized palm oil (RBDPO).

Background Art

[0002]

Glycidol is a compound in which an epoxy ring is formed at the 2- and 3-positions of a glycerol backbone. In recent years, glycidol fatty acid esters in which fatty acids are ester-bound to glycidol are detected from a plural types of edible oils and/or fats. Among the plural types of the oils and/or fats with confirmed presence of glycidol fatty acid esters, palm oils and/or fats and refined edible oils and/or fats made from palm oils and/or fats in particular are reported to have relatively high content of glycidol fatty acid esters (Non-Patent Literature 1).

[0003]

There are reports saying that when glycidol fatty acid esters are ingested into the body, the glycidol fatty acid esters are hydrolyzed by the action of lipases present in the body, resulting in the generation of glycidol. There is also a literature that points out the harmfulness of glycidol (Non-Patent Literature 2).

[0004]

In view of the above background, it is desirable to develop an oil and/or fat with a reduced content of glycidol and glycidol fatty acid esters.

[0005]

As methods for reducing the content of glycidol and glycidol fatty acid esters, Patent Document 1 discloses a low-temperature deodorization treatment of a glyceride composition at 190 to 230°C, and Patent Documents 2 and 3 disclose production methods including degumming.

Prior Art Documents

Patent Documents

[0006]

Patent Document 1: JP 2011-147436 A

Patent Document 2: WO 2019/038320

Patent Document 3: WO 2019/027315

Non-Patent Literatures

[0007]

Non-Patent Literature 1: Results of Field Survey on the Contents of 3-MCPD Fatty Acid Esters and Glycidol Fatty Acid Esters in Foods (2012 and 2013), Food Safety and Consumer Affairs Bureau, Ministry of Agriculture, Forestry and Fisheries, December 17, 2014

Non-Patent Literature 2: IARC, IARC Monogr, Eval, Carcinog, Risks Hum., 77, 469-486, 2000

Disclosure of the Invention

Technical Problem

[0008]

It is found that the method of Patent Document 1 results in insufficient decrease in the acid value of refined oils after deodorization and an oily flavor of refined oils.

[0009]

An object of the present invention is to solve the problems mentioned above and to provide a refined, bleached, and deodorized palm oil (RBDPO) that has good flavor and color and in which the content of glycidol and glycidol fatty acid esters is reduced to a satisfactory level.

Solution to Problem

[0010]

As a result of intensive studies, the present inventors found the following, and thereby completed the present invention: good flavor and color, excellent oxidation stability, and reduction of glycidol and glycidol fatty acid esters can be achieved by performing, after a treatment usually performed at a stage prior to bleaching such as deacidification with an alkali or degumming with an acid, a contact treatment using an acid during bleaching operation of crude palm oil (CPO), and by subjecting the bleached palm oil to deodorization in a specific temperature range after reducing the phosphorus content in the bleached palm oil to a certain concentration or less.

[0011]

That is, the present invention relates to

(1) A method for producing a refined, bleached, and deodorized palm oil (RBDPO), including adding an aqueous solution of an acid when a crude palm oil (CPO) is subjected to bleaching operation after a deacidification and/or degumming treatment in refining of the crude palm oil (CPO), wherein a phosphorus concentration in an oil and/or fat after bleaching is 10 ppm or less, and an oil and/or fat after deodorization at 230°C to 260°C satisfies the following conditions:

quality of the oil and/or fat after deodorization:

- a content of glycidol and glycidol fatty acid esters of 1.5 mg/kg or less in terms of glycidol equivalent

- a CDM stability time of 10 hours or longer

(2) The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to (1), wherein from 0.01 to 10 wt.% of the following aqueous solution is added as an acid in the adding an aqueous solution of an acid:

- an aqueous solution of citric acid and/or phosphoric acid having a concentration of from 1 to 85 wt.%;

(3) The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to (1), wherein the adding an aqueous solution of an acid is adding an aqueous acid solution to a mixture of clay and an oil and/or fat in the bleaching;

(4) The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to (2), wherein the adding an aqueous solution of an acid is adding an aqueous acid solution to a mixture of clay and an oil and/or fat in the bleaching;

(5) The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to any one of (1) to (4), wherein the deodorization is performed under the following conditions:

- a vacuum degree of from 100 to 800 Pa

- an amount of steam used of from 0.5 to 5 wt.%;

(6) A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in (1) or (2);

(7) A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in (3);

(8) A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in (4); and

(9) A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in (5).

Advantageous Effects of Invention

[0012]

The present invention can provide a refined, bleached, and deodorized palm oil (RBDPO) having a reduced content of glycidol and glycidol fatty acid esters. The content of glycidol and glycidol fatty acid esters in the resulting deodorized oil and/or fat can be reduced to 1.5 mg/kg or less, preferably 1.0 mg/kg or less, in terms of glycidol equivalent.

Further, the CDM stability time is 10 hours or longer, and the oxidation stability can be improved.

Description of Embodiments

[0013]

The present invention will be described in detail below.

[0014]

The production process of palm oil includes refining from crude palm oil (CPO) and refining from refined, bleached, and deodorized palm oil (RBDPO). The refining from crude palm oil (CPO) includes squeezing the pulp of oil palm to obtain crude palm oil (CPO) and subjecting the resulting crude palm oil (CPO) to refining steps such as degumming, deacidification, bleaching, deodorization, and dewaxing to produce refined, bleached, and deodorized palm oil (RBDPO). The refining from refined, bleached, and deodorized palm oil (RBDPO) includes further subjecting the refined, bleached, and deodorized palm oil (RBDPO) to refining such as bleaching and deodorization.

[0015]

The production method according to an embodiment of the present invention is applicable to the production process for producing refined, bleached, and deodorized palm oil (RBDPO) from crude palm oil (CPO).

[0016]

The raw material oil and/or fat that can be used in an embodiment of the present invention is not particularly limited as long as it is an oil and/or fat obtained by subjecting crude palm oil (CPO) to a treatment usually performed at a stage prior to bleaching, such as deacidification using an alkali or degumming using an acid. When a treatment usually performed at a stage prior to bleaching, such as deacidification using an alkali or degumming using an acid, is not performed, the glycidol concentration is not sufficiently reduced, which is not preferable.

[0017]

In an embodiment of the present invention, the bleaching operation includes a series of steps, including bleaching preparation, bleaching, and, when necessary after bleaching, bleaching filtration. During bleaching preparation, the raw material oil and/or fat is transferred to a reactor (bleaching tank) where bleaching is performed. During bleaching, a processing aid such as bleaching clay, and the like are placed into the bleaching tank, and the bleaching tank is heated under reduced pressure. During bleaching filtration, cooling is performed and the clay is filtered out.

In an embodiment of the present invention, the deodorization operation includes a series of steps, including deodorization preparation, deodorization, and post-deodorization treatment. During deodorization preparation, bleached oil after bleaching filtration is transferred to a deodorization vessel (deodorization column). During deodorization, deodorization is performed

in the deodorization column. During post-deodorization treatment, cooling is performed, an antioxidant is added, etc.

[0018]

The refining of crude palm oil (CPO) according to an embodiment of the present invention includes adding an aqueous solution of an acid when a crude palm oil is subjected to bleaching operation after the crude palm oil is pre-refined by deacidification using an alkali and/or degumming using an acid. The refining of crude palm oil (CPO) according to an embodiment of the present invention preferably includes the adding an aqueous solution of an acid immediately before the bleaching in the bleaching operation.

[0019]

The acid used in an embodiment of the present invention may be an aqueous solution of an organic acid and/or an inorganic acid. Examples of the organic acid include at least one organic acid or derivative thereof selected from the group consisting of ascorbic acid, erythorbic acid, lactic acid, tartaric acid, citric acid, gallic acid, phosphoric acid, malic acid, and salts thereof. The inorganic acid is preferably a phosphoric acid, such as orthophosphoric acid, diphosphoric acid (pyrophosphoric acid), and metaphosphoric acid.

[0020]

In a preferred embodiment of the present invention, the acid used is an aqueous solution of citric acid and/or phosphoric acid. The concentration of the aqueous solution of citric acid and/or phosphoric acid to be added is preferably from 1 to 85 wt.%, and the amount of the aqueous solution of citric acid and/or phosphoric acid to be added is preferably from 0.01 to 10 wt.%. The conditions are not specified as long as the above ranges are satisfied. However, among the ranges, the amount of the aqueous solution of citric acid and/or phosphoric acid to be added is more preferably from 0.01 to 5 wt.%, even more preferably from 0.05 to 1 wt.%, and further preferably from 0.05 to 0.5 wt.%. When the amount of the aqueous solution of citric acid and/or phosphoric acid to be added is less than 0.01 wt.%, the amount of glycidol and glycidol fatty acid esters may not be sufficiently reduced. Meanwhile, when the amount of the aqueous solution of citric acid and/or phosphoric acid to be added exceeds 10 wt.%, the burden on the equipment may be increased.

[0021]

In an embodiment of the present invention, the phosphorus concentration is the concentration of elemental phosphorus present in an oil and/or fat. The concentration of phospholipids present in an oil and/or fat can be estimated based on the phosphorus concentration. The phospholipids present in an oil and/or fat may be coordinated to metal elements. Note that, although phosphoric acid may be added in the degumming during a pretreatment or in an embodiment of the present invention, phosphorus derived from phosphoric acid does not affect the phosphorus concentration in an oil and/or fat because phosphoric acid is water-soluble and cannot remain in an oil and/or fat.

[0022]

The phosphorus concentration in the bleached oil and/or fat in an embodiment according to the present invention is 10 ppm or less. When the phosphorus concentration in the bleached oil and/or fat exceeds 10 ppm, the effect of the present invention cannot be achieved. There is a possibility that the phospholipid content or the concentration of the metal elements coordinated to phospholipids at the time of deodorization affects the increase and decrease of the remaining amount of glycidol and glycidol fatty acid esters, although this is an inference.

[0023]

The deodorization is performed at a deodorization temperature of from 230 to 260°C. In a preferred embodiment, desirably, the deodorization is performed at a vacuum degree of from 100 to 800 Pa and an amount of steam used of from 0.5 to 5 wt.%. When the deodorization temperature is lower than 230°C, the flavor and color of the deodorized edible oil and/or fat may deteriorate. Meanwhile, when the deodorization temperature exceeds 260°C, the content of glycidol and glycidol fatty acid esters may be increased.

The vacuum degree is more preferably from 200 to 800 Pa, and even more preferably from 200 to 700 Pa. When the vacuum degree exceeds 800 Pa, the flavor of the deodorized edible oil and/or fat may deteriorate, which is not preferable. Further, when the amount of steam used is less than 0.5 wt.%, the flavor of the deodorized edible oil and/or fat also may deteriorate, which is not preferable. Further, when the amount of steam used exceeds 5 wt.%, the burden on the equipment may be increased, which is not preferable. The deodorization time is preferably from 30 to 120 minutes, and particularly preferably from 60 to 90 minutes. When the deodorization time is less than 30 minutes, the flavor of the deodorized edible oil and/or fat may deteriorate, which is not preferable. When the deodorization time exceeds 120 minutes, the content of glycidol and glycidol fatty acid esters may be increased, which is not preferable.

[0024]

Examples of a deodorization device used in an embodiment of the present invention include a reduced-pressure steam distillation device, and the deodorization may be performed in a batch type, a semi-continuous type, or a continuous type device. When the amount of the oil and/or fat to be treated is small, a batch type device is preferable; when the amount of the oil and/or fat to be treated is large, a semi-continuous type or continuous type device is preferable.

The semi-continuous type device to be used may be, for example, a Girdler deodorizer composed of a deodorization column equipped with several trays. The treatment performed using this device is as follows. An oil and/or fat is supplied from the upper part of the device and brought into contact with steam on a tray for an appropriate period of time. Then, the oil and/or fat is descended to the tray below, and after an interval, moved to the next tray below, and so on. The continuous type device to be used may be, for example, a thin film deodorizing device capable of bringing a thin film of an oil and/or fat into contact with steam. The semi-continuous type device is preferably from the perspective of the ability to control the temperature and the amount of steam used.

[0025]

Stability based on the Conductmetric Determination Method (CDM) is a value indicating oxidation stability of oils and/or fats. In the present specification, the value obtained by the CDM stability test is referred to as “CDM stability time” and is used as an evaluation index for oxidation stability. A longer CDM stability time indicates better oxidation stability. In the present specification, the method of the CDM stability test follows the Standard Methods for the Analysis of Fats, Oils and Related Materials, 2.5.1.2-1996. Specifically, clean air is fed into a reaction vessel while an oil and/or fat is heated to 120°C in the reaction vessel; then, volatile decomposition products produced by oxidation are collected in water, and the conductivity of the water is continuously measured. The time up to the inflection point at which the value changes abruptly indicates the “CDM stability time”.

[0026]

In an embodiment of the present invention, the content of glycidol and glycidol fatty acid esters is measured by the following method.

[0027]

0.3 mL of isooctane is added to 100 mg of an oil and/or fat sample to dissolve the oil and/or fat sample. 3 mL of sodium bromide solution containing 90 U/mL lipase is added to a test tube, and the test tube is shaken on a shaker for 30 minutes. The test tube is heated at 80°C for 10 minutes, and then is allowed to be cooled or water-cooled to room temperature. 50 µL of 2.0 µg/mL internal standard mixed solution and 3 mL of hexane are added to the test tube, and the test tube is capped. The test tube is stirred with a vortex mixer. After centrifugation, the aqueous layer is transferred to a new test tube using a Pasteur pipet. 3 mL of hexane is added to the test tube to which the aqueous layer has been transferred, and the test tube is capped. The test tube is stirred with a vortex mixer. After centrifugation, the organic layer is removed. 20 µL of phenylboronic acid solution and 3 mL of hexane are added to the test tube, and the test tube is capped. The test tube is shaken on a shaker for 10 minutes. The organic layer is transferred to a new test tube using a Pasteur pipet. The organic layer in the new test tube is concentrated to 0.5 to 0.8 mL under nitrogen, and then analyzed by GC-MS.

Note that, in the GC-MS, molecular ion peaks m/z 147 and m/z 150 are used in the quantification.

Examples

[0028]

The present invention will be described in more details using examples presented below. Note that in the examples, “%” indicates weight basis.

[0029]

(1) Flavor Evaluation

The flavor was evaluated by multiple people. The best flavor (no taste and no odor) was given 5 points. The worse the flavor, the lower the score. The scores of flavor in the table are the

average values of the scores given by the evaluators. In the evaluation criteria, 3 or more points were regarded as “pass”, and less than 3 points were regarded as “fail”.

[0030]

(2) Phosphorus Concentration

Analysis of Elemental Content

An inductively coupled plasma mass spectrometer (7700 Series ICP-MS available from Agilent Technologies) was used in the analysis of phosphorus concentration. Table 1 presents the analytical instrument conditions in an embodiment of the present invention. Note that, an analytical sample was prepared by the following method. 1 g of the oil and/or fat was placed in a sample decomposition vessel made of fluorine resin and precisely weighed. Then, 7 ml of concentrated nitric acid and 1 ml of hydrogen peroxide were added, and acid decomposition was performed with a microwave decomposition device for samples (ETHOS PLUS available from Milestone). After the decomposition, the volume was adjusted to 50 ml using ultrapure water, and a sample solution was prepared.

[0031]

[Table 1]

RF Power	1.55 kW
Plasma Gas Flow Rate	15 L/min
Auxiliary Gas Flow Rate	0.90 L/min
Nebulizer Gas Flow Rate	1.02 L/min
Peri-pump Setting	0.1 rps
Measurement Point	6 points/peak
Integration Time	0.1 sec/point
Number of Repetitions	1 time

[0032]

(3) CDM Stability Time

The oxidation stability of the oil and/or fat was evaluated using Rancimat, a CDM tester available from Metrohm.

Measurement conditions: measurement temperature was 120°C, blown air amount was 20 L/h, and the oil and/or fat sample fed was 3 g.

Note that, the deodorized oil and/or fat was used in the evaluations of (1) Flavor Evaluation and (3) CDM Stability Time. The evaluation of (2) Phosphorus Concentration used the oil and/or fat from which activated clay was removed after completion of bleaching.

[0033]

Example 1

Crude palm oil (CPO) degummed with phosphoric acid was subjected to bleaching-deodorization. An 85% aqueous solution of phosphoric acid was added to the raw material CPO in an amount of 0.1 wt.% with respect to the weight of the oil and/or fat. Activated clay was

added in an amount of 1.5 wt.% with respect to the weight of the oil and/or fat, and the mixture was subjected to a bleaching treatment for 10 minutes under the conditions of 110°C and 1330 Pa while stirring. The oil and/or fat from which activated clay was removed after completion of bleaching was subjected to a deodorization treatment for 90 minutes under the conditions of 250°C, 266 Pa, and an amount of steam used of 3 wt.%. After the deodorization, glycidol fatty acid esters contained in the oil and/or fat were analyzed.

[0034]

Example 2

Crude palm oil (CPO) pre-refined by deacidification using an alkali was subjected to bleaching-deodorization. An 85% aqueous solution of phosphoric acid was added to the raw material CPO in an amount of 0.1 wt.% with respect to the weight of the oil and/or fat. Activated clay was added in an amount of 1.5 wt.% with respect to the weight of the oil and/or fat, and the mixture was subjected to a bleaching treatment for 10 minutes under the conditions of 110°C and 1330 Pa. The oil and/or fat from which activated clay was removed after completion of bleaching was subjected to a deodorization treatment for 90 minutes under the conditions of 250°C, 266 Pa, and an amount of steam used of 3 wt.%. After the deodorization, glycidol fatty acid esters contained in the oil and/or fat were analyzed.

[0035]

Example 3

Crude palm oil (CPO) degummed with phosphoric acid was subjected to bleaching-deodorization. A 50% aqueous solution of citric acid was added to the raw material CPO in an amount of 0.1 wt.% with respect to the weight of the oil and/or fat. Activated clay was added in an amount of 1.5 wt.% with respect to the weight of the oil and/or fat, and the mixture was subjected to a bleaching treatment for 10 minutes under the conditions of 110°C and 1330 Pa. The oil and/or fat from which activated clay was removed after completion of bleaching was subjected to a deodorization treatment for 90 minutes under the conditions of 250°C, 266 Pa, and an amount of steam used of 3 wt.%. After the deodorization, glycidol fatty acid esters contained in the oil and/or fat were analyzed.

[0036]

Comparative Example 1

Crude palm oil (CPO) degummed with phosphoric acid was subjected to bleaching-deodorization. Activated clay was added in an amount of 1.5 wt.% with respect to the weight of the oil and/or fat, and the mixture was subjected to a bleaching treatment for 10 minutes under the conditions of 110°C and 1330 Pa while stirring. The oil and/or fat from which activated clay was removed after completion of bleaching was subjected to a deodorization treatment for 90 minutes under the conditions of 250°C, 266 Pa, and an amount of steam used of 3 wt.%. After the deodorization, glycidol fatty acid esters contained in the oil and/or fat were analyzed.

[0037]

Comparative Example 2

Crude palm oil (CPO) degummed with phosphoric acid was subjected to bleaching-deodorization. An 85% aqueous solution of phosphoric acid was added to the raw material CPO in an amount of 0.1 wt.% with respect to the weight of the oil and/or fat. Activated clay was added in an amount of 1.5 wt.% with respect to the weight of the oil and/or fat, and the mixture was subjected to a bleaching treatment for 10 minutes under the conditions of 110°C and 1330 Pa while stirring. The oil and/or fat from which activated clay was removed after completion of bleaching was subjected to a deodorization treatment for 90 minutes under the conditions of 210°C, 266 Pa, and an amount of steam used of 3 wt.%. After the deodorization, glycidol fatty acid esters contained in the oil and/or fat were analyzed.

[0038]

Comparative Example 3

Crude palm oil (CPO) was subjected to bleaching-deodorization. An 85% aqueous solution of phosphoric acid was added to the raw material CPO in an amount of 0.1 wt.% with respect to the weight of the oil and/or fat. Activated clay was added in an amount of 1.5 wt.% with respect to the weight of the oil and/or fat, and the mixture was subjected to a bleaching treatment for 10 minutes under the conditions of 110°C and 1330 Pa while stirring. The oil and/or fat from which activated clay was removed after completion of bleaching was subjected to a deodorization treatment for 90 minutes under the conditions of 250°C, 266 Pa, and an amount of steam used of 3 wt.%. After the deodorization, glycidol fatty acid esters contained in the oil and/or fat were analyzed.

[0039]

Table 2 presents the evaluation results of the oils and/or fats obtained in Examples 1 to 3 and Comparative Examples 1 to 3.

[0040]

[Table 2]

	Phosphorus Concentration After Bleaching (ppm)	Glycidol Equivalent After Deodorization (mg/kg)	Flavor After Refining	CDM Stability Time
Example 1	5.3	0.76	4.6	14.7
Example 2	8.8	0.63	4.5	13.8
Example 3	6.4	0.60	4.6	12.4
Comparative Example 1	21.4	1.66	4.5	9.2
Comparative Example 2	5.1	0.67	2.6	11.5
Comparative Example 3	33.7	2.14	4.1	8.3

[0041]

As presented in Table 2, in the examples, in which pre-refining by deacidification with an alkali or degumming with an acid was performed, an aqueous solution of citric acid or phosphoric acid was added during bleaching, and the phosphorus concentration was 10 ppm or less, oils and/or fats obtained had good flavor and possessed excellent oxidation stability because of having a CDM stability time of 10 hours or longer. The content of glycidol and glycidol fatty acid esters in examples was able to be reduced to 1.0 mg/kg or less, in terms of glycidol equivalent.

[0042]

- In Comparative Example 1, pre-refining by deacidification with an alkali or degumming with an acid was performed, but an aqueous solution of citric acid or phosphoric acid was not added during bleaching. In this case, the glycidol equivalent after deodorization was 1.66 mg/kg, and the glycidol equivalent after refining could not be reduced to 1.0 mg/kg or less.

- In Comparative Example 2, the deodorization temperature was set to 210°C, and the flavor was scored as 2.6 points in this case.

- In Comparative Example 3, pre-refining by deacidification with an alkali or degumming with an acid was not performed, and the phosphorus concentration was not 10 ppm or less. Thus, the glycidol equivalent after deodorization was 2.14 mg/kg, and the glycidol equivalent after refining could not be reduced to 1.0 mg/kg or less.

[0043]

The above results are summarized in Table 3. An edible oil and/or fat which had good flavor and oxidation stability, and in which the content of glycidol and glycidol fatty acid esters was reduced to 1.0 mg/kg or less in terms of glycidol equivalent could be only obtained when: pre-refining by deacidification with an alkali or degumming with an acid was performed; an aqueous solution of citric acid and/or an aqueous solution of phosphoric acid was added during bleaching operation; the phosphorus concentration in the bleached oil and/or fat was reduced to 10 ppm or less; and deodorization was performed at a deodorization temperature of from 230 to 260°C.

[0044]

Similar to Patent Documents 2 and 3, a degumming treatment was also performed in Comparative Example 1. However, since Comparative Example 1 does not satisfy the configuration of the present invention, the content of glycidol and glycidol fatty acid esters could not be reduced.

[0045]

[Table 3]

	Refining Conditions				Quality of Refined Oil		
	Implementation of Deacidification and/or Degumming Treatment	Addition of Aqueous Solution of Acid During Bleaching Operation	Phosphorus Concentration of 10 ppm or Less	Deodorization Temperature of from 230 to 260°C	Glycidol Equivalent of 1.0 mg/kg or Less	Flavor	CDM Stability Time of 10 Hours or Longer

Examples	○	○	○	○	○	○	○
Comparative Example 1	○	×	×	○	×	○	×
Comparative Example 2	○	○	○	×	○	×	○
Comparative Example 3	×	○	×	○	×	○	×

Industrial Applicability

[0046]

According to the present invention, an oil and/or fat having a reduced content of glycidol and glycidol fatty acid esters can be produced without impairing the flavor.

Claims

[Claim 1]

A method for producing a refined, bleached, and deodorized palm oil (RBDPO), the method comprising adding an aqueous solution of an acid when the crude palm oil is subjected to bleaching operation after a deacidification and/or degumming treatment in refining of crude palm oil (CPO), wherein a phosphorus concentration in an oil and/or fat after bleaching is 10 ppm or less, and an oil and/or fat after deodorization at 230°C to 260°C satisfies the following conditions:

quality of the oil and/or fat after deodorization:

- a content of glycidol and glycidol fatty acid esters of 1.5 mg/kg or less in terms of glycidol equivalent, and
- a CDM stability time of 10 hours or longer.

[Claim 2]

The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to claim 1, wherein from 0.01 to 10 wt.% of the following aqueous solution is added as an acid in the adding an aqueous solution of an acid,

- an aqueous solution of citric acid and/or phosphoric acid having a concentration of from 1 to 85 wt.%.

[Claim 3]

The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to claim 1, wherein the adding an aqueous solution of an acid is adding an aqueous acid solution to a mixture of clay and an oil and/or fat in the bleaching.

[Claim 4]

The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to claim 2, wherein the adding an aqueous solution of an acid is adding an aqueous acid solution to a mixture of clay and an oil and/or fat in the bleaching.

[Claim 5]

The method for producing a refined, bleached, and deodorized palm oil (RBDPO) according to any one of claims 1 to 4, wherein the deodorization is performed under the following conditions:

- a vacuum degree of from 100 to 800 Pa, and
- an amount of steam used of from 0.5 to 5 wt.%.

[Claim 6]

A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in claim 1 or 2.

[Claim 7]

A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in claim 3.

[Claim 8]

A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in claim 4.

[Claim 9]

A method for reducing glycidol and glycidol fatty acid esters in a refined, bleached, and deodorized palm oil (RBDPO) using the method for producing a refined, bleached, and deodorized palm oil (RBDPO) described in claim 5.