

PROCESS FOR PRODUCING SALAD OIL

The present invention relates to a process for producing a salad oil, which is a useful liquid oil, from a specified oil or fat which has been obtained by treating palm oil.

Fats which are in solid form at ambient temperature are usually converted into liquid oils to make them convenient to use. Solid oils, such as palm oil are, now mass-produced and the quantity used thereof will be increased in the future. Therefore, the development of new effective uses of solid oils is eagerly demanded. However, the use of solid fats per se is limited. Under these circumstances, it is desirable to produce a liquid salad oil from palm oil.

Various processes have been tried for liquefying solid fats. The most simple process comprises merely mixing a solid fat with a liquid oil. However, this process is not very effective, since the amount of solid fat which can be incorporated into the liquid oil can only be very small if the intended liquid oil is to be obtained.

Another known process for liquefying a solid fat comprises fractionating a solid fat to yield a low-melting point fraction, but it will be apparent from, for example, oleins obtained by fractionation of palm oil, that even the low-melting point fraction tends to be in solid form in seasons other than summer and the product thus obtained is only a semi-liquid oil.

Under these circumstances, various processes based on a transesterification reaction with lipase have been proposed. For example, Japanese Unexamined Published Patent Application (hereinafter referred to as "J. P. KOKAI") No. Sho 61-293389 discloses transesterification of palm oil and an odourless liquid starting oil with a lipase having 1,3-specificity. However, this process is not always satisfactory, since the amount of palm oil

which can be incorporated is only 50% at the most.

J. P. KOKAI Nos. Sho 49-107304 and 64-81899 describe a process wherein a liquid oil is mixed with an oil obtained from palm oil by fractionation and
5 transesterification of the mixture is conducted. However, the oil obtained from this process has an insufficient cooling resistance.

A primary object of the present invention is to provide a process for efficiently producing a salad oil
10 from palm oil which overcomes the above-described problems.

This and other objects of the present invention will be apparent from the following description and examples.

The present invention provides a process for
15 producing a salad oil which comprises transesterifying a mixture of (A) an oil or fat produced from palm oil and having the following characteristics:

iodine value: 55 to 75

constituent fatty acids:

20 palmitic acid: 30 to 42% by weight

oleic acid: 42 to 48% by weight

linoleic acid: 11 to 20% by weight

tripalmitin: 2% by weight or less

open-tube melting point: 5 to 25°C

25 and (B) a liquid edible oil other than the component (A) in a weight ratio of 5:95 to 95:5, with immobilized lipase having 1,3-specificity, in the absence of solvent, and then fractionating the product in the absence of solvent.

30 The present invention was completed on the basis of a finding that a salad oil can be efficiently produced by treating palm oil to produce an oil or fat having specified characteristics, homogeneously mixing the thus-obtained oil or fat with a liquid edible oil having
35 another composition and subjecting the mixture to a 1,3-specific transesterification between fatty acid residues of the oil or fat and fatty acid residues of the liquid

edible oil.

The oil or fat (A) having the above-described characteristics preferably has an iodine value of 57 to 75, an amount of palmitic acid residue of 30 to 40% (by weight; the same shall apply hereinafter) and an open-tube melting point of 5 to 25°C. The oil or fat used as component (A) in the present invention is preferably produced from palm oil by dry fractionation or solvent fractionation under conditions controlled so that the above-described characteristics will be obtained. It is important in the present invention that the oil or fat having the above-described characteristics is used. When a starting oil which has characteristics that are not within the above-described ranges is used, the object of the invention cannot be attained.

The iodine value, fatty acid composition and open-tube melting point are determined according to standard oil and fat analysis methods (edited by Yukagaku Kyokai) and the amount of tripalmitin is determined according to high-performance liquid chromatography.

The immobilized lipase having 1,3-specificity usable in the present invention includes, for example, Lipozyme (a product of Novo Co.) which is produced by immobilizing a lipase having 1,3-specificity derived from *Mucor Miehei* by using an ion exchange resin as a carrier. The immobilized lipase usable in the present invention is not limited to Lipozyme, and any lipase having 1,3-specificity which is carried on a known carrier can be used.

The liquid edible oils usable as component (B) in the present invention may include soybean oil, rape seed oil, cotton seed oil, corn oil, safflower oil, rice oil, sunflower oil and sesame oil. These oils can be used either singly or in the form of a mixture of two or more oils.

Both oil components (A) and (B) used in the present invention may be refined oils, bleached oils or

deodorized oils. The weight ratio of the oil or fat used as component (A) to the liquid edible oil used as component (B) in the present invention is 5:95 to 95:5, preferably 55:45 to 90:10, in order to attain the object of the present invention, which is to produce a liquid oil having a cooling resistance satisfying the standard of salad oils (the Japanese Agricultural Standard that it is not clouded after being left to stand at 0°C for 5.5h).

10 A salad oil can be produced in a quite satisfactory yield in a practical and economically advantageous manner by subjecting the mixture of the substances in the above-described weight ratio to transesterification.

Namely, when the amount of the palm oil or fat in the starting mixture exceeds 95 parts for 5 parts of the liquid edible oil in the mixture, the salad oil cannot be recovered in a satisfactory yield in the subsequent fractionation step. When the ratio of the oil or fat to the liquid edible oil is higher than 55:45, the salad oil can be produced in a more economically advantageous manner.

The transesterification reaction in the present invention is preferably conducted at about 60 to 80°C, particularly at around 70°C.

25 From a commonsense point of view, a high temperature is desirable for increasing the speed of the transesterification reaction. However, an excessively high temperature will pose a problem of deactivation of the lipase.

30 It is desirable in the present invention that the homogeneous oil mixture is formulated so that it will be saturated with water at the reaction temperature.

By saturation with water, the amount of free fatty acids produced in the course of the reaction as by-products can be kept small and the activity of the immobilized lipase can be maintained for quite a long period of time.

In the present invention, the transesterification reaction can be conducted either batchwise or continuously. However, the continuous process, in which a column filled with the immobilized lipase is used, is superior from the viewpoints of apparatus and efficiency.

When the transesterification reaction is conducted batchwise, heating at a relatively high temperature for a long period of time is required in order sufficiently to conduct the reaction, particularly when a solid fat is used, and, in addition, the amount of free fatty acids formed by a hydrolysis side reaction is relatively high. In the continuous process, the heating time is shorter and the amount of by-produced fatty acids is also smaller.

In the present invention, the solid fat is separated by fractionation from the modified product thus produced.

The fractionation is conducted in the absence of solvent, which is one of the characteristic features of the present invention. To produce the salad oil intended in the present invention (i.e. salad oil which is not clouded after being left to stand at 0°C for 5.5h according to the Japanese Agricultural Standard), the reaction mixture is preferably slowly cooled to 3 to 10°C, preferably around 5°C, to precipitate the solid components from the mixture and the solid fat is fractionated by filtration according to a known method.

According to the present invention, the relative amount of the starting material derived from palm oil can be increased to an extent larger than that of known processes and the salad oil produced by the present invention has a satisfactory cooling resistance.

The following examples further illustrate the present invention:

Example 1

40% of an oil or fat produced by dry fractionation of palm oil and having an iodine value of 58.0, palmitic

acid content of 39.8%, oleic acid content of 42.5%,
linoleic acid content of 11.2%, tripalmitin content of
0.2% and open-tube melting point of 21.6°C was
homogeneously mixed with 60% rape seed oil. 360 g/h of
5 the mixture was passed through a 1l column filled with
300g of Lipozyme (immobilized lipase of Novo Co.) to
conduct the transesterification. The reaction product
obtained in the initial stage (72h) was taken out and
then about 5kg of the reaction product in the next stage
10 was taken, dried and slowly cooled to 5°C in 48h and the
crystals thus formed were filtered out at that
temperature. The yield of the liquid oil was 87%. Even
when the liquid oil was cooled to 0°C in ice/water for
30h, it was not clouded, suggesting that it had a
15 sufficient cooling resistance for that required of salad
oil.

Comparative Example 1

40% of palm oil having an iodine value of 52.1,
20 palmitic acid content of 44.0%, oleic acid content of
39.2%, linoleic acid content of 10.2%, tripalmitin
content of 9.4% and an open-tube melting point of 35°C
was homogeneously mixed with 60% of the same rape seed
oil as that used in Example 1. After transesterification
25 and slow cooling was conducted in the same manner as that
of Example 1, the liquid oil was obtained at a yield of
78%. When the oil was cooled in the same manner as that
of Example 1, it was clouded after 17h.

30 Comparative Example 2

40% of the same oil produced from palm oil as that
used in Example 1 was homogenously mixed with 60% of the
same rape seed oil as that used in Example 1. The
mixture was slowly cooled to 5°C in 48h and then filtered
35 at that temperature. The yield of the liquid was 58%
which was far lower than that obtained in Example 1 and
this process is practically unsatisfactory.

Example 2

5 60% of the same oil derived from palm oil as that
used in Example 1 was homogeneously mixed with 40% of the
same rape seed oil as that used in Example 1. 360 g/h of
the mixture was passed through a 1l column filled with
300g of Lipozyme (immobilized lipase of Novo Co.) to
conduct transesterification. The reaction product
obtained in the initial stage (72h) was taken out and
10 then about 5kg of the reaction product in the next stage
was taken, dried and slowly cooled to 5°C in 48h and the
crystals thus formed were filtered out at that
temperature. The yield of the liquid oil was 70%. Even
when the liquid oil was cooled to 0°C in ice/water for
15 5.5h, it was not clouded, suggesting that it had a
sufficient cooling resistance as that required of salad
oil.

Comparative Example 3

20 60% of the same oil derived from palm oil as that
used in Example 1 was homogeneously mixed with 40% of the
same rape seed oil as that used in Example 1. The
mixture was cooled to 5°C in 48h. No liquid oil could be
obtained by filtration.

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Example 3

A salad oil was prepared by the same method as in Example 1 except that rape seed oil was replaced by soybean oil. As a result, the yield of the liquid salad oil was 84 %. Even when the liquid oil was cooled to 0°C in ice/water for more than 5.5 h, it was not clouded to suggest that it had a sufficient cooling resistance as that required of the salad oil.

Example 4

A salad oil was prepared by the same method as in Example 1 except that rape seed oil was replaced by corn oil. As a result, the yield of the liquid salad oil was 85 %. Even when the liquid oil was cooled to 0 °C in ice/water for more than 5.5 h, it was not clouded to suggest that it had a sufficient cooling resistance as that required of the salad oil.

Comparative Example 4

40 % of the same oil derived from palm oil as that used in Example 1 was homogeneously mixed with 60 % of the same soybean oil as that used in Example 3. The mixture was cooled to 5 °C in 48 h. As a result, the yield of the liquid oil was 59 %.

Comparative Example 5

40 % of the same oil derived from palm oil as that used in Example 1 was homogeneously mixed with 60 % of the same corn oil as that used in Example 4. The mixture was cooled to 5°C in 48 h. As a result, the yield of the liquid oil was 55 %.

**CLAIMS:**

1. A process for producing a salad oil which comprises transesterifying a mixture of (A) an oil or fat produced from palm oil and having the following characteristics:

iodine value: 55 to 75

constituent fatty acids:

palmitic acid: 30 to 42 % by weight

oleic acid: 42 to 48 % by weight

linoleic acid: 11 to 20 % by weight

tripalmitin: 2 % by weight or less

open-tube melting point: 5 to 25°C

and (B) a liquid edible oil other than the component (A) in a weight ratio of 5:95 to 95:5, with immobilized lipase having 1,3-specificity, in the absence of solvent, and then fractionating the product in the absence of solvent.

2. The process for producing a salad oil of claim 1 wherein the palm oil has the following properties:

iodine value: 57 to 75

constituent fatty acids:

palmitic acid: 30 to 40 % by weight

3. The process for producing a salad oil of claim 1 or 2, wherein the oil or fat used as component (A) is produced from palm oil by dry fractionation or solvent fractionation.



4. The process for producing a salad oil of claim 1, 2 or 3, wherein the liquid edible oil used as the component (B) is selected from the group consisting of soybean oil, rape seed oil, cotton seed oil, corn oil, safflower oil, rice oil, sunflower oil and sesame oil.

5. The process for producing a salad oil of any preceding claim, wherein the weight ratio of the oil or fat used as the component (A) to the liquid edible oil used as the component (B) is 55:45 to 90:10.

6. The process for producing a salad oil of any preceding claim, wherein the transesterification reaction is conducted at about 60 to 80°C.

7. The process for producing a salad oil of any preceding claim, wherein the fractionation is carried out such that the reaction mixture is slowly cooled to 3 to 10°C to precipitate the solid components from the mixture and the solid fat is removed by filtration.

8. A process for producing a salad oil substantially as hereinbefore described in Example 1, 2, 3 or 4.

9. A salad oil produced by the process of any preceding claim.
