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OIL TREATMENT

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14 Claims. (Cl. 260—409)

This invention relates to the treatment of fats and oils.

One of the objects of this invention is to provide an improved method of bleaching fats and oils.

Other objects and advantages of this invention will become apparent from the description and claims which follow.

Vegetable oils, for example, cottonseed oil, cocoanut oil, soya bean oil, corn oil, rape seed oil, peanut oil, palm oil, and the like, are generally subjected to three steps in the preparation of edible compositions, namely, a refining step, a bleaching step, and a deodorization step. In many cases a hydrogenation step is introduced between the bleaching step and the deodorization step. The refining step is generally carried out by treating the oil with caustic which reacts with the free fatty acids to form soaps, and the soaps and foots are removed to produce a refined oil. The refined oil is then treated with from two per cent to three per cent of a solid adsorbent, such as fuller's earth, activated earths, activated carbon, or mixtures of these materials, to bleach or decolorize the oil. After removal of the solid adsorbents from the oil, the oil may be hydrogenated or may be passed directly to the deodorization chambers. Deodorization is generally effected by treating the oil at elevated temperatures and under a reduced pressure by passing steam through the body of the oil.

Animal fats and oils, for example, lard, oleo stearine, and tallow, may also be refined, bleached and deodorized or hydrogenated and deodorized.

In the claims, the term "oils" is employed in its broad sense to include animal and vegetable fats and oils regardless of the melting point of the particular material.

The use of solid adsorbents for complete bleaching of oils results in an oil loss which is dependent upon the amount of adsorbent employed in the bleaching step and upon the individual adsorbent.

The present invention contemplates a partial bleaching of oils by treatment with a solid adsorbent followed by a final or complete bleaching of the oil during hydrogenation or deodorization.

In the practice of my invention, crude oil, for example, cottonseed oil, may first be refined, for example, with caustic at a temperature of from 90 degrees F. to 140 degrees F. The refined oil is then heated to a temperature of from 160 degrees F. to 220 degrees F., for example, to a temperature of about 180 degrees F., and a small proportion of solid adsorbent, such as fuller's earth, is mixed thoroughly with the heated oil. I have discovered that generally less than one half the usual quantities of fuller's earth may be employed in partially bleaching dark colored oils and smaller quantities may be employed in partially bleaching light colored oils in accordance with my invention. Generally, from about 0.1 per cent to one per cent fuller's earth is satisfactory. For example, in bleaching a refined oil having a color of 7.6 red, from two per cent to three per cent fuller's earth is generally employed in the conventional bleaching process to bleach the oil to a color of from 2.0 red to 2.5 red. In accordance with my invention, I may employ about up to one per cent fuller's earth, which is sufficient to effect a 50 per cent reduction in the color, or to reduce the color to about 5.0 red. The adsorbent is then removed by passing the mixture of adsorbent and oil through a filter press.

The partially bleached oil is then deodorized at a temperature of from 350 degrees F. to 470 degrees F. under a vacuum of about 28 inches and steam is passed through the body of the oil for about five hours to remove volatile compounds which impart undesirable odors to the oil. I have discovered that bleaching of the oil may be completed simultaneously with the deodorization. An oil, previously partially bleached to a color of about 5.0 red, will be reduced to a color as low as that obtained by standard bleaching with six per cent fuller's earth, namely, to a color of from 2.0 red to 2.5 red, during the deodorization step or other heat treatment step.

If the oil is to be hydrogenated, the hydrogenation step precedes the deodorization step. In general, hydrogenation may be carried out at a temperature of from 365 degrees F. to 385 degrees F. in the presence of a catalyst such as nickel. Hydrogenation may be effected under a vacuum or at atmospheric pressure. During hydrogenation the oil may be bleached, the rate and degree of bleaching being dependent upon the degree of heat maintained during hydrogenation. I have found that substantially the same amount of bleaching may be accomplished during hydrogenation as is effected during deodorization. Where the hydrogenation step is to be followed by a deodorization step it is not necessary to closely control the hydrogenation step to effect a complete bleaching since the bleaching may be completed in the deodorization step.

I have discovered that bleaching of the oil may also be completed by heating the oil under atmospheric pressure or increased pressure, with

or without passing steam through the body of the oil or in the presence or absence of hydrogen.

Animal fats and oils may be treated in the same manner as described for the treatment of vegetable oils.

My process has been applied satisfactorily on a large scale in bleaching cottonseed oil, cocoanut oil, rape seed oil, corn oil, soya bean oil, peanut oil, palm oil, tallow, and oleo stearine. In large scale operations on these oils and fats, I have found that from about 0.3 per cent to 0.6 per cent solid adsorbent, such as fuller's earth, and that deodorization temperatures between 350 degrees F. and 400 degrees F. are quite satisfactory. I have found that a highly satisfactory bleach may be obtained by effecting a bleach with a solid adsorbent equivalent to about 50 per cent of the standard bleach for the particular oil and completing the bleaching by heat treatment.

Table A represents data which was obtained in semi-commercial practice of my invention in the treatment of 326,000 pounds of cottonseed oil and 212,000 pounds of soya bean oil. I have found that the use of about one third of one per cent fuller's earth is generally satisfactory in the treatment of cottonseed oil, and that about one half of one per cent fuller's earth is generally satisfactory in the treatment of soya bean oil.

In Table A, the first column of data represents the color reading of the refined oil. The second column of data represents the red color reading of a small sample of each of the samples of the refined oil which has been subjected to the standard bleach wherein the oil is bleached by treatment with six per cent standard fuller's earth in accordance with the specifications of the American Oil Chemists Society, published in "American Oil Chemists Society's Methods," page 17. It will be noted that samples of soya bean oil were not treated with six per cent fuller's earth.

In each case, the refined oil was heated to a temperature of from 160 degrees F. to 220 degrees F. and fuller's earth then added and thoroughly mixed with the oil. The third column of data represents the percentage of earth added. The mixture of oil and earth after being agitated for a short period, for example, from ten to fifteen minutes, was then passed through a filter press to free the oil of the earth. The fourth column of data represents the red color reading of the oil after partial bleaching with fuller's earth. It will be noted that in each of the cottonseed oil samples, the red color was reduced about 50 per cent with respect to the reduction obtained by the standard bleach employing six per cent fuller's earth.

In each case, a portion of the refined, partially bleached oil was deodorized by heating the oil to a temperature of from 350 degrees F. to 400 degrees F. under a vacuum of about 28 inches, and steam was passed through the oil for a period of about five hours. The data in the fifth column represents the color reading of the deodorized oil sample.

A portion of certain of the main samples of refined, partially bleached oil was hydrogenated in the presence of a nickel catalyst at a temperature of from 365 degrees F. to 385 degrees F. under a pressure of about 40 pounds per square inch for from five to twelve hours. The data in the sixth column represents the color reading of the hydrogenated material.

A portion of certain of the samples of refined, partially bleached oil was hydrogenated in the presence of a nickel catalyst at a temperature of from 365 degrees F. to 385 degrees F. under a pressure of about 30 pounds per square inch. The cottonseed oil so treated was subjected to the action of hydrogen for from fifty minutes to one hundred thirty-five minutes. The soya bean oil so treated was subjected to the action of hydrogen for from ninety minutes to one hundred fifty minutes. The hydrogenated material was then deodorized by heating the material to a temperature of from 350 degrees F. to 400 degrees F. under a vacuum of about 28 inches, and steam was passed through the material for a period of about five hours. The data in the seventh column represents the color reading of the hydrogenated, deodorized oil.

Table A

Oil sample	Color reading		Color reading 6 per cent fuller's earth bleach red	Per cent earth used	Color reading red	Deodorized oil color reading		Hydrogenated oil color reading		Hydrogenated and deodorized oil color reading	
	Yellow	Red				Yellow	Red	Yellow	Red	Yellow	Red
COTTONSEED OIL											
A	35	7.1	1.4	0.411	3.2	15	1.4	10	1.5		
B	35	7.3	1.5	0.222	4.3	15	1.8			12	1.4
C	35	6.8	1.6	0.363	4.2			15	1.2	12	1.0
D	35	6.5	1.5	0.360	4.3	20	1.9	14	1.5	14	1.3
E	35	6.7	1.6	0.273	4.1	15	1.3	12	1.3	15	1.4
SOYA BEAN OIL											
I	50	7.4		0.972	5.0	6.0	1.3	10	1.2	5.0	0.8
II	50	6.1		0.280	4.8	6.0	1.3	14	0.9	8.0	0.9
III	50	6.5		0.441	4.4	10	2.7	14	2.0	7.0	0.9
IV	50	6.0		0.480	4.4	14	1.4	14	1.8	5.0	0.9

The use of my method of bleaching fats and oils results in a substantial reduction in the cost of bleaching since much smaller quantities of solid adsorbent are required than in the conventional bleaching method. Bleaching to 50 per cent of the total standard bleaching results in more than a 50 per cent saving in the solid adsorbent since the last full point of color which is removed by solid adsorbents requires about six times the quantity of solid adsorbent required in the removal of the first full point of color. My method also effects a savings in the cost of filter press cloths and of cleaning the filter press since larger quantities of oil may be run through the filter

press before sufficient solid adsorbent has been collected to require the replacement of the cloths and cleaning of the filter press. It is apparent that a reduction in the quantities of adsorbent employed in treating the oil also reduces the oil loss resulting from retention of oil by the earth, since about one pound of oil is lost for each ten pounds of earth employed.

I claim:

1. The method of bleaching glyceride oils which comprises treating a refined glyceride oil with up to about 1 per cent of an activated adsorbent earth to effect a partial decolorization of the oil, separating the activated earth adsorbent from the oil, and thereafter heating the oil to a higher temperature of about 350 to 400 degrees F. in order to effect more complete decolorization.

2. The method of bleaching refined glyceride oils which comprises adding to the oil up to one per cent of a solid adsorbent to effect a partial decolorization of the oil, agitating the mixture of oil and adsorbent, separating the solid adsorbent from the oil, and thereafter heating the oil to a higher temperature of from 350 degrees F. to 400 degrees F.

3. The method of bleaching refined glyceride oils which comprises adding to the oil up to one per cent of a solid adsorbent to effect a partial decolorization of the oil, agitating the mixture of oil and adsorbent, separating the solid adsorbent from the oil, heating the oil to a higher temperature of from 350 degrees F. to 400 degrees F. under a vacuum, and subjecting the oil to the action of steam.

4. The method of bleaching refined glyceride oils which comprises adding to the oil up to one per cent of a solid adsorbent to effect a partial decolorization of the oil, agitating the mixture of oil and adsorbent, separating the solid adsorbent from the oil, and thereafter hydrogenating the oil at a higher temperature of from 350 degrees F. to 400 degrees F.

5. The method of bleaching refined glyceride oils which comprises heating the oil to a temperature of from 160 degrees F. to 220 degrees F., adding thereto from 0.1 per cent to one per cent of a solid adsorbent, agitating the mixture of adsorbent and oil, separating the adsorbent from the oil, heating the oil to a temperature of from 365 degrees F. to 400 degrees F. under a vacuum, and treating the oil with steam.

6. The method of bleaching refined vegetable oils which comprises heating the oil to a temperature of from 160° F. to 220° F., adding thereto up to one per cent fuller's earth to effect a partial bleach of the oil, agitating the mixture of fuller's earth and oil, separating the fuller's earth from the oil, heating the oil to a temperature of from 350° F. to 400° F. under a vacuum of about 28 inches, and passing steam through the oil under the vacuum for a period of about 5 hours.

7. The method of bleaching refined cottonseed oil which comprises heating the oil to a temperature of from 160 degrees F. to 220 degrees F., adding thereto up to one per cent of a solid adsorbent to effect a partial decolorization of the oil, agitating the mixture of adsorbent and oil, separating the adsorbent from the oil, heating the oil to a temperature of from 350 degrees F. to 400 degrees F., and subjecting the oil under reduced pressure to the action of steam.

8. The method of bleaching refined cottonseed oil which comprises heating the oil to a temperature of from 160° F. to 220° F., adding thereto up to one per cent fuller's earth to effect a partial bleach of the oil, agitating the mixture of fuller's earth and oil, separating the fuller's earth from the oil, heating the oil to a temperature of from 350° F. to 400° F. under a vacuum of about 28 inches, and passing steam through the oil under the vacuum for a period of about 5 hours.

9. The method of bleaching refined cottonseed oil which comprises heating the oil to a temperature of from 160 degrees F. to 220 degrees F., adding thereto from 0.1 per cent to one per cent fuller's earth to effect a partial decolorization of the oil, agitating the mixture of oil and fuller's earth, separating the fuller's earth from the oil, heating the oil to a temperature of from 350 degrees F. to 400 degrees F., and subjecting the oil under vacuum to the action of steam for about five hours.

10. The method of bleaching refined cottonseed oil which comprises heating the oil to a temperature of from 160 degrees F. to 220 degrees F., adding thereto from 0.1 per cent to one per cent fuller's earth to effect a partial decolorization of the oil, agitating the mixture of oil and fuller's earth, removing the fuller's earth from the oil, and hydrogenating the oil at a temperature of from 365 degrees F. to 400 degrees F.

11. The method of bleaching refined soya bean oil which comprises heating the oil to a temperature of from 160 degrees F. to 220 degrees F., adding thereto up to one per cent of a solid adsorbent to effect a partial decolorization of the oil, agitating the mixture of adsorbent and oil, separating the adsorbent from the oil, heating the oil to a temperature of from 350 degrees F. to 400 degrees F., and subjecting the oil under reduced pressure to the action of steam.

12. The method of bleaching refined soya bean oil which comprises heating the oil to a temperature of from 160° F. to 220° F., adding thereto up to one per cent fuller's earth to effect a partial bleach of the oil, agitating the mixture of fuller's earth and oil, separating the fuller's earth from the oil, heating the oil to a temperature of from 350° F. to 400° F. under a vacuum of about 28 inches, and passing steam through the oil under the vacuum for a period of about 5 hours.

13. The method of bleaching refined soya bean oil which comprises heating the oil to a temperature of from 160 degrees F. to 220 degrees F., adding thereto from 0.1 per cent to one per cent fuller's earth to effect a partial decolorization of the oil, agitating the mixture of oil and fuller's earth, separating the fuller's earth from the oil, heating the oil to a temperature of from 350 degrees F. to 410 degrees F., and subjecting the oil under vacuum to the action of steam for about five hours.

14. The method of bleaching refined soya bean oil which comprises heating the oil to a temperature of from 160 degrees F. to 220 degrees F., adding thereto from 0.1 per cent to one per cent fuller's earth to effect a partial decolorization of the oil, agitating the mixture of oil and fuller's earth, separating the fuller's earth from the oil, and hydrogenating the oil at a temperature of from 365 degrees F. to 400 degrees F.

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CERTIFICATE OF CORRECTION.

Patent No. 2,292,027. August 4, 1942.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 59, for "410 degrees" read --400 degrees--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of September, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)