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BLEACHING OILS AND FATS

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This invention relates to the bleaching of oils and fats.

A relatively large proportion of the available supply of oils and fats is in the form of very dark fats and greases. There are many uses where such dark stocks are not suitable and in which lighter colored oils or fats are more desirable. For example, when a dark colored stock is used as the base for soap making, at least a part of the coloring matter is carried into the finished soap; this makes the soap darker than would be the case if the soap had been made from a light colored stock. Such darker colors are undesirable in soap because of the great appeal which a white soap or a light colored soap has to the user. As another example, when an oil or fat is to be used as the base stock for an edible product, such as shortening or a salad oil, it is very important that it be of light color. Oils and fats used for a variety of other purposes, such as in the textile and leather industry, require light colored stock.

When the available supplies of high grade stocks are sufficient, they may be used for the purposes mentioned above. However, with the desire in industries for lighter colored oils and fats, the supplies of darker stocks have become relatively more available and it has become increasingly important to utilize such dark colored stock to augment the supply of high grade stocks.

Under some circumstances it is possible to hydrolyze or split the oils or fats and distill the fatty acids from the coloring matter. Such a splitting and distilling process often results in the development of odors from decomposition products because of the high temperatures used, and these odors are carried into the soap. Another process, in which glycerides are converted to the methyl or ethyl esters and distilled, has been developed in connection with making lighter colored soaps from fatty acids. Such processes require extensive equipment, and operating conditions which are uneconomical except in the case of very large installations. Such processes also are open to the objection that the oil or fat is not retained in its glyceride form and for many uses it must be in this form.

Because of the needs of the industry for the production of lighter glyceride oils and fats from darker stocks, the art has proposed numerous bleaching processes. A wide variety of chemicals have been proposed as bleaching agents for oils and fats, including various oxidizing agents, reducing agents, halogen compounds, acids, etc. In general, none of these have produced eminently satisfactory results nor have they been adopted commercially on any extensive basis. The most common method of bleaching oils and fats has been to treat them with a bleaching earth, such as fuller's earth, or materials known to the trade as activated earths. These earths exert a strong bleaching action, especially if they are the activated earths, but the extent of the bleaching of the oil or fat that can be accomplished with a reasonable amount of earth, in the case of very dark stocks, is not sufficient to produce the desired light colored oils and fats. In general it is not economical to use more than about 6% of earth in such a bleaching process, for the reason that in relation to the bleaching accomplished by a larger amount, the loss of the stock that is absorbed in the earth, to say nothing of the cost of the earth, does not render the use of larger amounts economical. If the stock cannot be bleached sufficiently with about 6% of earth, it is the usual practice to use the stock in some manner in which its dark color is not objectionable.

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In an earlier filed application we have referred to this state of the art and have described a process in which dark colored stocks are bleached by treatment with an acidic phosphoric compound and an oxygen liberating compound. Such an oxygen liberating compound may be hydrogen peroxide; a "per" type salt compound, such as sodium perborate, sodium percarbonate, or sodium persulfate; an oxyhalogen compound, such as sodium hypochlorite or sodium chlorite. These compounds liberate oxygen in a highly active, sometimes referred to as "nascent," state. It is not necessary to have an understanding of the invention described in said earlier filed application in order to understand this invention, but it is mentioned because of the fact that although the process works admirably, the oxygen liberating compounds used are relatively expensive, and the process does not operate satisfactorily when air is used as the source of oxygen. Since air is the cheapest source of oxygen, it would be highly desirable if air could be substituted for the oxygen liberating compound. This prospect, however, did not appear encouraging because, with the exception of palm oil, the blowing of glyceride oils or fats with air darkens them markedly. The treatment of palm oil by blowing it with air has long been known and has been regularly used in commercial practices. The coloration in palm oil, however, is unique and presents different bleaching problems from that of animal fats, such as

tallows and greases, and the vegetable oils, such as cottonseed oil, soybean oil, etc.

We have discovered that a markedly superior bleaching of oils and fats, especially very dark colored low grade tallows, fats and greases, may be accomplished by treatment with an acidic phosphorus compound in the presence of oxygen if an inhibitor is present in the oil or fat. The oxygen may be furnished by an oxygen liberating compound, as referred to previously, or by air or ordinary oxygen (O_2). Our invention includes the surprising discovery that when the inhibitor is used, air may be substituted for an oxygen liberating compound. Inasmuch as air is practically without cost the ability to substitute air is a tremendous advantage of the present invention and its use will be described as the preferred embodiment. Contrary to what might have been expected from the known state of the art of air blowing tallow, vegetable oils, and other non-carotenoid pigments containing fats, we have found that it is possible to effect a remarkable bleaching action by blowing with air if an inhibitor is used along with the phosphoric acid. Especially is this surprising considering the very dark stocks that may be used as the raw material, the pronounced bleaching action obtained, and the great difficulty with which the prior art has had in bleaching such stocks by any means.

We appreciate that it has been proposed to use phosphoric acid in connection with bleaching, and as has been mentioned previously, that it has been proposed to air blow palm oil and other carotenoid pigment containing oils. It has not been proposed, insofar as we can ascertain, to employ the combined action of phosphoric acid and an inhibitor in conjunction with the use of air or oxygen in other form to obtain a lightening in the color of fats and greases.

It is to be emphasized that our invention is of particular significance in the treatment of very dark colored tallows or greases, which appear black or very dark brown in the raw state. Such dark colored greases are also characterized by a high free fatty acid content. The latter makes it particularly difficult to bleach such stocks and it is for this reason that the dark greases have generally heretofore been used in making light colored products only after splitting and distillation of the fatty acids. This, however, as pointed out heretofore, has certain disadvantages and also does not leave the lighter colored material in the glyceride state.

In practicing a preferred embodiment of the invention described merely as illustrative, the dark colored fat or grease is mixed with a small amount of a commercial grade of a phosphoric acid compound and a small quantity of the silicon containing inhibitor of the type to be described more fully hereinafter. The fat containing these addition agents is maintained in a molten form at a slightly elevated temperature and the mixing is continued, during which time air is blown through the fat or grease. Following this treatment the stock is settled and a sludge withdrawn, and the stock is washed with hot water to remove the treating chemicals. Any acid remaining may be neutralized before or after washing. After washing the treated oil may be bleached with fuller's earth or any conventional bleaching earth in the usual manner, if further bleaching is desired. The earth bleaching operations and variations thereof are well known in the industry. If desired, the bleaching earth may be mixed with the stock at the same time as the phosphoric acidic compound and the silicon inhibitor.

The acidic phosphoric compound to be used may be any phosphorus compound that is distinctly acid in nature, preferably any phosphoric acid, a salt thereof having an acid reaction, or a compound forming such an acid or salt under the reaction conditions. Phosphoric acid is commercially available and relatively inexpensive. Commercial ortho-phosphoric acid is available in concentrations of from 70% to 85% and these may be used conveniently. The water and impurities which make up the balance of such commercial acids are not detrimental to the process. Any other acidic phosphoric compound may be used, such as pyrophosphoric acid, and acidic salts of phosphoric acids, such as potassium or sodium dihydrogen phosphate or disodium dihydrogen pyrophosphate, and acidic pentavalent and organic phosphorus compounds.

The inhibitor may be any silicic acid or fluosilicic acid or salt thereof. The silicic acid may be metasilicic acid or silica in any degree of hydration. Other examples are the so-called silica gels and wet ground amorphous silica. The salts preferably are the alkali and alkaline earth metal salts of the acids such as sodium silicate, magnesium silicate, and sodium fluosilicate. All of these materials are characterized by their containing a silicate, fluosilicate, metasilicate, and the like groups or radicals, which may be conveniently classed as materials containing "silicate" radicals as this expression is used herein. The inhibitor may be added to the stock conveniently in the form of a slurry or a solution prepared with a small amount of water. The acidic phosphoric compound also may be included in the slurry.

The amount of the inhibitor may be within the range of 0.1 to 5%, based on the oil or fat to be treated. Somewhat smaller amounts reflect some improvement but generally not enough to justify the use of the process. Larger amounts too do not reflect an improvement that justifies using the additional quantity. Generally the amount is 0.5 to 2% on an anhydrous basis, and is of the same order as the amount of the phosphoric acid compound. The amounts are related somewhat to the extent and nature of the coloring matter in the oil or fat.

The amount of the phosphoric compound generally is within the range of 0.25 to 3% of the oil or fat to be treated, ½ to 1½% being the optimum range. It is unlikely that the operation would be carried out with less than 0.25% since the bleaching action, while significant, is not sufficient to justify the operation on a commercial basis. The use of amounts more than 3% is not harmful but the increase in the improvement is not sufficient to justify amounts larger than this in a commercial operation. The amount will also bear a relation to the form of the inhibitor. If a silicic or fluosilicic acid as such is used the amount of the phosphoric compound may be very small. If a silicate or fluosilicate is used, such as sodium silicate, the amount of the phosphoric compound should be sufficient to be in excess so that the mixture will be on the acid side.

If an oxygen liberating compound is used instead of air or gaseous oxygen, the amount of said compound may be 0.01 to 2%, based on the oil or fat to be treated.

As illustrative of the results that may be accomplished when air is used as the source of

the oxygen, the following examples are given merely as illustrative:

Example I

A very dark fat, the color of which is too dark to determine, is treated with 1.5% of 85% phosphoric acid and 6% of a 20% solution of sodium silicate (1.2% anhydrous). These are mixed with the fat in melted form at a temperature of about 65° C. and the mixture is blown with air for 2 hours at this temperature. Following this, the stock is settled and washed with sufficient hot water to remove all of the chemicals. It is then bleached at 105° C. for 15 minutes with 6% of an activated earth bleach, and filtered. The resulting stock had a color of 19 Red, as determined on a Lovibond colorimeter using 1" column of oil.

For the purposes of comparison, the identical stock was treated with phosphoric acid and blown with air at the same temperature, and under the same conditions except that the sodium silicate was not employed. Following this the stock was settled and washed, after which it was bleached with a 6% activated earth bleach and filtered, exactly as described above. The color of the treated fat was too dark to read on the colorimeter, indicating that no improvement resulted from the air blowing, even though phosphoric acid was present and the treatment was followed by earth bleaching. Blowing such stock with air alone makes the color even darker, and bleaching with earth alone does not result in a satisfactory lightening of the color.

Example II

The same dark tallow was treated with 1.5% of an 85% commercial phosphoric acid and 2% of sodium fluorosilicate (anhydrous) dissolved in a small amount of water. These reagents were mixed thoroughly with the oil by agitating and it was blown with air for 2 hours at 65° C. After washing to remove the added chemicals, the stock was bleached for 15 minutes at 105° C. with 6% of an activated earth bleach and it was found to have a color of 17.5 Red when measured on a Lovibond colorimeter using a 1" column.

The fat bleached in the manner described in this example was made into soap in a conventional manner and the soap treated with a mineral acid to recover the fatty acids therefrom. These fatty acids had a Lovibond color of 7.8 Red on a 1" column. This is a very light color considering the dark color of the starting stock. Similar results are obtained with soap made from the stock bleached in accordance with Example I.

It will be seen from the above examples that the invention is particularly adapted to refining greases used in soap making because often there is a tendency for the color to revert in the soap after the fat has been saponified. Thus while many ordinary bleaching processes produce an oil or fat of reasonably light color, nevertheless upon making soap from the bleached stock and acidifying the soap to form fatty acids, it will be found that these fatty acids are darker than stock from which the soap is made. No doubt latent color forming materials in the fat are not removed in such bleaching processes and form colors during the soap making. In our process it is to be noted that the bleaching action is one which does not result in undesirable color developments during soap making, as is shown by the light color of the fatty acids obtained from the soap stock.

Example III

A similar dark tallow as used in Example I was heated to 65° C. and treated with a slurry made up as follows: 0.5% metasilicic acid, based on the weight of the fat, was added to water equal to approximately 10% of the weight of the fat. This was incorporated in the fat by mechanical agitation. Then 1%, based on the weight of the fat, of 85% phosphoric acid was added and mixed thoroughly with the oil by agitation. The oil was then blown with air for two hours, maintaining the temperature at 65° C. At the end of this period, the fat was washed with water to remove the added chemicals and the stock bleached for 15 minutes at 105° C. with 5% activated earth. The color of fat after bleaching and filtering was found to be 9.8R–50Y as measured on a Lovibond colorimeter using a 1" column.

A soap made from this tallow following the regular soap boiling procedure including a bleach for 30 minutes with 0.3% sodium hydrosulfite gave soap having a fatty acid color of 6R–50Y as measured on the Lovibond colorimeter using a 1" column.

Example IV

A lot of brown grease was bleached with 6% activated earth for 15 minutes at 105° C. After bleaching and filtering, a Lovibond colorimeter reading of 29.5R–75Y using a 1" column was obtained.

Another portion of this tallow without previous earth bleaching was heated to 65° C. and 0.5% of finely powdered silica gel was added. Then 1%, based on the weight of the fat, of 85% phosphoric acid was added and the fat was air blown and mechanically agitated for one hour, maintaining a temperature of 65° C. The fat was then washed with water and bleached with 6% activated earth according to the procedure previously described. After filtration, the fat had a Lovibond color reading in a 1" column of 9R–50Y.

Example V

Thirty thousand pounds of dark tallow were heated to 150° F. with mechanical agitation and the following materials added in the order indicated. 150 lbs. amorphous silica (wet ground), 150 lbs. of phosphoric acid (75%), 1500 lbs. of bleaching earth. The mechanical agitation was continued together with air blowing of the fat for 45 minutes, maintaining a temperature of 65° C. At the end of this period, sufficient chalk was added to neutralize the excess of mineral acid. The air blowing was discontinued and the temperature of the fat raised to 220° F. for 15 minutes. The fat was then filtered in the usual manner and a Lovibond color reading on a 1" column of 10R–75Y was obtained.

Example VI

Thirty thousand pounds of dark tallow were heated to 150° F. and mechanically agitated. A slurry was made up as follows: 150 lbs. of amorphous silica (wet ground), 150 lbs. of phosphoric acid (75%), 1500 lbs. water. These materials were added in the order indicated. The fat was blown with air for 45 minutes, maintaining the temperature at 150° F. It was then washed with water. The temperature was raised to 220° F. and the fat bleached with 1500 lbs. of activated earth for 15 minutes. After filtering, the fat was

found to be 8.8R–50Y in a Lovibond 1" column.

The temperature at which the treatment with the phosphoric acid compound, the inhibitor and the air blowing is carried out may vary over the general range of about 40 to 100° C. The minimum temperature is that at which the oil or fat will be in a liquid state and the maximum temperature is that at which charring of the fat would occur in the presence of the acidic compound. Because of the heat requirements, a minimum temperature which will accomplish the desired bleaching in a reasonable time is recommended, and the optimum temperature range is probably about 50 to 75° C.

The order of the addition of the chemicals is not important except that the silicon inhibitor should be present in the stock at the time of the air blowing. In the preferred embodiment the phosphoric acid compound and the silicon inhibitor are added to the stock and the two mixed with it during the air blowing; this is the simplest method of handling the materials. Good results can be obtained, however, by first treating the stock with the phosphoric acid compound and withdrawing a sludge that is formed by this treatment, following which the stock is mixed with the silicon inhibitor and blown with air. In general, however, there is no advantage of going through two separate operations including an intermediate separation of the phosphoric acid sludge, when as good results can be obtained in a single treatment simultaneously with both chemicals.

The treating time varies, from about one-half or less to four hours, and the air blowing should be continued as long as any improvement in color is manifest. Any elapsed time between the addition of the acid and inhibitor and the air blowing does not seem to be critical. There is no advantage in continuing the treatment beyond this point where color improvement is obtained and this can be readily ascertained by the operator. In such instances, quite short periods can be used, but the maximum bleaching effect is generally obtained by continuing the treatment for at least one-half hour.

The chemical mechanism of the process is not entirely clear and we do not wish to be bound to any theory or explanation of the exact chemistry involved. It would appear possible, however, that in view of the presence of the phosphoric acid compound at least a part of the silicon compound present as salts of a silicic or fluosilicic acid is converted into the corresponding acid; for example, if magnesium silicate is used, some silicic acid will be formed or if sodium silicofluoride is used some hydrofluosilicic acid will be formed. It seems likely, therefore, that it is some form of a hydrated silica or acidic silicon compound which acts as an inhibiting agent to inhibit the undesirable darkening of the fat when it is blown with air.

In the above examples, the washing operation to remove the treating agents is not critical. It is convenient to carry this out in two stages, the first one employing a small amount of not over 15% water, for example 1 to 10%, and the second empolying a somewhat larger amount of water, such as 5 to 100% and preferably 10 to 25%. After the fat has been sprayed with the wash water, it is permitted to stand and the water with the treating agents and coloring matter therein separates as a lower layer and can be withdrawn from the bottom of the tank.

The earth bleaching operation, described as a treatment which may be used following the air blowing and washing, may be carried out according to any standard technique. This involves mixing the stock with about 2 to 6% of the earth and agitating the mixture at an elevated temperature which induces maximum bleaching, such as 80 to 125° C. The agitation is continued as long as any improvement in color is noted. After this the stock is filtered to remove the earth.

It is important to note that good results are obtained by following the air blowing treatment with earth bleaching. While a remarkable improvement in color is noted as a result of the air blowing treatment, this treatment seems to render the fat particularly susceptible to earth bleaching and a striking improvement is obtained by the earth bleach operation as a result of the preliminary air blowing process. Thus these two steps coact to produce an improved final result, which is more than might be expected from the results obtained by the separate treatments.

In the description of the illustrative examples of the invention heretofore, air has been used as the source of oxygen since this is the most economical source and would probably be used in the commercial practice of the invention. Our process may be employed, however, using the silicon-containing inhibitor with oxygen and an acidic phosphorus compound, when the oxygen is obtained from sources other than air. The following additional examples are given as illustrative of such embodiments.

Example VII

A dark tallow was treated with 2% of phosphoric acid and ½% of a 12% solution of sodium hypochlorite for 1 hour at a temperature of 65° C. with agitation. After settling and decanting the tallow was then bleached with 6% of an earth bleach at 105° C. The tallow had a Lovibond color of 34 Red and 75 Yellow (1" column).

As compared therewith, the same tallow was treated with the same materials under the same conditions except that in addition there was added ½% of a 20% solution of a sodium silicate which was mixed with the phosphoric acid before the addition of the same to the tallow. The resulting tallow had a Lovibond color of only 18 Red and 75 Yellow (1" column).

The remarkable improvement obtained by the inclusion of a silicate radical containing substance with the phosphoric acid, when the oxygen is obtained from a hypochlorite instead of air, is shown in the example.

Example VIII

Following the same procedure as described in the previous example, a tallow was treated with 1% of phosphoric acid and 1% of hydrogen peroxide. The Lovibond color was 12.2 Red and 50 Yellow (1" column).

As compared therewith, the same process on the same tallow was carried out, except that ½% of wet ground amorphous silica was included, which was mixed with the phosphoric acid and 5% water in a slurry before addition of the same to the tallow. The color of the tallow was 9.6 Red and 50 Yellow (1" column).

In this example, the use of silica in addition to the phosphoric acid and oxygen from hydrogen peroxide, shows an improvement in the color.

Example IX

Following the same procedure as in Example VIII, the same tallow was treated with 1% phos-

phoric acid and 0.1% of sodium chlorite. The Lovibond color of the tallow was 12.5 Red and 50 Yellow (1" column).

In a comparative sample, the same amount of phosphoric acid and sodium chlorite were used but in addition there was included ½% amorphous silica, which was mixed in a slurry with the phosphoric acid and 5% water before adding the same to the tallow. The Lovibond color of the treated tallow was 9.2 Red and 50 Yellow (1" column).

This example shows that the color is improved when the wet silica is included with phosphoric acid and oxygen obtained from sodium chlorite.

In the specification the reference to "oxygen" is intended to be generic to oxygen obtained from any source, such as an oxygen liberating compound, gaseous oxygen, or a mixture of oxygen with other gases, such as air.

It will be obvious to those skilled in the art that the invention is capable of operation with a large variety of treating agents within the genera described, and other than those specifically listed as illustrative, and also with a wide variety of procedures other than those described as the preferred embodiment. All such procedures are intended to be within the invention as fall within the scope of the following claims.

We claim:

1. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with an acidic phosphoric compound selected from the group consisting of orthophosphoric acid, pyrophosphoric acid and acidic salts thereof, and oxygen in the presence of a silicate radical containing inhibitor.

2. The process of claim 1, in which the oxygen is liberated in situ from sodium hypochlorite.

3. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with an acidic phosphoric compound selected from the group consisting of orthophosphoric acid, pyrophosphoric acid and acidic salts thereof, and a silicate radical containing inhibitor, and blowing the stock with air at a temperature at which the stock is liquid.

4. A process of bleaching dark colored oil and fat stocks, which comprises intimately mixing said stock with orthophosphoric acid, oxygen, and a silicic acid inhibitor at a temperature at which the stock is liquid.

5. A process or bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and a silicic acid inhibitor, and blowing the stock with air at a temperature at which the stock is liquid.

6. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and a silica gel inhibitor, and blowing the stock with air at a temperature at which the stock is liquid.

7. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and finely divided hydrated amorphous silica inhibitor, and blowing the stock with air at a temperature at which the stock is liquid.

8. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and a soluble silicate inhibitor under acidic conditions, and blowing the stock with air at a temperature at which the stock is liquid.

9. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with about ½ to 1.5% of orthophosphoric acid, and 0.5 to 2% of a silicic acid inhibitor, blowing the stock with air at a temperature of 50 to 75° C., and washing the stock to remove the treating agents.

10. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with oxygen in the presence of a silicate radical containing inhibitor and an acidic phosphoric compound selected from the group consisting of orthophosphoric acid, pyrophosphoric acid and acidic salts thereof, at a temperature to maintain the stock liquid, separating the stock from the treating agents, and treating the stock with a bleaching earth.

11. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with an acidic phosphoric compound selected from the group consisting of orthophosphoric acid, pyrophosphoric acid and acidic salts thereof, and a silicate radical containing inhibitor, and blowing the stock with air at a temperature at least sufficient to maintain the stock liquid, and treating the stock with a bleaching earth.

12. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and a silicic acid inhibitor, blowing the stock with air at a temperature at which the stock is liquid, washing the stock to remove the treating agents, and treating the stock with a bleaching earth.

13. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and silica gel inhibitor, blowing the stock with air at a temperature at which the stock is liquid, washing the stock to remove the treating agents, and treating the stock with a bleaching earth.

14. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and finely divided hydrated amorphous silica inhibitor, blowing the stock with air at a temperature at which the stock is liquid, washing the stock to remove the treating agents, and treating the stock with a bleaching earth.

15. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with orthophosphoric acid and an aqueous solution of a soluble silicate inhibitor under acid conditions, blowing the stock with air at a temperature at which the stock is liquid, washing the stock to remove the treating agents, and treating the stock with a bleaching earth.

16. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with about ½ to 2% of orthophosphoric acid, 0.2 to 2% of a silicic acid inhibitor, blowing the stock with air at a temperature of 50 to 75° C., washing the stock to remove the treating agents, treating the stock with 2 to 6% of an a bleaching earth at a temperature of 75 to 125° C., and filtering the stock from the earth.

17. A process of bleaching dark colored oil and fat stocks, which comprises treating said stock with about ½ to 2% of orthophosphoric acid and ½ to 2% of a silica gel inhibitor in water, blowing the stock with air at a temperature of 50 to 75° C., washing the stock to remove the treating agents, treating the stock with 2 to 6% of a bleaching earth at a temperature of 75 to 125° C., and filtering the stock from the earth.

18. A process of bleaching oils and fats by treating with oxygen in the presence of orthophosphoric acid and a silicic acid inhibitor.

19. The process of claim 18 in which the oxygen is liberated from sodium hypochlorite which has been added to the oil and fat being treated.

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