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Method and plant for cooling of fatty oils

This invention relates to a method of cooling fatty oil and apparatus for use in carrying out the method.

Natural oils and fats have different characteristics due to the fact that they are composed of a great number of different triglycerides. These may contain fatty acids having carbon chains of different lengths and of different degrees of unsaturation.

Triglycerides with a high degree of unsaturation, indicated by a high iodine value, have a lower melting point than those containing more saturated fatty acids. If an oil is cooled to a certain temperature, the high melting point triglycerides (stearine) will crystallize, while the low melting point ones will remain fluid. The stearine can then be separated from the oil (olein) by different methods, the fat-oil thus being divided into two fractions, namely stearine with a high melting point and olein with a low cloud point and a low melting point.

This separating technique is called fractional crystallization and is used to obtain oils or fats, which are more suitable, for example for use as cooking oil or for margarine production.

In the conventional method, the high melting point stearine is removed from the oil by filtration, and the crystallization rate must be so slow so that

big crystals are formed.

To obtain the fractional crystallization the cooling may be carried out in different ways. Usually a large container known as a crystallizer is used and is equipped with an external jacket through which cooling fluid is passed. Internal cooling coils may also be used. When such a crystallizer is used the cooling time is generally about 6-24 hr, depending on the size of the crystallizer. The crystallizers are also provided with complicated agitators to keep the fatty oil in movement during the crystallization process. The internal agitation is kept low and the rate of the cooling slow in order to control the latent heat of crystallization and to avoid super-cooling. It has also been proposed to use a crystallizer which consists of concentric rings, every second one of which is intended for circulation of water while the other rings contain the oil which is agitated gently by stirrers which almost scrape the walls. This design of crystallizer makes the cooling surface larger.

According to the present invention there is provided a method of cooling fatty oil for crystallizing high melting point constituents, wherein the fatty oil is contained in a crystallizer having mixing means and connected in a circuit with a separate cooler, in the form of a plate heat exchanger, and fatty oil is taken from the crystallizer, circulated through said cooler and cooled by heat exchange with a coolant in said heat exchanger, and said cooled fatty oil is returned to the crystallizer.

By the method of the invention the fatty oil or part of the same is brought to circulate through the separate cooler and the cooling of the fatty oil

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can take place mainly by cooling with the coolant in this cooler, with the result that it is possible to cool large amounts of fatty oil down to a separation temperature of 20°C in a time as short as 2 hours and still obtain crystals of a size easy to filter. In order to obtain a regular size of the crystals it is advantageous to heat the oil prior to cooling. The heating, the optimum degree of which varies with the oil which is to be treated, is preferable to a temperature in the range of 60-90°C.

It is expedient for the temperature of the oil entering the separate cooler to be sensed and the temperature of the coolant supplied to the cooler to be controlled to maintain a predetermined difference between the oil and coolant temperatures.

The cooling may be carried out in two stages. In the first one the oil is mixed intensely in the crystallizer and is then quickly cooled to a temperature of 35-60°C with a temperature difference of at least 10°C between the fatty oil and the coolant being maintained. In the second cooling stage the oil is cooled to a temperature which is suitable for the filtration i.e. 12- 35°C, with the temperature difference between the fatty oil and the coolant being maintained in the range of 2-10°C.

In some cases it may be desirable to cool also fatty oil in the crystallizer which may be provided with cooling means, such as a jacket and/or a cooling coil for that purpose. Both external and internal cooling is then obtained.

Also provided in accordance with the invention is an apparatus for use in carrying out the cooling method, comprising a crystallizer, a pump and a separator cooler connected in a flow circuit, the crystallizer having mixing means and the separate

cooler being a plate heat exchanger.

A device may be included to sense the temperature of the oil flowing from the crystallizer into the separate cooler, and means responsive to a signal from this device provided to control the temperature of the coolant supplied to the cooler according to the oil temperature.

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When fatty oil is cooled in the above manner, crystals of an even size are obtained which are easy to separate from the oil.

The method of the invention as specifically
5 described herein is especially suitable for palm oil, but may be used for different fatty oils, preferably fully refined. When other fatty oils are cooled according to the method of the invention other temperature programmes adapted to the properties of the oil of interest
10 may have to be applied.

A better understanding of the invention will be had from the following more detailed description of one example of the method and an embodiment of an apparatus according to the invention.

15 EXAMPLE

A tank of stainless steel provided with a propeller mixer was filled with 50 kg neutralized, bleached and deodorized palm oil with an iodine value of 52. The temperature of the oil was 78°C, which means that no
20 crystal germs were to be found in the oil. By means of a positive pump oil was taken from the tank, passed through a plate heat exchanger and returned to the tank. The oil was cooled in the heat exchanger by water with an inlet temperature of 9°C for 5 mins, after which the oil had a
25 temperature of 50°C. Further cooling was effected with water, the temperature being continuously controlled in order to maintain it at a temperature of 5°C below the temperature of the oil at the inlet to the plate heat exchanger. The cooling was interrupted after a further
30 106 minutes when the oil had reached a temperature of 18.5°C. A part of the crystal suspension was filtered in a laboratory vacuum-filter. The iodine value and cloud point of the olein was determined. The crystal suspension was easy to filter and it could be seen in the microscope
35 that crystals with an even size of 200 µm had been obtained.

19 The iodine value of the olein was determined to 57.8 and the cloud point measured to 8°C.

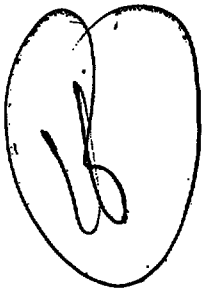
The accompanying drawing shows schematically an apparatus for cooling of fatty oils comprising a tank 1 provided with a propeller mixer 2 and into which heated oil to be cooled is fed. By means of a pump 3 connected in a circuit 4, a part of the oil is passed to a separate cooler 5 where the oil is cooled by a coolant 6. The oil is then returned to the tank 1 from the cooler 5 through a pipe 7. When the cooling of the fatty oil is carried out in the described apparatus a considerable reduction in the cost of the cooling apparatus is obtained compared to that used in earlier dry fractionation processes, since the tank and the mixing means are of a simple inexpensive construction compared with the jacketed tanks used previously. Due to the large cooling areas which are available in separate coolers of suitable design, the cooling may be carried through both faster and in a more controlled manner. This is especially true when the degree of cooling is controlled by regulating the temperature of the coolant in relation to the temperature of the oil. It has also been found that the formation of crystals of an even size is enhanced by the fatty oil being subjected to intensive mixing in the tank. This is contrary to the prior art which thought it unwise to agitate the oil other than slowly.



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Claims:

1. A method of cooling fatty oil for crystallizing high melting point constituents, wherein the fatty oil is contained in a crystallizer having mixing means and connected in a circuit with a
5 separate cooler, in the form of a plate heat exchanger, and fatty oil is taken from the crystallizer, circulated through said cooler and cooled by heat exchange with a coolant in said heat exchanger, and said cooled fatty oil is returned to
10 the crystallizer.
2. A method according to claim 1, wherein the cooling is effected substantially entirely in said separate cooler.
3. A method according to claim 1 or 2, wherein
15 the fatty oil is palm oil.
4. A method according to any one of claims 1 to 3, wherein the fatty oil is heated to a temperature of 60-90°C prior to cooling.
5. A method according to any preceding claim,
20 wherein the temperature of the oil entering the separate cooler is sensed and the temperature of the coolant supplied to the cooler is controlled to maintain a predetermined difference between said oil and coolant temperatures.
6. A method according to any one of claims 1 to 5, wherein in a first cooling stage the fatty oil is subjected to an intense mixing and rapid cooling to a
25 temperature of 35-60°C with a temperature difference of least 10°C being maintained between the fatty oil
30 and coolant.



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5 7. A method according to claim 6, wherein in a second cooling stage the fatty oil is cooled to a temperature suitable for the separation, in the range of 12-35°C, with the temperature difference between the fatty oil and coolant being maintained in the range of 2 to 10°C.

8. A method according to claim 6 or 7, wherein the crystallizer comprises cooling means.

10 9. Apparatus for use in carrying out the method of claim 1, comprising a crystallizer, a pump and a separate cooler connected in a flow circuit, the crystallizer having mixing means and the separate cooler being a plate heat exchanger.

15 10. An apparatus according to claim 9 wherein temperature sensing means is provided to sense the temperature of the oil passing into the cooler, and means responsive to the temperature sensing means is provided to control the temperature of coolant supplied to the cooler.

20 11. A method according to claim 1 and substantially as herein described.

25 12. An apparatus for cooling fatty oil substantially as herein described with reference to the accompanying drawing.
