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METHOD OF RECONSTRUCTING GLYCERIDE OILS

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This invention relates to oils, more particularly to the glycerides of fatty acids and to a method of reconstructing the same to change the physical and chemical properties thereof.

It is, of course, well known that the fatty oils, such as the vegetable oils, consist of a mixture of glycerides of various fatty acids having normally from 6 to 18 carbon atoms. The properties of the different glycerides vary and generally the glycerides of the lower fatty acids contained in the mixture have lower melting points than the glycerides of the higher fatty acids in the mixture. It is often desirable to increase the melting point of the mixture contained in said oils and this in the past has been accomplished by physical means.

For example, cocoanut oil, which consists of a mixture of low and high melting constituents, has been treated by refrigeration to solidify the higher melting constituents and then subjected to a pressing operation at the low temperature whereby the liquid portions were removed. The remaining material had a higher melting point, which was highly desirable, but the entire operation was very inefficient in that the yield of the higher melting point material was low and the residual liquid could be used for purposes where its value was lessened.

The present invention seeks to treat oils of the glyceride type having mixtures of low melting and higher melting point constituents, whereby the entire oil may have its melting point raised or may have other physical or chemical characteristics changed in a desired manner.

The present invention is based upon the discovery that it is possible to displace the lower fatty acids contained in fatty oils by heating said oil with a higher fatty acid or a mixture of such higher fatty acids and then distilling off the lower fatty acids from the mixture. It has been found that the reaction actually takes place under suitable conditions, even though it involves the displacement in a chemical combination of a stronger fatty acid by a weaker fatty acid.

In general, the process of the present invention consists in mixing a fatty oil with a higher fatty acid having 16 or 18 carbon atoms and heating the mixture at a sufficiently high temperature. Thereby, fatty acids having from 6 to 14 carbon atoms contained in the mixed glycerides may be displaced. The lower fatty acids may then be distilled off, condensed and utilized. It is possible to use various higher fatty acids in the process, as, for example, the saturated, unsaturated and hydroxylated fatty acids. Also, the products of the reaction may be treated in any desired manner and still further change the characteristics thereof.

The following examples will serve to illustrate the present invention:

Example No. 1

2720 grams of crude bleached cocoanut oil are mixed with 480 grams of distilled cottonseed fatty acids and placed in a suitable distilling vessel. The cocoanut oil had a saponification value of 258 and an iodine value of 9. The cottonseed fatty acids analyzed as follows:

FFA	102.6
Sap. number	204.7
Iodine number	101.4
Titer °C	34.8

The mixture was placed in the all glass laboratory distillation flask and heated while refluxing with CO_2 gas agitation. The temperature of the mixture was brought up to 300° C. and held there for at least two hours before allowing any distillation to take place under vacuum. (The source of CO_2 was stopped as soon as vacuum distillation was started.)

The distillation of the fatty acids was continued until it slowed down to a point indicating that the oil was low in FFA. It was then allowed to cool and the oil and the fatty acids weighed to determine loss due to reconstruction and distillation. Weight recoveries as high as 98.5% have thus been possible by proper condensation of the light fractions of fatty acids liberated during the reconstruction of the oil.

A very light fraction having an FFA (free fatty acid number) well over 170.0 was found in the cold receiver of the distillation system. The average FFA of the fatty acids collected, however, lies between 137.0–143.0 with a correspondingly high saponification number. That some neutral oil distills or is sprayed over is apparent from the correspondingly higher saponification number of the distillate. For instance, the saponification number of the distilled fatty acids should not be over 286.0 if they were pure fatty acids, but a saponification number of 298.0 to 304.0 on the distillate could only mean one thing—the presence of neutral oils.

The oil obtained after the reconstruction usually had an FFA of about 0.35–0.60, depending upon the length of reconstruction, vacuum and steam used.

The reconstructed oils were then cooled and subjected to hydrogenation with a nickel catalyst

until the iodine value had dropped to 1. The mixture was then filtered, washed with caustic alkali at about 150° F. It was then washed with water until free of alkali, filtered, bleached with bleaching earth and decolorizing carbon and finally deodorized at about 200° C. for several hours in a vacuum in steam. The oil was then allowed to cool under a vacuum and filtered.

The final oil before hydrogenation had an iodine value of 22.3, and after the completion of the treatment had an iodine value of 0.8. The saponification number of the oil had been reduced to 245, the setting point was 31.4° C., and the melting point 97° F.

Example No. 2

In order to reconstruct butter a mixture is provided containing approximately 75% of creamery butter which has previously been melted, washed several times with water and filtered with about 25% of distilled palm oil fatty acids. 1880 grams of this mixture was introduced into a still with a reflux condenser attached thereto. The mass was heated under a vacuum equal to 20–35 mm. of mercury at a temperature ranging up to about 260° C. over a period of about 2½ hours. This operation resulted in a displacement of the lower fatty acids of the butter fat by the palm oil fatty acids.

Thereupon the material was transferred into a distillation system under a vacuum of about 22 to 24 mm. of mercury where the distillation operation was continued at a temperature in the stock of up to about 285° C. over a period of 2 or 2½ hours. This resulted in a total recovery of reconstructed butter fat and free fatty acids of about 1862 grams, the small amount of loss being mechanical.

The following table indicates the changes which occurred in the various substances involved:

	FFA	Sap. value	Iodine value
Butter fat	0.4	227.4	35.6
Palm oil fatty acids	104.4	210.2	49.1
Mixture of 75% butter fat, 25% fatty acids	26.4	223.5	38.2
Fatty acids obtained from distillation	122.8	250.5	28.5
Esterified reconstructed oil	3.2	212.5	40.6

Example No. 3

The process of the present invention operates equally well with hydroxylated fatty acids. There was first provided a mixture containing approximately 25% of castor oil fatty acids and 75% of cocoanut oil, and 2180 grams of said mixture was introduced into a still provided with a reflux condenser. The mixture was heated under a vacuum equal to about 60 mm. of mercury, the temperature in the stock being up to 275° C. for approximately 2½ to 3 hours. The reaction whereby the lower fatty acids were displaced was, for all practical purposes, complete after this period of treatment.

Thereafter, the contents of the still were transferred to a steam distillation equipment and held under a vacuum of approximately 12 to 15 mm. of mercury for a period of 2½ hours while maintaining a temperature in the stock gradually rising to a maximum of about 300° C. As a result of this operation, the lower fatty acids were distilled and the cocoanut oil was reconstructed. A total yield of 2093 grams was obtained, the slight amount of loss being accounted for because of the tendency of materials to adhere to the walls of the distillation vessels.

The following table indicates the changes which occurred in the various substances involved:

	FFA	Sap. value	Iodine value
Cocoanut oil	0.025	257.1	8.0
Castor oil fatty acids	80.8	185.6	83.3
Mixture of 75% cocoanut oil and 25% castor oil fatty acids	20.1	239.1	27.7
Fatty acids obtained from distillation	136.8	287.5	12.6
Esterified reconstructed oil	2.15	233.9	36.2

Example No. 4

Fully saturated higher fatty acids also operate in accordance with the present invention. For example, a mixture was made of about 15% stearic acid with 85% cocoanut oil, and the treatment was continued as set forth above. After the completion of the operation, the stearic acid had practically completely displaced the lower fatty acids in the cocoanut oil, which were recovered by a distillation operation in the usual manner.

By following the conditions, namely, the amount and character of the higher fatty acids used in combination therewith, various properties in the final products will be obtained. The products of the present invention are particularly applicable for food purposes and they are useful in shortening, margerine oils, confectionary making, general cooking, frying and the like, and they are also useful in cosmetics and in pharmaceutical preparations.

Although I have described the invention setting forth several specific examples of the operation thereof, the invention is not to be limited by the examples given herein. For instance, I may use a single fatty acid in the reconstruction of oil, or I may use natural or artificial mixtures of fatty acids. Even the highly unsaturated fatty acids such as linoleic and clupadonic are suitable in the process. It is not necessary that the higher fatty acids have as high as 16 carbon atoms, but fatty acids having a lower number of carbon atoms may be used provided that the number is greater than that of the fatty acids to be displaced. It is not necessary that all of the lower fatty acids in the oils being reconstructed should be displaced, but I may displace all or part thereof, as desired. The amount of higher fatty acid used may be less than 15% of the oil being reconstructed and may be greater than 27%.

The conditions of the distillation may be different, as various temperatures and pressures may be used, depending on the characteristics of the oils and fatty acids involved. In some cases, I may use steam to assist the operations and, if desired, a catalyst may be employed. Various refining and auxiliary steps may be used in conjunction with the present invention. These and other changes in the details of the operation of the invention may be made and the invention is to be broadly construed and to be limited only by the claims appended hereto.

What I claim is:

1. A method of treating glyceride oils having in combination lower and higher fatty acids of from 6 to 18 carbon atoms to alter the physical and chemical characteristics of said oils which comprises providing a mixture of said oil and a free fatty acid having at least 2 more carbon atoms than the lowest fatty acid to be displaced but not over 18 carbon atoms, and heating said mixture to a sufficiently high temperature whereby a reaction takes place freeing the lower fatty

acids which are replaced by said added fatty acid and removing the fatty acids so freed.

2. A method of treating glyceride oils having in combination lower and higher fatty acids of from 6 to 18 carbon atoms to alter the physical and chemical characteristics of said oils which comprises providing a mixture of said oil and a free fatty acid having at least 2 more carbon atoms than the lowest fatty acid to be displaced but not over 18 carbon atoms, and heating said mixture to a sufficiently high temperature in a vacuum whereby a reaction takes place freeing the lower fatty acids which are replaced by said added fatty acid and removing the fatty acids so freed.

3. A method of treating glyceride oils having in combination lower and higher fatty acids of from 6 to 18 carbon atoms to alter the physical and chemical characteristics of said oils which comprises providing a mixture of said oil and an unsaturated free fatty acid having at least 2 more carbon atoms than the lowest fatty acid to be displaced but not over 18 carbon atoms, and heating said mixture to a sufficiently high temperature whereby a reaction takes place freeing the lower fatty acids which are replaced by said added fatty acid and removing the fatty acids so freed.

4. A method of treating glyceride oils having in combination lower and higher fatty acids of from 6 to 18 carbon atoms to alter the physical and chemical characteristics of said oils, the higher fatty acids having 16 and 18 carbon atoms and the lower fatty acids having from 6 to 14 carbon atoms, which comprises providing a mixture of said oil and a free fatty acid having from 16 to 18 carbon atoms, and heating said mixture to a sufficiently high temperature whereby a reaction takes place freeing the lower fatty acids which are replaced by said added fatty acid and removing the fatty acids so freed.

5. A method of treating glyceride oils having in combination lower and higher fatty acids of from 6 to 18 carbon atoms to alter the physical and chemical characteristics of said oils which comprises providing a mixture of said oil and a free fatty acid having at least 2 more carbon atoms than the lowest fatty acid to be displaced but not over 18 carbon atoms, and heating said mixture to a sufficiently high temperature above the vaporization point of said lower fatty acids and below that of said higher fatty acids, whereby a reaction takes place freeing the lower fatty acids, which are replaced by said added fatty acid and removing fatty acids so freed.

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