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MARGARINE OILS

Paul Seiden, Burlington, Ontario, Canada, assignor to The Procter & Gamble Company, Cincinnati, Ohio, a corporation of Ohio

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4 Claims. (Cl. 99—118)

This application is a continuation of application Serial Number 236,416, now abandoned, filed November 8, 1962.

The present invention relates to the preparation of margarine oil and, more particularly, to margarine oil containing a triglyceride oil additive derived from rapeseed oil, the combined fatty acid content of said triglyceride oil being at least 10%, by weight, of arachidic acid, behenic acid and mixtures thereof.

An especially preferred aspect of this invention relates to margarine oil containing palm oil, coconut oil and/or palm kernel oil into which hydrogenated rapeseed oil has been blended. Mixtures containing these oils in the proportions hereinafter described are highly useful in the preparation of margarine.

Margarine consists of an emulsion of two phases, one of these being fatty in nature while the other is aqueous in nature. The physical characteristics of a finished margarine such as firmness, spreadability, and ease of melting in the mouth, are to a large extent determined by the characteristics of the oily, or fatty, constituent which makes up the fatty phase of the emulsion. These characteristics are to a large extent dependent on the percentages of the fatty matter which exist in the solid state at the various temperatures normally encountered during the storage, use and consumption of the margarine.

For example, the margarine should melt readily in the mouth to avoid a sensation of "waxiness" or "stickiness" and to have a satisfactory flavor. This means there must be almost no fatty material in the solid state at or near body temperatures. On the other hand, at temperatures of use it must be capable of being spread and this requires that some portion of the fatty material be in the solid state at that temperature, but not so much that the margarine is hard and difficult to spread and not so little that the margarine will "slump" or lose its shape.

In addition, it is usually preferred to produce a margarine product that duplicates or approaches the characteristics of butter. In general, however, margarines are formulated to have better physical stability at high temperatures than butter and therefore can be stored in both refrigerated or non-refrigerated storage. In specific cases margarines can be produced deliberately different from butter in other characteristics; i.e. margarines can be made spreadable at refrigerated temperature.

When some margarines are heated above about 70° F., part of their liquid oil content may start to seep or "oil-off" from the body of the margarine to the lower surfaces. This seepage increases with increase in temperature. If it becomes excessive, liquid oil can leak through the parchment wrap, soiling it as well as the outside carton and case. In addition to making the package unsightly and oily to the touch, the oil is more susceptible to rancidity because of the greater exposure of the oil to the air. Further, since margarine contains an aqueous phase, bacterial or mold contamination can also occur.

It is generally recognized therefore that margarines must have sufficient heat resistance to resist oil-off under trade conditions.

The conventional way of improving heat resistance of

a margarine is to increase the higher melting saturated or trans fatty acid glyceride content by further hardening the margarine oil. However such an increase, though improving the heat resistance of the margarine, results in an increased solids content and hence a significant loss in the eating quality or "melt in the mouth characteristics" of the margarine.

The solid content referred to hereinabove is expressed, at different temperatures, in terms of a "Solid Contents Index" (SCI) which is measured by what is essentially the test described in The Journal of the American Oil Chemists' Society, March 1954, volume XXXI, pages 98—103. The test involves a dilatometric measurement of the amount by which a fat expands when heated from a specific temperature to complete melting. Since this expansion is due to both a volume increase when solids change to liquids without a temperature change and a volume increase due to thermal expansion without change in phase from solid to liquid, allowance is made for the thermal expansion so that the change in volume gives a measure of the amount of solid phase present at the temperature of measurement. The test has been modified in that readings are taken after 30 minutes at the temperature of measurement.

SCI data for an oil are usually presented in the form of a curve in which the SCI is plotted against temperature. It is readily apparent that a flat SCI curve is undesirable for a margarine oil since it is necessary to have a change within a small temperature range from a plastic material to one that is essentially a liquid.

One feature of the present invention is the addition to margarine oils of an additive which while providing improved heat resistance tends to cause only a small increase in the solids content. By this feature, a margarine can be obtained which sacrifices far less eating quality than has been the case in the past. Since there is a definite relationship between the heat resistance, eating quality or "melt in the mouth characteristics" and spreadability properties of margarine, it is possible, by the present invention, to produce margarine with better eating qualities and/or spreadability particularly for use in colder geographic areas where less heat resistance is required. Thus, the present invention makes it possible to provide other improvements in addition to an improvement in heat stability.

In formulating margarine, soft oils can be hydrogenated and blended to provide good performance characteristics in eating quality, heat resistance, and spreadability. These soft oils include soybean oil, cottonseed oil, corn oil, sunflower oil, and peanut oil. However, certain other oils, particularly palm oil, coconut oil, and palm kernel oil generally cannot be used as major components in a blended margarine (that is, in an uninteresterified or non-randomized margarine) since, when mixed with soft oils, they tend to harm the performance characteristics of the margarine, particularly the heat resistance and eating quality. Therefore, use of palm oil, coconut oil, and palm kernel oil in margarine has been very limited.

At certain times and in certain geographical areas it may be economically desirable to use a mixture of palm oil and coconut oil as a major constituent of a margarine oil. One of the advantages of this invention is that it provides a means for using such a mixture of oils in margarine.

By another feature of the present invention, margarine formulations can be developed having increased quantities of palm oil, coconut oil, and/or palm kernel oil. Thus, greater flexibility in formulation can be achieved and high quality margarines can be composed with economically priced components depending on fluctuations in oil prices.

While it is a principal feature or object of the present invention to provide a margarine oil for preparing margarine having improved heat resistance, it is another feature of the present invention to provide a margarine oil for producing margarine having improved spreading characteristics at low temperature.

Still another object of the present invention is the provision of a margarine oil containing a soft oil, for example, soybean oil, and palm oil in which more palm oil is incorporated than heretofore possible to yield a margarine of improved quality.

Yet another object of the present invention is the provision of a margarine oil containing coconut oil and palm kernel oil in which more coconut oil is incorporated than heretofore possible to yield a margarine of improved quality.

A still further object of the present invention lies in the provision of a margarine oil whereby a margarine is prepared having improved polymorphic crystal stability; in other words, a margarine is made more resistant to texture changes and physical breakdown due to change in the type of fat crystals.

A further object of the present invention lies in the provision of a margarine oil whereby a margarine is prepared having an improved balance of eating quality versus heat stability.

A still further object of the present invention lies in the provision of a margarine oil whereby a margarine having good eating quality and heat stability is prepared from higher levels of palm oil and coconut oil than has heretofore been possible.

In its broadest aspects the present invention provides a margarine oil adapted to be manufactured into a margarine of good spreadability, oil-off, slump and eating quality, the margarine oil containing 0.2% to 2.5% by weight of a highly hydrogenated triglyceride oil the combined fatty acids of which contain at least 10%, by weight, of acid selected from the group consisting of arachidic acid and behenic acid and mixtures thereof. The arachidic and/or behenic acids must be combined in a triglyceride molecule; however, it is not necessary that they be present as tri-arachidic triglycerides and/or tribehenic triglycerides. The arachidic and/or behenic acid is just as effective as the mono- or di-arachidic and/or behenic triglyceride where the other acid or acids in the triglyceride may be stearic, palmitic, etc. Thus, by the present invention, it has been found that the triglycerides containing arachidic acid and behenic acid exhibit unique properties which are beneficial for margarine formulation.

It has been found most desirable to obtain the behenic acid triglycerides and/or arachidic acid triglycerides by the hydrogenation of rapeseed oil. The hydrogenation is carried out under the usual conditions of time, temperature and pressure conventional in the art in the presence of any suitable catalyst. Accordingly details of the hydrogenation will not be given here. The hydrogenation must be carried out until the oil has an iodine value (IV) of less than 30 and preferably less than 10, in order to achieve the advantages of the present invention.

The quantity of behenic acid glyceride and/or arachidic acid glyceride used in the present invention is determined by the degree of hydrogenation of the rapeseed oil. The designation of this amount is dependent upon whether the proportion of behenic acid and/or arachidic acid is given in "percent of acid in triglyceride form" or in "percent of triglyceride." If the amount is given as percent of acid in triglyceride form, the value is 0.08% to 1.5% by weight of the margarine oil. Below 0.08% there is a beneficial effect but it is very small and of no practical importance. Above 1.5% the margarine product contains too many very high melting solids at body temperature and hence has unacceptable eating quality. If the amount of behenic acid and/or arachidic acid is given as percent of the triglyceride, it is necessary to consider the relative portions of mono-, di- and tri-behenic and/or arachidic

acid plyceride forms. Since a highly hydrogenated rapeseed oil is specified, the other fatty acids which might be present in the triglyceride will, for the most part also be saturated; for example, palmitic or stearic acid. Since large amounts of any saturated fatty acid will seriously affect the melting characteristic of the product in the mouth, the optimum product should maximize the behenic and/or arachidic acids and minimize the stearic and palmitic acids. Hydrogenated rapeseed oil contains substantial quantities of behenic acid and arachidic acid; around 20% to 40% by weight. Hence the use of hydrogenated rapeseed oil minimizes the amounts of other saturated fatty acids that are added to the margarine oil along with the behenic and arachidic acids.

Rapeseed oil hydrogenated to an IV less than 30 should be used in an amount of 0.2% to 2.5% by weight of the mixture of oils in the margarine oil, and preferably, in an amount of 0.4% to 1.5% by weight of the margarine oil. The greater the degree of hydrogenation, and hence the lower the IV, the more acid in the oil will be converted to behenic and/or arachidic acid, and the less hydrogenated rapeseed oil can be used to give the same effect.

The present invention is particularly well adapted to improving the charatceristics of margarine prepared from margarine oils having a relatively high content of palm oil, coconut oil or palm kernel oil. These margarine oils can also include other oils; for example, soybean oil, cotton seed oil, corn oil, sunflower seed oil, lard and tallow. When blended with these other oils, the palm oil, coconut oil and palm kernel oil constitute the following percent by weight of the margarine oil:

Palm oil	10–40
Coconut oil	5–30
Palm kernel oil	5–30

The following examples are given to illustrate the present invention.

The margarines in the examples below were prepared by mixing the margarine oil with milk powder, salt and emulsifier in the following manner:

Eighty pounds of the margarine oil being tested was melted and heated to 110° F. in a hot water jacketed pilot plant mix tank. 1.65 pounds of commercial milk powder and 2 pounds of salt were mixed (slurried) in 15 pounds of water. An emulsion was prepared from the margarine oil and from the milk slurry with an addition of 0.05 lb. monoglycerides prepared from partially hydrogenated soybean oil.

The margarine emulsion was chilled through a conventional Votator A unit assembly and a B unit. Votators (chillers) are well-known in the art, but a description of such apparatus may be found at pages 921–924 of A. E. Bailey, Industrial Oil and Fat Products, 2nd Ed., Interscience Publishers Inc., New York City, New York (1951).

The extruded product was packed at approximately 40° F. and tempered as usual for 48 hours at 50° F.

Example 1

One hundred pounds of soybean oil was hydrogenated to an iodine value of approximately 85 using regular selective conditions. Forty eight pounds of this oil was mixed with 32 pounds of Malayan palm oil and deodorized under normal conditions. To three individual samples of this deodorized oil was added, respectively, 0.6%, 1.0% and 1.4% by weight of highly hydrogenated rapeseed oil having an iodine value of 4.0 and a C_{20-22} content of approximately 40%. Each sample of oil was then processed into a margarine in the manner previously described. The margarines were each tested by standard uniform testing procedures. Spreadability at 50° F. and eating quality were judged by a panel of experts and graded on a scale of 1 to 10, 1 being poor and 10 being excellent. Slump tests were also graded by a panel of

experts on the same grading scale against standard photographs. Oil-off figures were quantitatively determined by measuring the oil lost by a margarine sample after 48 hours at 85° F. The reported figures are the calculated percentages of lost oil.

	Percent by weight highly hydrogenated repeseed oil			
	Control 0%	0.6%	1.0%	1.4%
Spreadability (50° F.)	7.8	7.7	7.5	7.5
Oil-Off 85° F./48 hours, percent	25.6	15.3	7.2	4.6
Slump	1.5	4.0	5.0	7.0
Eating quality (50 ° F.)	8.5	8.5	7.6	7.5
SCI (92°) at—				
50° F	24.9	25.3	25.6	25.9
70° F	10.1	10.7	11.0	11.3
80° F	6.1	7.0	7.5	7.8
92° F	1.7	2.0	2.6	2.8

These results show that the control margarine, prepared from the mixture of 60 percent soybean oil and 40 percent palm oil, had good spreadability, unsatisfactory oil-off, failure in the slump test, and excellent eating quality. As the amount of highly hydrogenated rapeseed oil which was added increased, there was essentially no detrimental effect on the excellent spreadability or the good eating quality of the soybean oil, palm oil blend; however, the addition of highly hydrogenated rapeseed oil improved markedly the oil-off and slump test qualities of the margarine.

Example 2

One hundred pounds of soybean oil was hydrogenated to an iodine value of 83.0 using selective hydrogenation conditions. Seventy-two pounds of this partially hydrogenated soybean oil was blended with eight pounds of Malayan palm oil and deodorized at 200° C. under regular conditions. Following deodorization the same procedure was followed as described in Example 1 except highly hydrogenated rapeseed oil was added to two samples and highly hydrogenated soybean to the third. Margarines were prepared from each of these oils, and were tested in the manner described in Example 1.

	Control	Sample 1	Sample 2	Sample 3
Percent highly hydrogenated rapeseed oil (IV 4.0)	0	0.7	1.16	----------
Percent highly hydrogenated soybean oil (IV 4.0)	0	0	0	0.9
Spreadability (50° F.)	8.5	8.2	8.1	8.3
Oil- Off 85° F./48 hours, percent	15.0	8.0	4.5	13.2
Slump	4.0	6.0	7.5	4.0
Eating quality (50° F.)	8.3	8.1	7.9	8.0
SCI (80° F.) at—				
50° F	21.9	22.2	22.7	22.5
70° F	11.3	11	12	11.9
80° F	7.4	8.1	8.5	8.2
92° F	1.9	2.8	3.3	3.2

These data show that the addition of highly hydrogenated rapeseed oil or highly hydrogenated soybean oil to a margarine oil containing palm oil and soybean oil does not materially affect the excellent spreadability of margarine made therefrom. Nevertheless the addition of the highly hydrogenated rapeseed oil greatly improves both the oil-off and slump characteristics of the margarine; the addition of the highly hydrogenated soybean oil does not materially affect either of these two characteristics.

Substantially similar results are obtained when coconut oil and/or palm kernel oil is included in the soybean oil, palm oil blend containing the highly hydrogenated rapeseed oil. The soybean oil portion of the blend can be replaced in whole or part by cottonseed oil, corn oil, sunflower seed oil, lard or tallow without substantially affecting the results.

What is claimed is:

1. A margarine oil adapted to be manufactured into margarine of good spreadability, oil-off, slump, and eating quality comprising an oil selected from the group consisting of soybean oil, cottonseed oil, corn oil, sunflower oil, and mixtures thereof, and an oil selected from the group consisting of 5% to 30% by weight, coconut oil, 10% to 40%, by weight, palm oil, and 10% to 40%, by weight, palm kernel oil, and containing 0.2% to 2.5%, by weight, rapeseed oil hydrogenated to an iodine value of less than 30, the combined fatty acid content of said hydrogenated rapeseed oil being at least 10%, by weight, of acid selected from the group consisting of arachidic acid, behenic acid and mixtures thereof.

2. The margarine oil of claim 1 in which the rapeseed oil is hydrogenated to an iodine value of less than 10.

3. A margarine oil adapted to be manufactured into a margarine of good spreadability, oil-off, slump, and eating quality comprising an oil selected from the group consisting of soybean oil, cottonseed oil, corn oil, sunflower oil and mixtures thereof, and containing 10% to 40%, by weight, palm oil, and 0.4% to 1.5%, by weight, rapeseed oil hydrogenated to an iodine value of less than 10, the combined fatty acid content of said hydrogenated rapeseed oil being at least 10%, by weight, of acid selected from the group consisting of arachidic acid, behenic acid, and mixtures thereof.

4. The margarine oil of claim 3 containing in addition to the enumerated oils 5% to 30% by weight, coconut oil.

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RAYMOND N. JONES, *Primary Examiner.*

A. LOUIS MONACELL, M. W. GREENSTEIN,
Assistant Examiners.