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MODIFIED EDIBLE FAT OBTAINED ON THE BASIS OF SUNFLOWER OIL

According to VNIIMK data, to obtain the necessary biological and feeding value of margarine its glyceride part must contain approximately 20% of linoleic acid, not less than 50% of oleic acid and up to 30% of saturated fatty acids, including $C_{16:0}$ and $C_{18:0}$ acids. The total of isomerised and saturated fatty acids and their distribution in triglycerides mixture must be such as to provide for the fatty basis of margarine the melting temperature of $20\pm2^{o}C$ (by the capillary method), the solidness of 100 ± 20 g/cm at $15^{o}C$ (according to the Kaminsky method), not more than 3% of solid triglycerides at $35^{o}C$ and not more than 30% of the solid phase within the $0-15^{o}C$ interval (determined by the dilatometric method).

The main component of the glyceride part of margarine is lamellar fat which is normally obtained through the highly-selective hydrogenation of liquid vegetable oils on metal catalyzers (nickel or nickel-copper) under intensive isomerisation of non-limit fatty acids.

Studies of the "hydrogenated sunflower oil (SO) - starting SO" systems showed that due to a small content of saturated fatty acids in sunflower oil the necessary ratio between melting temperature and solidity of these mixtures was only obtained at a high concentration of isomerised non-limited acids in hydrogenizators provided that the ratio of isomerised acids to the saturated ones is no less than 4. However, due to this reason the three-phase systems "partially hydrogenated SO - initial SO - water phase (cooled margarine emulsions) are not sufficiently stable and their organic plasticity is within the $0-15^{o}C$ interval.

The initial optimum small crystalline structure of these systems (α- and β'-polymorphous

forms of solid fatty phase) are worsening with time as a result of recrystallization of solid solutions and polymorphous triglycerides ($\alpha - \beta' - \beta$ - transition). Changes in the glycerides phase structure are quicker with growing concentration of the liquid oil component (oil) in the system and its temperature, which is particularly noticeable at the alternate temperature regime of margarine storage and consumption. Organoleptically, these changes result in higher margarine solidness, mealiness, sandiness and in other quality defects.

The mixing of selectively hydrogenated SO with animal fats or the corresponding increase in the proportion of saturated acids in hydrogenisators by changing the hydrogenation regime results in obtaining solid fats with the favourable ratio between isomerised and saturated fatty acids. However, the physical properties of the systems "solid fat - liquid oil" are in this case still unsatisfactory, inasmuch as the distribution of fatty acids in glycerides was far from statistical equilibrium. Indeed, complete and in some cases partial retherification of the system's solid component and the more so of the whole system has cardinally improved its plasticity and sharply raised the stability of the crystalline structure (β' - form).

These studies show that to further improve the qualities of margarine produced on the basis of sunflower oil it is expedient to lower the ratio between isomerised and saturated fatty acids in a solid component of the system to the level not exceeding 3, and to bring the distribution of fatty acids in the glycerides as close as possible to the statistical distribution.

We showed that reetherification of triglyceride mixtures can be effected both on the known homogenous alkaline catalysts (sodium alcoholates, etc.) and in the process of direct hydrogenation on heterogenic polyfunctional catalysts containing nickel, its compounds and other components. In

the latter case, the reactions of hydrogenation, isomerisation and partial reetherification of glycerides (hydroreetherification) are combined.

Improved modificated edible fats for margarine can be obtained on the basis of sunflower oil basis according to the following technological scheme:

1) SO mixtures etherification on homogenous alkaline catalysts with hydrogenated SO and/or animal fat (margarine fatty basis or its plasticerising component).

2) hydroreetherification on heterogenic polyfunctional catalysts of SO mixtures with animal fat or SO itself (solid component of the margarine fatty basis).

Table 1 cites characteristics of 6 samples of modified fat obtained by methods under discussion:

1. Reetherification mixture of unselectively hydrogenated SO (70%) and initial SO (30%).

2. Reetherificated mixture of the same components in the ratio of 75 : 25.

3. Reetherificated mixture of selectively hydrogenated SO (70%) and animal fat (30%).

4. Reetherificated mixture of initial SO (60%) and animal fat (40%).

5. Hydroreetherificated SO.

6. Hydroreetherificated mixture of initial SO (60%) and animal fat (40%).

Pattern 1 represents the fatty basis of high quality bread-and-butter margarine. Patterns 3, 5 and 6 are used as its main component (in mixture with liquid oil). Patterns 2, 4 are plasticizising components, which considerably improve the traditional fatty basis of margarine. (Table 2, numbers of patterns correspond to those of Table 1).

Modified fat and margarines on its basis sufficiently long preserve the small crystalline β - modification of the solid phase on the real conditions of consumption. Fat - containing products reetherificated on alkaline catalysts possess optimum plasicity in a wide temperature

Table 1

Characteristics of Modified Fats

Pattern N	Square C	Solidness, g/cm	Transsaturation	Solid Fat Content %			
				0°C	15°C	20°C	35°C
1	32.8	110	1.5	27.4	21.0	15.9	1.9
2	32.9	100	1.6	33.9	27.8	19.6	2.5
3	32.7	150	1.2	32.0	30.3	22.2	3.0
4	33.3	60	0.2	12.9	12.3	8.4	2.7
5	32.3	250	3.0	44.6	41.3	31.1	1.8
6	32.0	280	2.2	42.6	41.0	29.4	3.0

Table 2

Characteristics of Margarine Fatty Basis

Pattern N	Square C	Solidity, g/cm	Solid Fat Content %			
			0°C	15°C	20°C	35°C
1	32.8	110	27.4	21.0	15.9	1.9
2	31.4	100	29.5	24.0	18.0	1.4
3	30.8	90	28.2	21.9	16.0	1.5
4	28.9	115	28.4	23.8	17.3	1.8
5	30.5	120	35.2	28.9	22.3	2.3
6	31.5	115	33.0	24.6	18.9	2.0

range. Margarine produced on the basis of hydroreetherificated fat is also superior in this parameter to the products made according to the traditional methods. Qualitatively similar results were obtained when sunflower oil was fully or partially replaced by cotton oil.