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# Shortenings Based on Hydrogenated Cotton Oils

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**Key words:** hydrogenated cottonseed oil, hard fats, iodine number, hard triglyceride content, range of plasticity, consistency, shortening, quality indicators.

Shortening properties give a variant of fat that allows using this product both for baking and for frying [1,2]. Shortenings are suspensions of crystal-like fats in oil or semi-liquid fats [3]. The composition of shortening used in catering includes 3-15% of fully saturated hard fats crystallizing in the  $\beta$ -form, the base is a soft partially hydrogenated fat, i.e. a mixture of hard animal fat with vegetable oil, or a interesterified fat [4,5]. Shortening is used for frying, and it has a higher stability during frying than most products based on vegetable oils [6].

Liquid shortening and shortening with plastic properties are distinguished [7]. Production of shortenings is carried out by melting the hard phase and subsequent cooling under the influence of shearing forces. At the same time, crystals are formed which, in liquid shortening, have a size of from 5 to 10 microns. The content of hard, refractory fats in liquid shortening is 5-30% [8].

The shortenings were prepared under laboratory and experimental conditions using hydrogenated cottonseed oil and hard fats. The composition of shortening is given in table 1.

**Table 1.**  
**Composition of new kinds of shortenings**

Name of fatty raw materials	Content of components, %						
	Vegetable raw materials			A mixture of raw materials of animal and vegetable origin			
Hydrogenated cottonseed oil, $J_n$ 80	90.0	-	-	-	-	-	91.0
Hydrogenated cottonseed oil, $J_n$ 88	-	88.0	-	-	-	89.0	-
Hydrogenated cottonseed oil, $J_n$ 96	-	-	-	35.0	-	-	-
Hydrogenated cottonseed oil, $J_n$ 109	-	-	-	14.5	-	-	-
Ro palm oil	-	-	91.0	55.0	-	-	-
Hard animal fat	-	-	-	-	82.5	-	-
Hydrogenated cottonseedoil, T = 60	10.0	-	-	-	-	-	-
Palm oil, T = 56	-	12.0	9.0	10.0	-	-	-
Hard animal fat, T = 59	-	-	-	-	3.0	11.0	9.0
Content of TTG, % at:							
10.0 °C	26	31		25		32	
26.7 °C	20	20		18		21	
40.0 °C	No less than 9	11		10		No less than 9	

Note.  $J_n$  - iodine number,  $rJ_2/100$  g; PO- refined and bleached; T – titer, °C.

As can be seen from the data table.1, new types of shortenings differ in the content and ratio of hydrogenated cottonseed oil and solid edible fats. To analyze the quality and physical-chemical characteristics of new types of shortenings, modern methods of physical-chemical research have been used [9, 10]. The iodine number of solid triglycerides in fat shortening has been determined. The range of plasticity of the shortening has been established depending on the choice of the fatty basis — a mixture of hard animal fat with vegetable oil and solid fats.

The consistency was evaluated by measuring the penetration at a temperature of 26.7 °C, while the holding of solid triglycerides in both types of shortening at 26.7 °C ranged from 15 to 21%. The range of plastic deformation in accordance with this method lays between the values of penetration from 150 to 300 mm / 10 g. As a result of these tests, it was found that shortening of acceptable quality can be performed using any of the above mentioned fats as an approving component.

The functional properties of shortening depend on the solids content at a certain temperature. The composition of shortening was chosen in such a way that, at temperatures from 10 to 15° C it was not too hard and did not become too soft at 32-38° C.

The use of hydrogenated fats or oils increases the oxidation stability of shortening and frying stability. To the greatest extent, this occurs under selective hydrogenation conditions and a low iodine number of a mixture of hard animal fat with vegetable oil; however, non-selective hydrogenation provides a flatter melting curve and, accordingly, a wide range of plastic deformation.

An important characteristic of shortening is the range of plastic deformation, since the consistency depends on temperature. A product with a good plasticity range remains soft at low temperatures and hard at high temperatures. When an ideal plasticity range is reached, the product has the same, most desirable consistency at low and high temperatures.

The capacity for whipping and the plasticity range of shortening depend primarily on the correct choice of the fat base - a mixture of hard animal fat with vegetable oil and solid fats, secondly - on the condition of cooling and tempering. Shortenings with a wide range of plasticity are usually subjected to rapid cooling to a temperature of 15-21 ° C, followed by a stage of crystallization or processing, then the shortening is packaged and tempered at 27 ° C for 24-72 hours. The effect of tempering is shown in Fig. 1, on which shows the data shortening, stabilized with hydrogenated cottonseed oil with a titer of 60 ° C and palm oil with a titer of 56 ° C; tempering was carried out at a temperature of 26.7 and 29.4 ° C for 48 h.

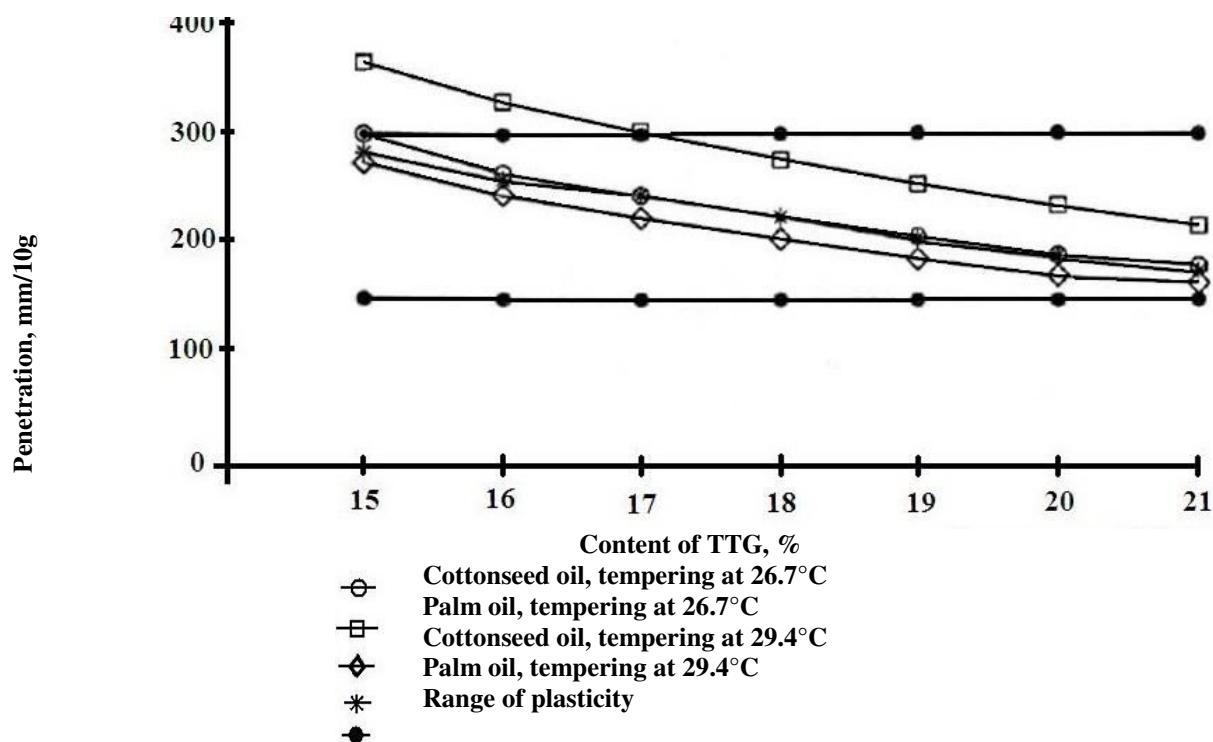


Fig.1. The effect of tempering on the degree of penetration of fat shortening

The effect of tempering at temperatures of 26.7 and 29.4 ° C on the shortening consistency, in which as solid fat was used hydrogenated cottonseed oil with a titer of 60 ° C or palm oil with a titer of 56 ° C, stabilized with hydrogenated cottonseed oil with a titer of 60 ° C and palm oil with a titer of 56 ° C; tempering was carried out at a temperature of 26.7 and 29.4 ° C for 48 hours. The consistency was evaluated by measuring penetration at a temperature of 26.7 ° C, while the content of TTG in both types of shortening at 26.7 ° C ranged from 15 to 21%.



The studied and proposed fat shortening formulations are characterized by high quality indicators and solid triglyceride content. The use of hydrogenated cottonseed oil for the production of shortenings ensures the replacement of fatty products imported into the republic. The composition of shortening and the technology of its production ensures the ability of fats to withstand large fluctuations in the temperatures of processing and preserving their structure.

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