

Analysis of Different Methods for Obtaining Cocoa Butter Substitutes from Cotton Salum and Palmitines

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Abstract: In the article are analyzed some ways of reception of substitutes of cocoa butter (SCB) from cotton saturated fat and palmitines. We made conclusion that during hydrogenation of cotton palmitin till fusion temperature 40-42 o C and, further, interesting the received saturated palmitin fat with received by priming palmitin, it is possible to receive SCB with fusion and hardening temperature of 36-37 o C and 27 -28 o C, accordingly.

Keywords: cocoa butter, substitute cocoa butter, hydrogenation, interesterification, cotton palmitin, saturated fat, triacylglyceride.

Due to a significant increase in prices for cocoa butter in the world, research and development work is being intensively carried out to obtain its substitutes from local vegetable oils. In this case, the following processes for processing vegetable oils are used: hydrogenation, fractionation and transesterification of triglycerols [1].

At the first stage of processing vegetable oils, the goal is to bring the fatty acid composition of the resulting substitute to the indicators of natural cocoa butter, and at the second, the triglyceride composition to the indicators of the latter [2]. It should be noted that vegetable oils rich in palmitic acid ($C_{16:0}$ and $C_{16:1}$) should be subjected to such processing. These include palm, palm kernel and cottonseed, which contain palmitine more than 24% of the total weight of the oil.

In the countries of Central Asia, incl. Uzbekistan produces large quantities of cottonseed oil and palmitine, from which margarine, confectionery and baking fats are produced on an industrial scale [3].

Unfortunately, the confectionery and baking fats produced by Tashkent Yog-Moy Kombinaty JSC do not meet the requirements for cocoa butter substitutes in terms of melting and solidification temperatures, as well as hardness. Their compatibility with natural cocoa butter is very low, which does not make it possible to use them in the production of chocolate confectionery products [4,5].

We have analyzed several methods for producing cocoa butter substitutes (CBS) from cottonseed oils and palmitines.

The first method of obtaining ZMK was carried out according to the following scheme:

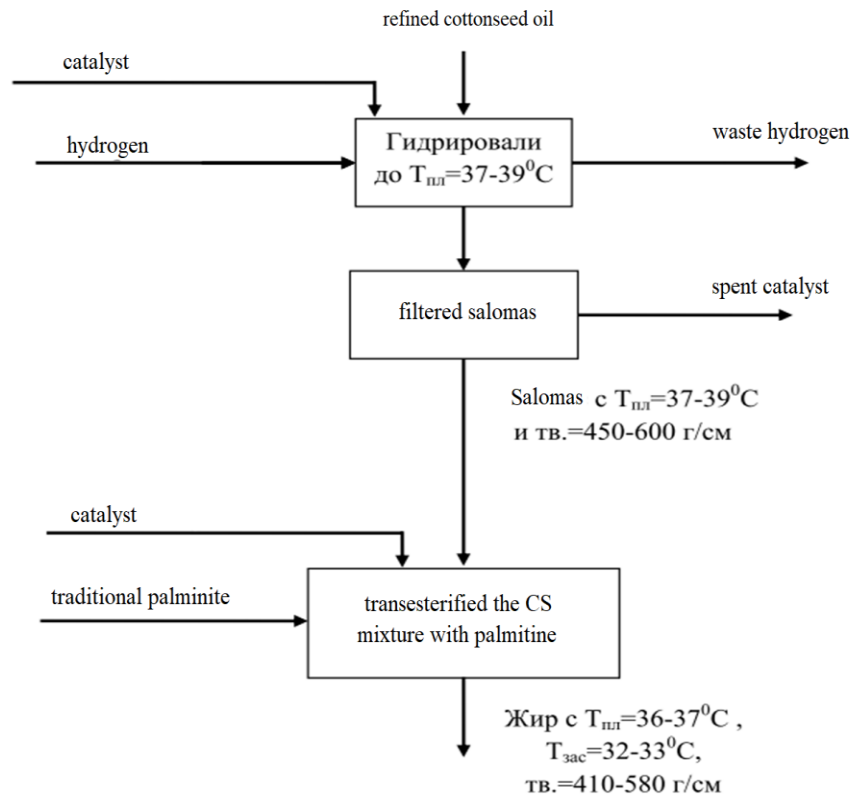


Fig. 1. The first scheme for obtaining ZMK using the methods of hydrogenation of CM and transesterification of a mixture of cottonseed oil with traditional palmitine.

From Fig.1. it is clear that the resulting fat has low hardness and a high pour point, which is far from these indicators of natural cocoa butter.

We carried out the second method of obtaining ZMK according to the following scheme:

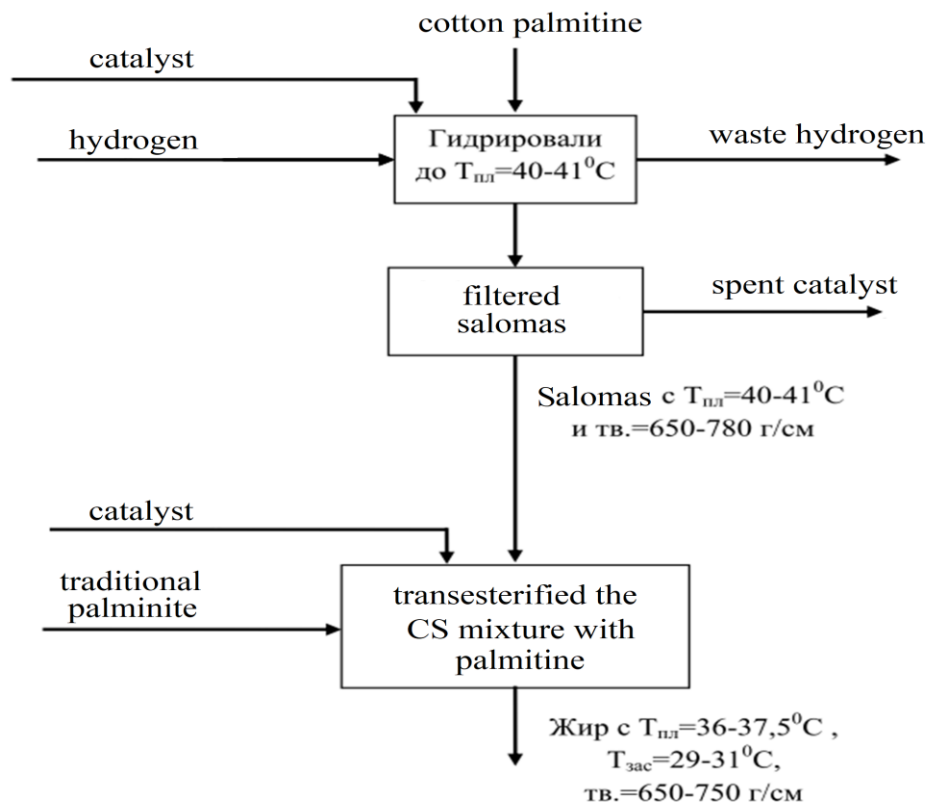


Fig.2. The second scheme for obtaining ZMK by hydrogenation of cotton palmitine and transesterification of a mixture of palmitic salomas with traditional palmitine.

From Fig.2. it is clear that the second method of obtaining ZMK by hydrogenation of cotton palmitine and transesterification of a mixture of palmitic lard with traditional palmitine also does not satisfy the requirements for natural cocoa butter in terms of the pour point and hardness of the resulting ZMK.

It is known that during low-temperature fractionation of cottonseed oil, the use of seeds (transesterified CM, beef or lamb fat, etc.) makes it possible to increase the content of palmitic acid in the resulting palmitic fraction by 7-10%, which gives grounds to use such palmitine in the production of ZMK [6 ,7].

We carried out the third method of obtaining ZMK according to the following scheme:

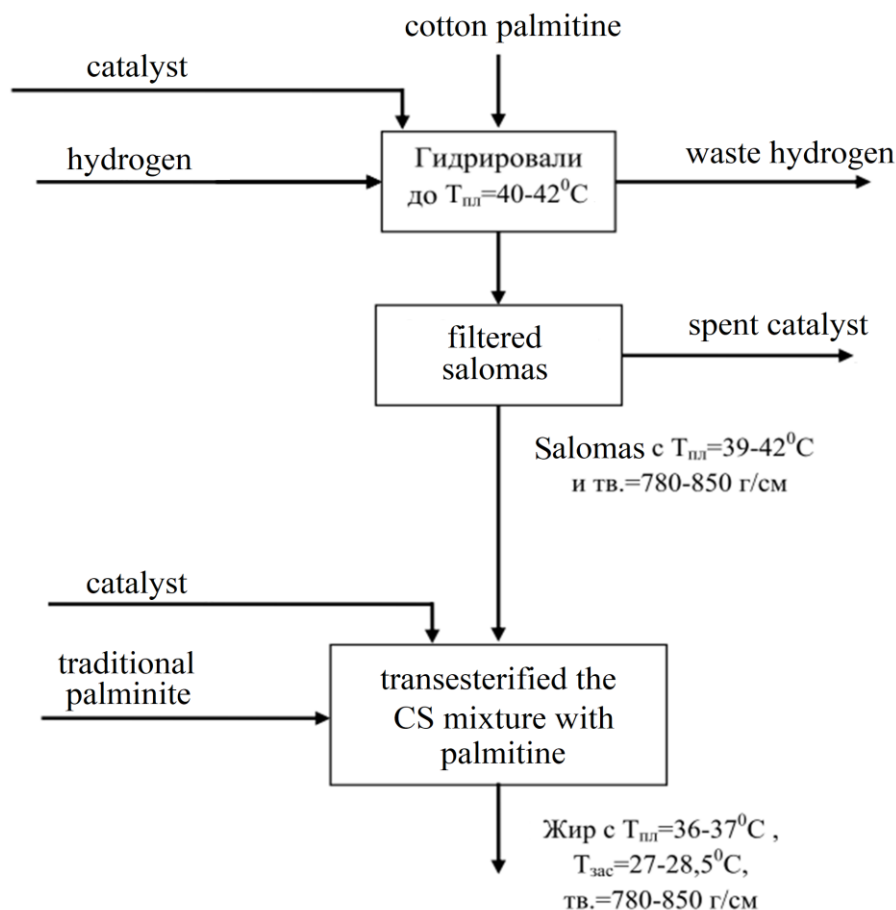


Fig.3. The third scheme for obtaining ZMK by hydrogenation of cotton palmitine and transesterification of a mixture of palmitic salomas with palmitine obtained with a seed.

From Fig. 3 it is clear that the fat obtained according to this scheme has similar melting and freezing temperatures, as well as hardness, to the corresponding indicators of natural cocoa butter. This is achieved by enriching the resulting fat, i.e. ZMK palmitic acid in triacylglycerides.

Table 1 presents comparative data on the main indicators of natural cocoa butter (control) and the obtained ZMK according to the three studied schemes. It should be noted that traditional palmitine had a melting point of 21 °C, and palmitine obtained with a seed - 27 °C.

Comparative quality indicators of natural cocoa butter (control) and ZMK obtained according to three schemes

The name of indicators	Natural cocoa butter (control)	ZMK obtained according to the scheme:		
		I	II	III
Melting point, °C	35.5	38.1	37.4	36.5
Hardness according to				

Kaminsky at 15 °C, g/cm	990	600	750	850
Pour point according to Zhukov, °C	26.0	29.8	28.9	27.5
Acid number, mg KOH /g	0.45	0.37	0.33	0.35
Mass fraction of solid TAG, %				
-at 10 °C	84.0	89.7	88.3	86.1
-at 20 °C	78.6	84.3	82.2	80.3
-at 25 °C	71.5	75.1	73.9	72.8
-at 30 °C	51.3	57.3	55.1	53.1
-at 35 °C	3.5	6.9	5.6	4.7

From Table 1. it is clear that in terms of its main physicochemical indicators, the ZMK obtained according to the third scheme is close to natural cocoa butter, which gives grounds for its further use in the production of chocolate products individually or in a mixture with the latter.

Thus, we can conclude that by hydrogenating cotton palmitine to a melting point of 40-42 °C and further, transesterifying the resulting palmitic salomas with palmitine obtained with a seed, it is possible to obtain ZMK with a melting and solidification temperature of 36-37 °C and 27 -28 °C, respectively. In this case, the hardness of the resulting ZMK is 780-850 g/cm at 15 °C according to Kaminsky. Moreover, the mass fraction of solid TAG in the resulting ZMK according to the third scheme is close to the corresponding indicators of natural cocoa butter.

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