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# Compatibility of Cotton Confectionary Fat with Natural Cocoa Butter

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**Abstract:** The article deals with the methods of hydrogenation and perietherification, the opportunity of obtaining cocoa oil substitute, which is close to the natural cocoa oil in its physical and chemical dualities as its freezing and melting temperature, solidity, the content of triglycerids of fraction and etc. New scientific, experimental and practical results of obtaining cocoa oil substitute have been presented.

**Keywords:** cotton palmitin, hydrogenation, salomas, cocoa, cocoa oil, perietherification, fatty acid content, triacylglycerids, modification, solidity, its freezing and melting temperature, transisomers, hydrogenate.

**Introduction**. Due to the raise in price of cocoa butter on the world market, at present many countries produce it's alternate materials on basis of various natural oils (palm, soy and others).

In Uzbekistan the main type of vegetable oil is cotton seed, which is in contrast to other types of oil contains up to 24% of palmitin ($C_{16:00}$) acid. Analogic fatty acid is contained in significant amount in natural cocoa butter [1].

Therefore, obtaining the alternate materials of cocoa butter, particularity confectionary fat, by means of catalytic hygrogenization of cotton seed oil is considered rational. Here with, it is needed to get hydrogenizate(salomas) enriched with 2-oleosaturated triglyceride, as natural cocoa butter contains more than 80% of triglycerides. Such triglycerides impart to cocoa butter specific properties, high hardness and fusibility (fluidity).

In present time, substitution of cocoa butter for confectionary fat is defined according to the type of producing product (glaze, chocolates ant etc.)

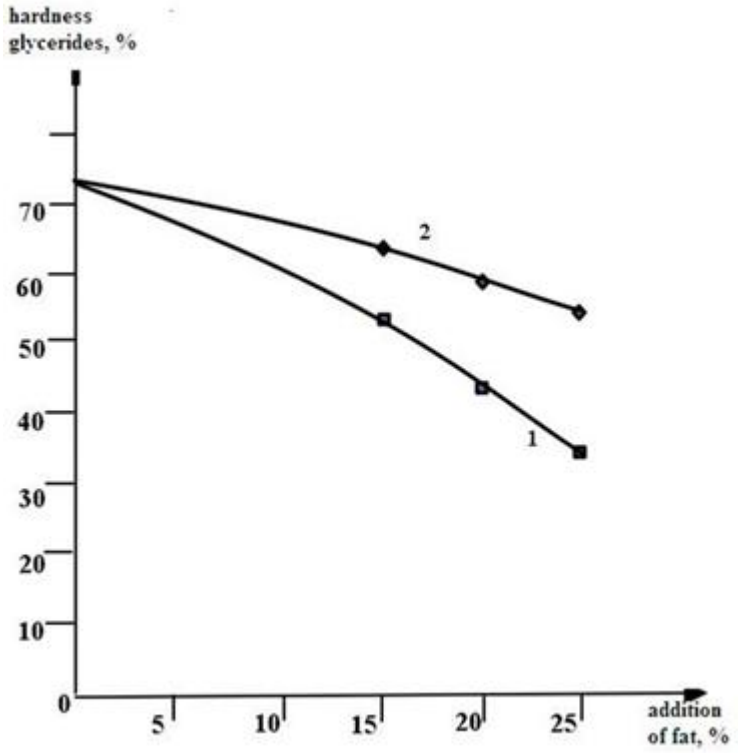
For example, confectionary industry adds to natural cocoa butter up to 25% of alternate materials, as farther increase of the lost worsens the property and quality of the derivable products. Mostly, the content of confectionary fat in chocolate glazes doesn't transcend 15%, that is shown by bloom on the surface and the reducing its storage stability [2].

It is known, that confectionary fat obtaining by hydrogenation of vegetable oils, differs from cocoa butter with butter-fat acid and triglyceride composition. It contains up to 65% of transisomerisized nosaturated fat acids, that change the type of coagulate and structural – mechanical indicator of cocoa butter, as triglycerides of such fats at coagulate combine with triglycerides cocoa butter eutectic mixtures, differ with low level of dilatometric indicators and the temperature of coagulate [3].

**Materials and methods:** That's why, we chose for hydrogenization refined cotton oil and cotton palmitin, on the basis which got confectionary fat and alternate material of cocoa butter, which indicators are shown on the table 1.

**Table1. Comparative indicators of natural cocoa butter, cotton confectionary fat and alternative materials of cocoa butter got on the basic of palmitin**

| Names of oils and fats | Melting temperature, $^0$C | Moisture temperature, $^0$C | | Congela-tion point, $^0$C | Butter fat acid composition | | | | | | Triglecerid composition,% | | | | | Mass fraction of transisomers, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $15^0$ C | $20^0$ C | | $C_{14:0}$ | $C_{16:0}$ | $C_{18:0}$ | $C_{18:1}$ | $C_{18:2}$ | $C_{20:0}$ | $C_{48}$ | $C_{50}$ | $C_{52}$ | $C_{54}$ | $C_{56}$ | |
| Natural cocoa butter (control) | 32.9 | 1100 | 910 | 29.8 | - | 26.0 | 35.2 | 35.0 | 2.8 | 1.0 | 0.7 | 18.8 | 46.0 | 33.1 | 1.4 | - |
| Cotton confectionary fat | 37.8 | 570 | 350 | 30.5 | 0.4 | 21.0 | 6.0 | 64.5 | 8.1 | - | 1.8 | 14.4 | 29.5 | 54.0 | 0.3 | 63.0 |
| Alternative materials of cocoa butter | 37.2 | 750 | 530 | 31.0 | 0.3 | 24.1 | 5.2 | 62.4 | 8.0 | - | 1.7 | 15.0 | 29.0 | 54.1 | 0.2 | 58.7 |




Pic.1. Dilametric characteristics of isohard mixtures of confectionary fat [1] and alternative material of cocoa butter [2] with cocoa butter.

Comparative indicators of natural cocoa butter, cotton confectionary fat and alternative materials of cocoa butter got on the basic of palmitin.

It's seen on the table. 1, that producing by oil –fat industry confectionary fat on the basis of hydrogenization of cotton seed oil differs much from natural cocoa butter with fat-acid and triglyceride content. If in the last one there is no transizomers, that in confectionary fat their portion is 63%.

At that,the temperature of melting of confectionary fat in accordance with natural cocoa butter increase 5,1ºC and in the contrary, its hardness is about 2 times lower than the last ones.

Considering this, cotton palmitin hard fraction of cotton oil, rich (till 24%) in palmitin ($C_{16:00}$) acid [4].

It is seen on the table.1, that alternative material of cocoa butter, gotten by means of hydrogenization of cotton palmitin in comparison with cotton seed confectionary fat, it has more high (750 at 150°C) hardness and comparatively low temperature of melting. Differential indicators exist in fatty acid and triglyceride composition of offered alternative material of cocoa butter, in comparison with confectionary fat and natural cocoa butter.

We were studied the compatibility of cotton confectionary fat and offered alternative material of cocoa butter with cocoa butter means of their introduction till 25%. In this, there defined the dilatometric characteristic and the temperature of congelation of gotten mixtures in Jenson`s apparatus.

It is shown on pic.1, that changes of the content of hard triglycerides in the mixtures at definite temperature visually characterizes compatibilities of cotton confectionary fat and offered alternative material of cocoa butter with cocoa butter. As it is seen, the addition to the last ne the confectionary fat and alternative material of cocoa butter bring to different decreases of the content of hard glycerides at 20 and 25°C. For example, at 20°C the confectionary fat has coexistence 8% that is not enough in our opinion.

With the addition to the mixture the confectionary fat for substitution 25 % of cocoa butter, fraction of total mass of hard glycerides reduces from 73,2 % till 38,7 %, that is not reasonably for the climate of Uzbekistan. Conversely, the usage of offered alternative material of cocoa butter in such amount brings to the reducing of fraction of total mass of hard glycerides from 73,2 % till 55, 4% that is considered acceptable from the point of their coexistence with cocoa butter.

We`ve investigated dilatometric characteristics of explored mixtures of fats at temperature from 0ºC till 40ºC gotten results are shown on table.2. With this, for evaluating the influence of input of additive compounds of fat on technological properties of natural cocoa butter was investigated changes of its congelation in Jenson`s apparatus.

Dilatometric characteristics of mixtures of cotton confectionary fat and alternative material of cocoa butter with natural cocoa butter.

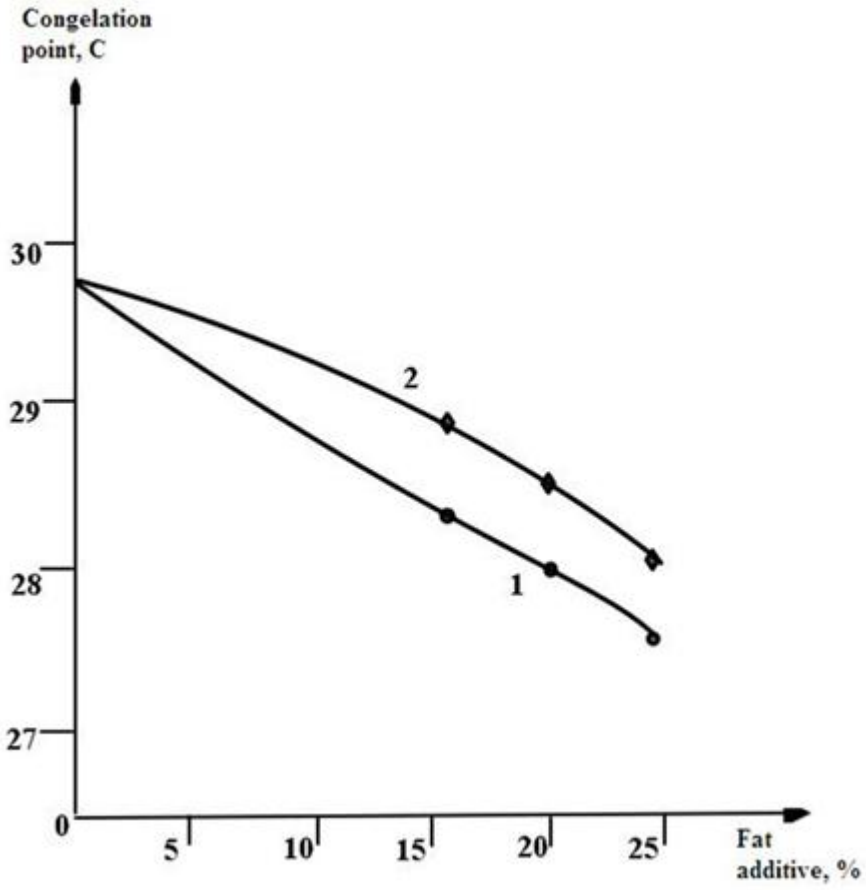
In confectionary industry for introducing the technological process of enrobing, its necessary that the temperature of congelation no more than 60 min.

As its seen in the table.2. in comparison with natural cocoa butter for investigated mixtures of fats typically decreasing of temperature beginning of crystallization ($t_{min}$) and finishing of crystallization ($t_{max}$) exactly, congelation temperature, but at this temperature rise practically doesn`t change ($\Delta t$). According to continuation of crystallization, all investigated mixtures satisfy a claim, but their congelation temperature below 28ºC.

**Table 2.**
**Dilatometriccharacteristicsofmixturesofcottonconfectionaryfatandalternativematerialofcocabutterwithnaturalcocoabutter**

| Names and fat composition | Content, % | Indicators of dilatation at $^0$C | | | | | | | Indicators of hardening of Jenson | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 15 | 20 | 25 | 30 | 35 | 40 | $t_{max}$, $^0$C | $t_{min}$, $^0$C | Temperature rise, $^0$C ($\Delta t$). | The duration of the pour, min. |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural cocoa butter (control) | 100 | 60.9 | 64.5 | 57.4 | 72.0 | 44.0 | 3.5 | 1.0 | 29.8 | 25.2 | 4.6 | 45 |
| Mixtures: | | | | | | | | | | | | |
| Cotton confectionary fat | 15 | 60.1 | 57.8 | 51.6 | 42.5 | 16.9 | 4.0 | 3.5 | 27.5 | 24.0 | 3.5 | 57 |
| Natural cocoa butter | 85 | | | | | | | | | | | |
| Alternative material of cocoa | 15 | 62.4 | 62.3 | 57.5 | 45.3 | 17.0 | 2.2 | 2.0 | 28.2 | 24.2 | 4.0 | 48 |
| Natural cocoa butter | 85 | | | | | | | | | | | |




**Pic.2.**Changes of crooked freering of cotton confectionary fat [1] and alternative material of cocoa butter [2] depending on their content in the mixture with natural cocoa butter

Changes of congelation temperature of investigated mixtures of fats depending on composition of additive compounds are shown on the pic.2.

From the pic.2 it is shown that, the addition to natural cocoa butter the cotton confectionary fat and alternative material of cocoa butter brings to reasonable decrease of congelation temperature of the first one. Here with, it's not discovered correlation of crooked congelation of temperature of mixtures of fats from composition trans-isomerized fatty acids in cotton confectionary fat and alternative cocoa butter.

**Results and Discussion:** So, investigations showed that the addition of cotton confectionary fat and alternative material of cocoa butter to the mixture composition with natural cocoa butter brings to the changes of physic-chemical and technological properties of the last one. At that,

change that is more significant is observed at addition of 25 % the mixture mass of cotton confectionary fat to composition of natural oil that offered alternative material of cocoa butter. That`s why its recommended to substitute part of cocoa butter for cotton confectionary fat with the amount till 15 % and offered alternative material of cocoa butter till 25 % from getting mass of fatty mixture.

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