# TRANSETERIFICATION OF MIXTURES OF OILS AND FATS - A PROMISING METHODFOR OBTAINING COCOA BUTTER SUBSTITUTES

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## ABSTRACT

*This article presents the results of scientific and experimental data, the best modes of obtaining a substitute for cocoa butter from cotton palmitin by the method of its transesterification in a mixture with other liquid oils are obtained. For experimental studies, modern methods of physicochemical analysis were used.*

**KEYWORDS:** *Tansesterification,Cocoa, Oil, A Substitute, Fat-Acid Structure, Triglyceride, Intensification, Hydrogenation, Salomas, Trigleceridhydrogenizate, Raw Materials, Catalyst.*

## INTRODUCTION

The transesterification of oils and fats is one of the promising methods for modifying triacylglycerols, which makes it possible to obtain solid fat compositions with different physicochemical and organoleptic properties . The advantage of this method of modification of fats in comparison with hydrogenation or others lies in the fact that it allows you to obtain solid fat products with the lowest content of trans-isoacids and enrichment with polyunsaturated acids. Fat products intended for baking bakery products of the oriental assortment are distinguished by a high content of the solid phase. The traditionally used fat product is low-melting natural mutton fat [2]. However, along with low-melting mutton fat, high-melting mutton fat is also supplied to bakeries, which disrupts the normal mode of the technological process, and the finished product acquires a specific greasy taste. In addition, due to the scarcity of mutton fat in recent years, margarine products produced on the basis of hydrogenated fats (salomas) are used as a substitute for baking cakes. However, at the same time, the presentation of the product deteriorates, the appearance of an extraneous taste and smell of lard is observed. The lack of the necessary fatty raw materials led to the virtual cessation of the production of many types of rich cakes, which were in high demand among the population.

As already noted, oils are a promising technology for the production of a fatty product for baking. The essence of the process of interesterification of oils and fats is the statistical redistribution of fatty acid radicals in a molecule or between molecules of triacylglycerol's. Unlike other methods of modifying the glyceride composition (fractionation, hydrogenation, mixing), the trans esterification process is simpler and does not cause the formation of by-products (absence or reduced content of trans-isomers; absence of polyunsaturated fatty acids and their polymers).With the appropriate selection of initial mixtures, it contributes to the production of fats with high plasticity in a wide temperature range and with an optimal ratio of linoleic, oleic and saturated acids. At the same time, there are no reversions of the smell and taste of the feedstock, the product has a stable organoleptic characteristic and crystal structure during storage, etc.[1-10]

To evaluate the process of transesterification of fats, various theories of the distribution of acid radicals in triacylglycerols are known. An analysis of the essence of these theories showed that they approximately describe the redistribution of fatty acids in triacylglycerols to some extent. And depending on the conditions of transesterification, one or another theory of the distribution of acid radicals is used.

To describe the partial interesterification of fats, in our opinion, it is sufficient to apply the theory of partial random distribution (the theory of Doershoek and Daubert), the application of which allows us to calculate the distribution of acid radicals at different depths of fat interesterification.

However, this method is not without drawbacks, which is confirmed by the difference between the calculated and experimental data on the distribution of fatty acids.

This suggests that when using any theory for calculating the distribution of acid residues, it is necessary to check with experimental data.

It is known that hydrogenated vegetable oils are the most widely used component of the fat base in most varieties of margarine. Hydrogenation of vegetable oils not only saturates fatty acids with hydrogen, but also changes its nutritional value. So, simultaneously with the partial saturation of double bonds, their isomerization occurs - spatial and positional isomers with a trans configuration are formed. These isomers are somewhat different in physicochemical properties from natural fatty acids and have other biological properties [11-20].

There are different opinions about the influence of the latter on the human body, and therefore this issue should be investigated more carefully. Numerous data on the adverse effects of trans-isomerized acids necessitates the development of methods for obtaining a fatty base without trans-isomers or with a minimum amount of it. Trans-isomers penetrate the intestinal mucosa along with natural cis-isomers and accumulate in various tissues. They have higher melting points and change the natural properties of body fat, making it more heat-resistant.

Despite the fact that trans-isomers are metabolized as easily as cis-isomers, they differ from natural fatty acids in that they interact differently with acyltransferases, but function as essential fatty acids and form phosphatides with unusual properties . Cholesterol esters of cis isomers of fatty acids undergo hydrolysis much more easily than trans isomers. There is every reason to believe that their introduction into cell structures significantly damages the permeability and other characteristics of cell membranes.

Hydrogenated fats have been shown to significantly alter the normal course of pancreatic enzyme secretion [21-28].

In order to obtain a fatty base with a minimum content of trans-isomerized acids, recommended by the Institute of Nutrition of the Academy of Medical Sciences, studies have been carried out for several years to reduce these acids in fats used for margarine. Transesterification of brazil nut oil (babasu) results in a product that does not contain trans-unsaturated acids. Kazanovskytransesterified liquid rapeseed oil with hydrogenated rendered pork fat, which contained a minimal amount of trans-isoacids .

In addition, a number of research works have been carried out to obtain fatty bases by the method of statistical interesterification. The addition of interesterified fats to the fat base significantly improves the structural and mechanical properties of the product. Binary and ternary mixtures of fats are subjected to interesterification to prevent crumbling of the fat and to obtain a spreadable margarine. It has been established that the best effect is achieved by adding binary interesterified mixtures, in an amount of 40-50% relative to the fat base. A similar picture was observed during transesterification of pork fat by Vander-Val, Akkeran et al.

To obtain solid triglycerides from various vegetable oils, directed transesterification is used to obtain edible fats (cotton, peanut, sesame, poppy, palm, soybean and their mixtures). It has been established that such treatment of the reaction mass and its duration affect the properties of the resulting product. The reaction of directional interesterification of glycerides was studied on mathematical models using a computer, and it was found that periodic variable temperature control will speed up these reactions.

Consequently, the researchers of the oil and fat industry of our republic are faced with the task of providing the confectionery industry with a wide range of fats, incl. cocoa butter substitutes. For this purpose, the only appropriate method is the technology for obtaining cocoa butter substitutes from hydrogenated tallow, natural animal fats and vegetable oils, incl. cotton palmitin by the method of interesterification. There are a number of technological solutions for statistical (complete) interesterification, to obtain edible fats with desired properties. Statistical transesterification makes it possible, in comparison with the initial ones, to significantly reduce the melting point, while the hardness increases the plasticity and uniformity of the entire mass.

But, for the confectionery industry, fats are required with a slightly higher solid phase than a statistically interesterified mixture and a slightly smaller amount than natural animal fats, as well as its mechanical mixtures. Such fats can be obtained by partial (single-phase) interesterification [29-34].

There are a number of research works on the study of single-phase (non-directional) interesterification as a method for obtaining a homogeneous fat mixture. By this method, the interesterification of cottonseed oil, rapeseed oil with coconut fat, which gives a slight improvement in texture, but improves palatability.

To explain the mechanism of partial random distribution, the theory of Doershchuk and Doubert is used, which has the following deviations from the theory of uniform distribution:

1. If there is an acid of the same name in the fat in an amount 33.33 mol%, or even lower, random formation of triglycerides is possible, in the molecules of which two radicals are substituted by this fatty acid;

2. If the acids of the same name are found in fat from 33.67 to 67.4 mol% of the total amount of acids, it is not necessary that each triglyceride molecule is included 2 times, as it should be with a uniform distribution.

It should be noted that this theory has not been tested on oils other than corn.In the literature available to us, no materials have been published on the use of these fats in the confectionery industry, the technology for obtaining and hardware design of the partial interesterification process. The few papers available are of a review nature [35-44].

The given data and recommendations are limited to general settings and do not disclose the specific requirements for fats used in the manufacture of chocolates and oriental sweets.

Thus, the analysis of well-known works on the use of fats in the production of confectionery products, in particular chocolates, showed that it is advisable to use interesterified fats to improve the quality and expand the range of sweets. In this case, it is necessary to take into account the resulting confectionery. This allows you to choose the type of partial or complete (statistical) interesterification of oils and fats.

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