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Studying Properties of Lauric and Non-Lauric Fats when Producing Confectionary Glazes

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Abstract

The article stipulates the regularity of forming fat confectionary glazes based on non-lauric and lauric substitutes of cocoa butter. It is shown that the fats under research have their technological and consumer advantages and disadvantages. Physical indicators of the quality of fats under research are shown. It is defined that for fats 3001-35S and 1401-33 the complete melting temperature does not exceed the recommended indicator, and the temperature of complete melting of confectionary fat "1402-36" is a bit higher. As a consequence, it may form high-melt, tallowy flavor of the glaze. Lauric substitute of cacao butter 1402-36 has the shortest duration of congelation. Such characteristic of crystallization says about the technological effectiveness and simplicity to use this type of fats. The data obtained show that the degree of lauric cacao butter substitutes shrink is a bit higher than the one of non-lauric cacao butter substitute. The sample of confectionary fat 1402-26 has the lowest degree of shrink. Defining the weight content of hard triglycerides (HTG) in fats under research by using the nuclear magnetic resonance method within 10-35^{0}C made it possible to define that fat 3001-35 S is characterized by the highest hardness. It is defined that compared to non-lauric fats, lauric cocoa butter substitute 3001-35S has advantages because of harsh melting profile. It will provide more intensive crystallization of the glaze on the product surface. The use of fats under research in the production of fat glazes provides an improved product safety under standard quality indicators.

Key words: substitutes of cocoa butter, lauric fat, non-lauric fat, far glaze.

INTRODUCTION

According to the analysts' estimates, the most dynamically developing area of the food industry is the segment of specialized fats, with the annual growth of above 6% [1]. At the same time, in the structure of this market chocolate products and glazes made with these fats hold position 5 (about 7%).

Over the recent time there has been a sustainable tendency related to increasing the consumer demand for various types of confectionary covered with glazes (sweets, caramel, zephyr, cookies, waffles, cakes, dry fruits and curd snacks) that have always used to be favorite dainties of both children and adults.

A glaze is a confectionary semi-finished product in the form of a refined mass consisting of sugar, cacao products and fat (cacao butter, cacao butter equivalents, cacao butter substitutes, and confectionary fat) and other food components [2]. In accordance with the standard, there are such types of glazes as chocolate, confectionary, sugar and fatty. A fatty (confectionary) glaze is a confectionary semifinished product, a polycomponent food based on confectionary fats (lauric and non-lauric cacao butter substitutes), cacao products, sugar, surface-active materials with or without various tastes and aromatizers [2, 3].

The main attention is paid to the quality of food and their compliance with medical and biological requirements. Research works are focused on improving the current and creating original technologies of essentially new food that will allow to purposefully change the chemical composition to meet the person's body needs and to considerably save on expensive raw materials (for example, cacao butter) [3].

The formation of rheological properties of chocolate is important in the production to obtain high quality products with a sharp texture [4, 5]. Such factors as fat content, moisture content, emulsifying agents depend on the type of the used fat, and have an impact on the rheological properties and cost of chocolate glaze production [6].

It is important to find the answer to the following question: what fats are used to make a glaze? In fact, fat defines the glaze fluidity, its crackle and blaze [7, 8]. Moreover, it is important for the fat not only to have good blaze and crackle, but also the melting point of not less than 36 °C — like the person's body temperature. When we eat products with a higher melting point (for example, a well-known lamb fat — 43 °C), they do not melt in the mouth. As a result, if the glaze is based on a low quality fat, there is also so-called effect of plasticine.

In spite of the unique properties of cacao butter, its use is complicated by a number of factors: the high cost and fluctuation of market prices [9], quality instability that depends on climatic conditions and places where cacao beans grow, technological complications when processing cacao beans and producing cacao butter [10]. The above factors stimulate producers of fat-and-oil products to develop cocoa butter alternatives, especially cocoa butter equivalents (CBE) because they are the closest to it according to physical and chemical and technological properties, as well as according to fat and acid and triglyceride composition. Cocoa butter equivalents are widely used in producing glaze, including chocolate and pastes.

The advantage of using a cacao butter substitute instead of cacao butter is its low cost (almost twice), simplicity of use and technological effectiveness (no tempering of masses on their bases), as well as a high degree of compliance with the type of the glazed product (for example, it is possible to choose the cacao butter substitute with a lower level of shrink and hardness than the cacao butter to produce smooth and flexible glazes for flour confectionary) [11]. Non-lauric cacao butter substitutes based on hydrogenated fats differ from cacao butter by the content of trans-isomerides of fatty acids (TFA) – 50% on average.

We have chosen the following fats as the fatty basis for glazes: 1401-33 – non-lauric cacao butter substitute, 3001-35S – lauric cacao butter substitute, and 1402-36 – confectionary fat. All fats under research were obtained by fractioning and partial hydrogenation of vegetable oils and fats.

METHODS

When making the research, general and special physical, chemical, organoleptic and mathematic methods of research were used. Fatty products were researched in accordance with the requirements of the current standards and methods. The content of fatty acids was defined according to the modification method by using the gas chromatograph “Chromatek-Crystal”; oxidation stability of oils – by using the automatic Rancimat 743.Metrohm device; β-carotin – by using the Lovibond PFX 995 device; chemical entities with the conjugated links (diolefines and trienes) – by AOCS, Official Methods, cd. 5-91, Reaptoval, 1997; polar materials - by accelerated variant of the JUPAC 2.505 method, fatty acid profile – by gas-liquid chromatography of fatty acid methyl esters – GOST R 51483-99. The weight content of HTG in the fats under research was defined by using the nuclear magnetic resonance (NMR) method. Qualitative analysis of oxidation after-products was made by using the Agilent 19091S-433 chromatograph, HP-5MS station 30 m · 0.25 mm, sorbent bed depth was 0.5 mkm. The speed of flow was 2.2 ml/min, the injector temperature was 270°C. The station thermostat temperature was 40→325°C with the temperature gradient of 10°C/min. All experiments were made twice. The results were processed by using the Statistica 6.0 software.

RESULTS AND DISCUSSION

The fats under research have their technological and consumer advantages and disadvantages. Table 1 shows them. Table 2 shows physical indicators of the quality of fats under research.

The temperature of melting is a determinative indicator when forming the ready product taste. A low temperature of melting contributes to quick melting and favoring. Besides, the temperature of melting has an impact on the fat accessibility. The higher the temperature of melting is, the worse is the rate the fat accesses the person’s organism.

It is known [2] that if the temperature of complete melting of fat is above 36°C, the organoleptic properties of the product worsen. As a consequence, this has negative impact on the taste of the ready confectionary that contains it. For fats 3001-35S and 1401-33, the temperature of complete melting does not exceed the recommended 34-36.5°C for fats used when making a glaze, which contributes to obtaining glazes with a high quality taste. The temperature of complete melting for confectionary fat 1402-36 is a bit higher that consequently may form high-melt, tallowy flavor of the glaze.

The temperature of chilling characterizes the transition of fat from the liquid state into the hard one. The temperature of the fat chilling is the conditionally accepted temperature when the produced melting heat either slows down or ceases chilling for some period of time, or the temperature at which the chilling mass will be warmed at the expense of the melting heat (Figure 1).

Table 1. Advantages and Disadvantages of Fats Used to Produce Glaze

Indicators	Non-lauric CBS	Lauric CBS
Opportunity to extend recipes by using cacao products and dairy products	+	-
Stability of gloss, resistance to “bloom”	+	-
Plasticity of glazes, preventing rippings and breaks when crystallzing	+	-
High heat resistance of glaze	+	-
Storage propert, no soapy flavor	+	-
Possibility to process recyclable wastes	+	-
Organolaeptic indicators of the ready product – high speed of melting, no greasiness	-	+
High hardness and crackle when cracking	-	+
High speed of crystallization, increase of productivity	-	+

Note: CBS – cocoa butter substitute

Table 2. Physical Indicators of Fats Quality

Indicators	1401-33	3001-35 S	1402-36
Melting temperature, °C	32-34	33-36	35-37
Congelation temperature, °C	30-31	31-32	33-34
Content of hard triglycerides (HTG), %			
at 10 °C	94-97	95-99	83-89
15 °C	91-96	94-98	75-80
20 °C	min 82	90-97	62-68
25 °C	min 68	85-91	42-50
30 °C	min 42	42-52	22-30
35 °C	max 3	max 6	6-11

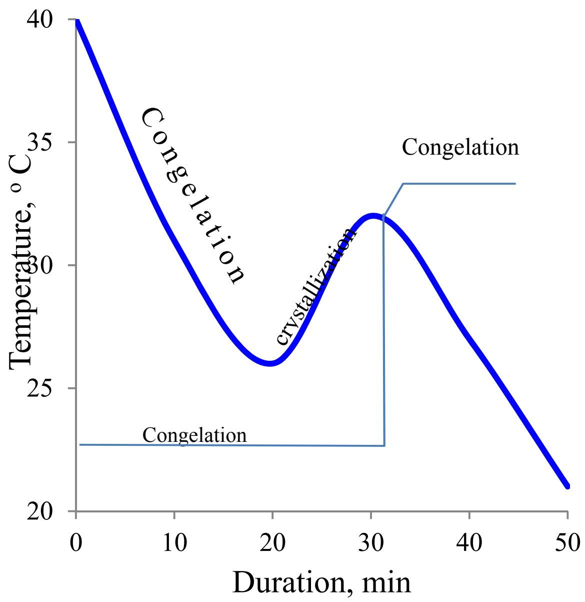

Figure 1 – Kinetics of Vegetable Fat Congelation

The period of the fat congelation is an important characteristic of the fat used when making glazes. This is the time when the fat sample achieves the congelation temperature. The higher the temperature of the fat congelation is, and the lower the crystallization time (within a certain framework) is, the better and quicker it crystalizes. According to the results of the experiment, we can see that the lauric cocoa butter substitute has the shortest congelation time (Fig. 2). Detailed characteristic of crystallization says about the technological effectiveness and simplicity to use this type of fats.

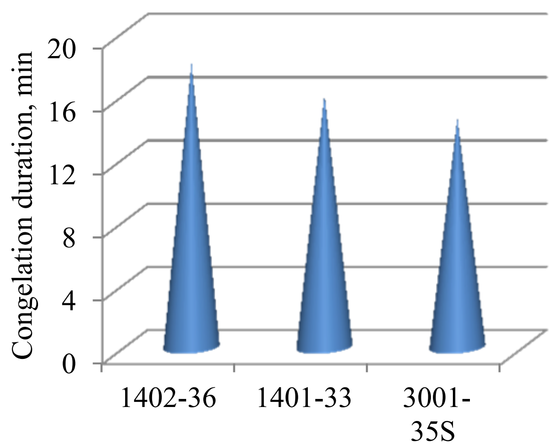

Figure 2 – Duration of Fat Congelation

All fats have a certain temperature of crystallization when chilled, turning from a liquid to hard state. This temperature is defined by triglycerides that are components of this fat and their physical properties. When crystallized fats' volume decreases, it allows choosing glaze bars and products made of their forms. When chilling the glaze, the degree of fats shrink, and, consequently, that of the glaze in monoliths based on them, depends on the fat hardness and requires to correct chilling modes.

According to the results of the conducted researches, it is possible to make the conclusion that the degree of lauric cocoa butter substitutes is a bit higher than the one of non-lauric cocoa butter substitutes. The lowest degree of shrink is peculiar of confectionary fat sample 1402-26 (Fig. 3).

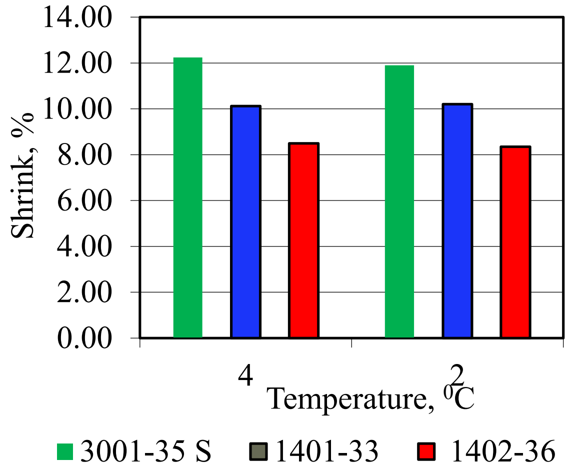

Figure 3 – Fat Shrink Depending on Temperature of Chilling

Hardness and weight content of HTG is also an important indicator that characterizes the fats quality.

It is known that the weight content of HTG at 20°C determines such structural and mechanic properties and hardness and frangibility (the higher the content of HTG is, the harder the fat is). The higher the weight content of HTG at 25-30°C is, the higher the heat resistance is. However, too high content of HTG (about 50% at 30°C) is not recommended either because it may cause low fusibility. The content of HTG within 30-35°C stipulates organoleptic properties of the product: melting in the mouth, and flavoring. The lower the weight content of HTG at these temperatures is, the better the fat and glazes based on it will melt in the mouth (Fig. 4).

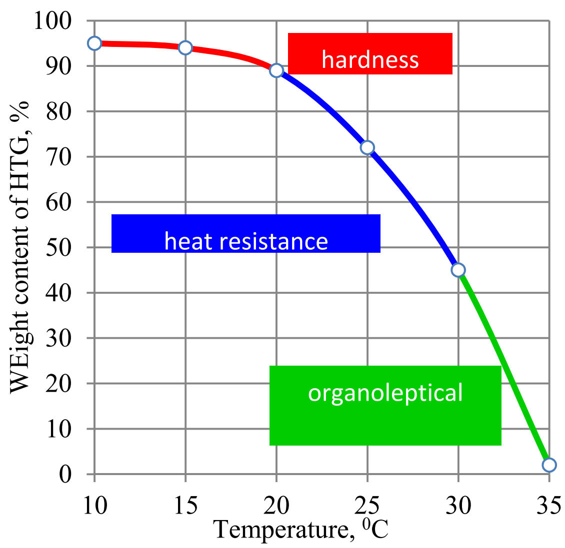

Figure 4 – Characteristics of Impact of the Weight Content of HTG on Fat Indicators

The weight content of HTG in the fats under research was defined by using the NMR method within 10 - 35^{0}C (Fig. 5).

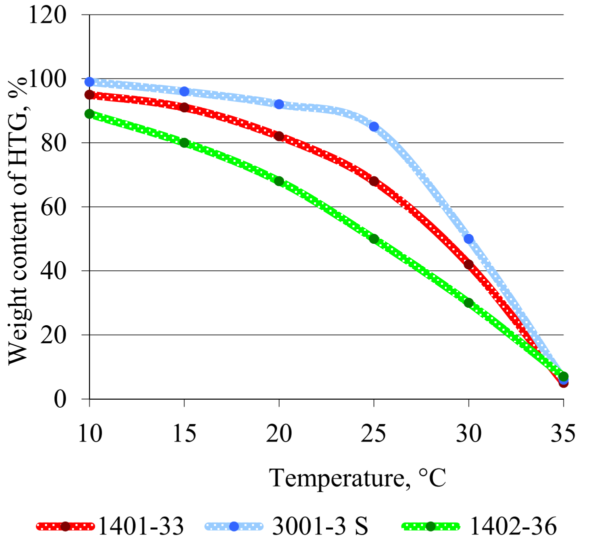

Figure 5 – Content of HTG in Fats Depending on Temperature

The study of the weight content of HTG within 20-35^{o}C made it possible to define both organoleptic advantages and technological properties of the fats under research. It is defined that fat 3001-35S has the highest hardness. It has rather high content of HTG at 20^{o}C (above 90 %) and 25^{o}C (above 80%). It also says that the fat has specific fragility at the normal temperature. As the temperature increases, the weight content of HTG in the fats under research decreases. However, in fat 1402-36 the HTG content is still high at 35^{o}C. It is proved by the data of researching temperature of compete melting of this fat.

It is also defined that as compared to non-lauric fats, lauric cacao butter substitute 3001-35S has advantages because of low melting profile, which will provide more intensive crystallization of glaze on the product surface.

CONCLUSION

Thus, based on the conducted research, it is possible to conclude that the fat for a glaze must be chosen taking into account its physical properties and possibility to regulate rheological properties of the glaze. The speed of fats crystallization must allow the glaze to quickly crystallize after facing the sweets bods and not to chip.

REFERENCES

[1] *Rossiyskiy rynok zhirov dlya konditerskoy promyshlennosti* [Russian market of fats for the confectionary industry] [Digital resource]. (n. d.) Date View October 27, 2017 http://www.candytech.ru/articles.php?c=19&n=12&a=207

[2] Minifay B.U. *Shokolad, kongety, karamel i drugie konditerskie izdeliya* [Chocolate, sweets, caramel and other confectionary]. Saint-Petersburg: Profession, 2005.

[3] Khatuntsev V.V., Petrichenko V.V., Tumanova A.E. and Khatuntseva L.N. Issledovanie phiziko-himicheskih svoystv zhirov dlia proizvodsta konditerskoy glazuri [Researching Physical and Chemical Properties of Fats for Producing Confectionary Glaze]. *Storage and Processing Agricultural raw Materials*, 2010; 5: 27-30.

[4] Schantz B. and Linke L. Bestes Fliessverhalten. Uber die Wirkungsweise verschiedener Emulgatortypen in Schokolade. *Lebensmitteltechnik*, 2002; 34(5): 42-44

[5] Chernyh I.A., Biboletova A.B., Krasina I.B., Kalmanovich S.A. and Krasin P.S. Upravlenie strukturoobrazovaniem shokoladnoy massy [Managing Structure Formation of Chocolate Paste]. *Polythematic Online Scientific Bulletin of the Kuban State Agrarian University*, 2015; 109: 824-836.

[6] Afoakwa E.O., Paterson A., Fowler M. and Vieira J. Comparison of rheological models for determining dark chocolate viscosity. *International Journal of Food Science & Technology*, 2009; 44(1): 162-167.

[7] Baranova Z.A., Krasina I.B. and Krasin P.S. Vliyanie vida zhira na kachestvennye harakteristiki zhirovoy glazuri []Impact of the Fat Type of Quality Characteristics of the Fat Glaze. Bulletin of Higher Educational Establishments. *Food Technology*, 2015; 5-6 (347-348): 36-39.

[8] Baranova Z.A., Krasina I.B., Timofeenko T.I. and Krasin P.S. Obosnovanie vybora zhira dlya proizvodstva konditerskih glazurey [Stipulating the Choice of Fat for Producing Confectionary Glazes]. Bulletin of Higher Educational Establishments. *Food Technology*, 2015; 2-3 (344-345): 109-112.

[9] Smirnova T.S. Kompleksnaya otsenka kachestva glazurey, predstavlennyh na otechestvennom rynke [Comprehensive Estimation of Quality of Glazes Provided on the National Market]. *Merchandiser of Food*, 2013; 12: 43-49.

[10] Malofeeva M.V Primenenie ekvivalentov masla kakao v proizvodstve glazuri [Applying Equivalents of Cacao Butter When Producing Glaze]. *Confectionary Production*, 2016; 2: 22-23.

[11] Miroshnikova P.M. Zameniteli kakao-masla laurinovogo tipa dlya proizvodstva glazurey [Lauric Substitutes of Cacao Butter for Producing Glazes]. *Confectionary Production,* 2005; 4: 40-42.