

SCIENTIFIC  
COLLECTION  
«INTERCONF»

№ 1 (37)

December, 2020

THE ISSUE CONTAINS:

Proceedings of the 1<sup>st</sup>  
International Scientific and  
Practical Conference

RECENT SCIENTIFIC  
INVESTIGATION



OSLO, NORWAY

6-8.12.2020

UDC 664.87

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## **STUDY OF THE INFLUENCE OF ALKALIZED COCOA POWDER ON THE STRUCTURAL AND MECHANICAL PROPERTIES OF INSTANT MOUSSES**

**Introduction.** The market of instant food is one of the most dynamically developing branches of the food industry [1]. This aspect is due to the fast pace of life and, consequently, the lack of time for cooking. Scientists of over the world are improving old recipes of food concentrates of sweet dishes, using non-traditional fillers, new structure-forming agents and developing new ones in order to expand the range, increase their nutritional value and improve taste. A large part of the instant desserts is chocolate dishes.

Cocoa is unique substance because it gives the final product both flavor and color. Cocoa (*Theobroma cacao*) in its natural form has a weakly acidic medium with a nominal pH of 5.0 to 5.6. Alkalization, or the Dutch process, neutralizes the usual acidity of cocoa, raises the pH to 7-8, and this leads to the formation of cocoa with darker color, reducing its sour and tart taste [2].

Therefore, the aim of this work was to improve the formulation of instant chocolate mousses, in which alkalized cocoa powder was used as a filler.

It is known [3] that mousse is a foam-gel system in which air bubbles form the dispersed phase and the dispersion medium is a liquid in the form of thin films. The process of foaming is influenced by the amount of foaming agent (protein), saponins, which increase the foaming ability (FA), while sugar, fat, vegetable powders reduce it.

Therefore, an important stage of work was the study of the effect of alkalized cocoa powder on the formation of foam, because with its addition to the system sugars, acids, phenolic substances are got, which affect the process of foam formation.

**Objects and methods of research.** The mousse made from alkalized cocoa powder TM "Mriya" (Ukraine) was analyzed, which was compared to mousse, based on natural cocoa powder TM "Nestle" (Russia).

The studies were performed using mousses made according to the classic recipe, which included semolina (23%), sugar (69.7%), citric acid (0.3%) and filler in the amount of 0.5%, 1.0% and 1,5%. The finished concentrate was poured with cold water in a ratio of 1:3 and was boiled at a temperature of 90..100°C for 10-15 minutes, then was cooled to a temperature of 30..40°C and was beaten with a mixer at minimum speed.

The viscosity of the mousse was determined using a 'Brookfield RV DV2T' rotary viscometer using an optional spindle 21 (USA). Mousses flow studies were performed using a 'BC-246' viscometer according to the method of GOST 9070-75 [4].

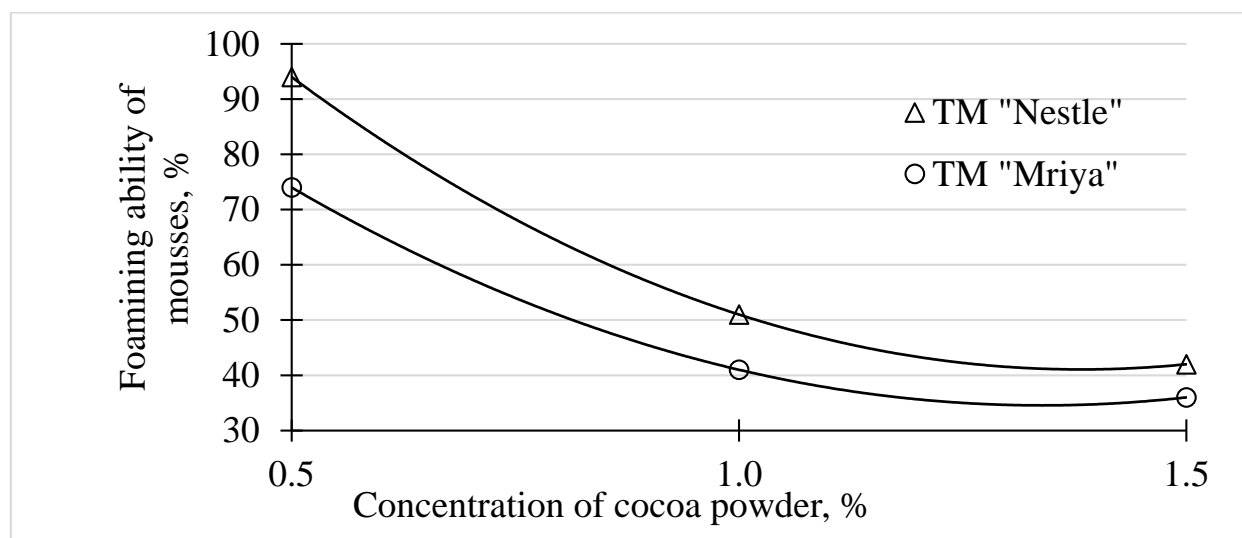
Foaming of instant mousses was determined by the Lurie method. The volume of the air phase, the volume of the foam, the volume of the dispersion medium were determined by calculation based on the data of foaming ability [5].

In addition, the microstructure of the foam was examined using a 'Konus Biorex-3' microscope (Italy) at a magnification of 100 times.

**Research results.** The results of studies of the effect of cocoa powder on the foaming ability of mousses and structural and mechanical properties of foams are presented in Fig.1. and Table. 1, respectively.

From the analysis of foaming ability of desserts it was determined that in case of increasing the addition of cocoa powder content from 0.5 to 1.5%, this indicator decreased by 50 - 55% for mousses based on cocoa powder "Nestle" and "Mriya", respectively. This pattern was explained by several reasons. Firstly, the increase in the amount of cocoa powder in the system helped to reduce the foaming ability due to its adsorption on the foaming agent (protein). Secondly, with the introduction of cocoa, additional monosaccharides were added, which increased the surface tension of the

solution, and tannins, destroying the hydrate shell of proteins, led to the formation of an impermeable film on the interface of gas and liquid phases during beating [6].



**Fig. 1. Foaming ability of chocolate whipped desserts**

**Table 1**

**Structural and mechanical characteristics of instant chocolate desserts**

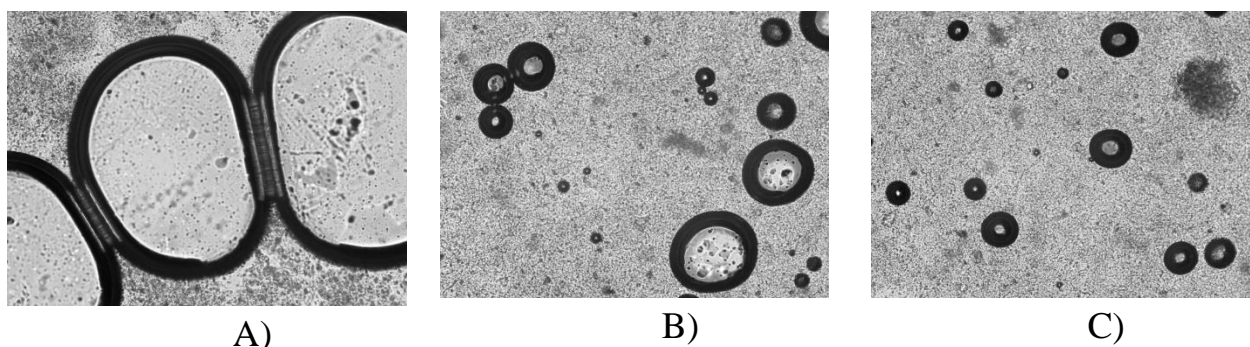
Dessert with cocoa powder	Dosage of the mixture to the mousse formulation, %	Volume concentration of air in the foam, %	Multiplicity of foam, c.u	Mousse density, g/cm <sup>3</sup>
TM «Nestle»	0.5	49.90	1.99	0.523
	1.0	47.60	1.91	0.567
	1.5	43.49	1.76	0.606
TM «Mriya» (alkalized)	0.5	42.80	1.75	0.534
	1.0	33.33	1.49	0.619
	1.5	23.00	1.29	0.669

Thirdly, the fat that was part of the cocoa powder was a defoamer, it destroyed the hydrated shell of the bubble of air in the foam, and therefore reduced the volume of air in the foam. The obtained data were confirmed by the results of the analysis of structural and mechanical properties of foams (table 1), because, increasing the dosage of cocoa powder from 0.5 to 1.5% reduced the volume concentration of air in the foam to about 30%. The value of density of musses also confirmed the obtained studies, because in the case of increasing the dosage of cocoa powder, the density increased almost 2 times. Further increase in the dosage of cocoa powder up to 2.0% led to

obtaining foam without air structure, that is why the results were not presented.

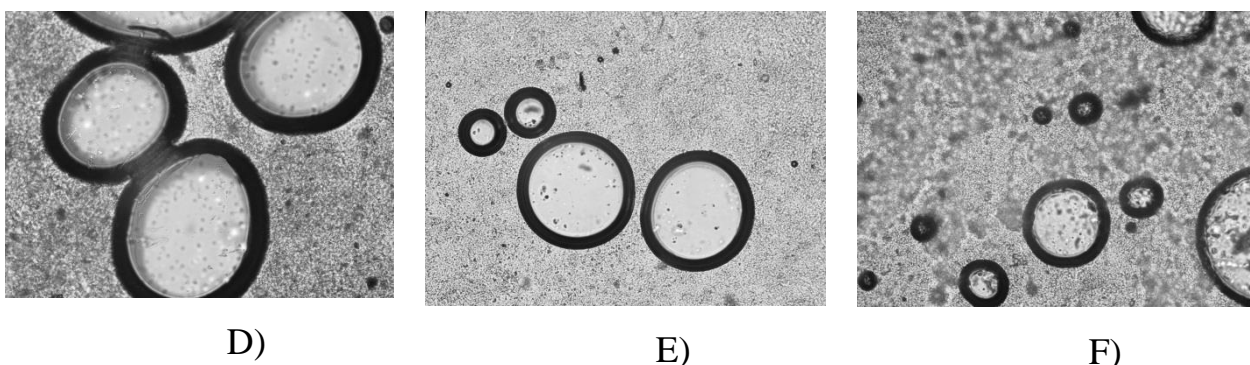
The highest results of foaming ability were observed in the sample with the addition of cocoa powder TM "Nestle", while alkalized cocoa powder TM "Mriya" significantly inhibited the formation of foam up to 14 - 22%. First of all, such results were explained by the active acidity of cocoa powders, because the alkalized cocoa powder of TM "Mriya" had a pH = 7.9 containing organic acids, which increased the FA of mousses by lowering the pH of the system. This led to a weakening of the balance between the film and the conformation of the protein molecule in solution, thereby reducing the ability to form foam [6].

The results of studies of the effect of cocoa powder on the microstructure of mousses are presented in Fig. 2 and Fig. 3.



**Fig. 2. Photos of the microstructure of instant chocolate whipped desserts with the addition of cocoa powder - TM "Nestle" in the amount of:**

**A) 0.5%; B) 1.0%; C) 1.5%**



**Fig. 2. Photos of the microstructure of instant chocolate whipped desserts with the addition of cocoa powder - TM "Mriya" in the amount of:**

**D) 0.5%; E) 1.0%; F) 1.5%**

It was determined that in the case of adding cocoa powder to the mousse formulation, polydisperse foams and bubbles having a spherical shape were formed. In the case of increasing the concentration of cocoa powder, there was a decrease in the area of bubbles, the number of bubbles with a cell size greater than 50  $\mu\text{m}$ , and an increase in the number of medium bubbles (bubble size was 101... 200  $\mu\text{m}$ ).

In the case of making mousses based on cocoa mixture in the amount of 1.5 in all three samples, foam was formed mainly with the bubble size of up to 50  $\mu\text{m}$ , while increasing the addition of cocoa powder led to the formation of bubbles with the size of more than 200  $\mu\text{m}$  and .

У разі виготовлення мусів на основі какао суміші в кількості 1,5 у всіх трьох зразках утворюється піна переважно з розміром пухирців до 50 мкм, тоді як збільшення додавання какао-порошку призводить до утворення пухирців з розміром понад 200 мкм, а their total number also decreased.

When choosing cocoa powder and its concentration, their influence on not only structural and mechanical parameters, but also organoleptic ones remained an important issue because it affected consumer choice. Therefore, it was investigated how cocoa powder affected the organoleptic properties of dessert masses. The results of studies of organoleptic characteristics of chocolate desserts are presented in table.2.

Table 2

### Organoleptic quality indicators of instant chocolate desserts

Dessert with cocoa powder	Dosage of cocoa powder to the mousse recipe, %		
	0.5	1.0	1.5
TM «Nestle»	The product was homogeneous, homogenized, without inclusions. Creamy tinge and a faint taste of chocolate	Homogeneous consistency of cream color, with a light chocolate taste.	Homogeneous texture, light chocolate color and taste of chocolate.
TM «Mriya» (alkalized)		Homogeneous consistency of light chocolate color, with chocolate taste.	Homogeneous consistency of rich chocolate color, with a pronounced taste of chocolate.

The results of organoleptic evaluation of fast food desserts showed that all desserts had a positive evaluation. However, in the case of adding 0.5% of cocoa powder, the dessert had no pronounced color and taste. The best organoleptic parameters were observed in a sample made with the addition of 1.5% of alkalized cocoa powder TM "Mriya", which had a pronounced taste and aroma of chocolate, it had its own bitterness. In appearance, it was a foam of intense chocolate color.

**Conclusion.** Taking into account the structural-mechanical and organoleptic characteristics of instant chocolate whipped desserts, it was expedient to use alkalized cocoa powder of TM "Mriya" in the technology of musses production in the amount of 1.5%, which made it possible to create a dessert with high taste properties. In addition, this choice of dosage provided an acceptable foam structure of the finished dish, while an increase in the amount of alkalized cocoa powder above 1.5% led to the formation of a jelly-like structure without air bubbles.

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