THE INFLUENCE OF INULIN ADDITIVE IN THE WATER COMPOSITION DURING THE PROCESSING OF BUTTER

T.A. Rashevskaya, I.S. Gulyi, L.D. Bobrovnik and I.Y. Goyko

Ukrainian State University of Food Technology, 252033 Vladimirskaya st. 68, Kyiv, Ukraine

ABSTRACT

The researches of water phase state in butter with inulin additive were carried out. The results stated that inulin additive increased the amount of closely linked adsorptional moisture in butter. It was displayed that water phase state influenced the formation of microstructure and crystal phase of butter.

INTRODUCTION

For the last years inulin attracts attention of scientists from many countries as a substance of immune activity. Inulin is a polysaccharide, containing in its composition 95 % remnants of fructose and 5% glucose.

A new kind butter with inulin[1] additive was processed at the Ukrainian State University of Food Technology. The high molecular inulin was used during this process. The technology for obtaining the inulin from vegetable raw materials has been also developed in the University. The researches displayed that inulin additive improved butter properties and corresponded to the formation of plastic thermoresistant butter consistence with coagulational crystal structure[2].

EXPERIMENTAL

The butter has been investigated by using samples with inulin additive and additive free one, which were manufactured by methods of transformation of high fatty cream (THFC). The above butter samples were investigated first time being fresh, second time being stored at 5°C for 10 days, third time at –18°C for 6 months.

The influence of inulin on forms of moisture link in butter, fat phase of butter at the formation of texture, and microstructure butter has been investigated. It was studied the forms of moisture connection in the butter samples by means of thermogravimetrical investigation with a help of derivatograph. The use of the DTA (differential thermal analysis), and TG (the change of mass), DTG (the velocity of change of mass) combined method made it possible to explore the influence of inulin on moisture link in butter[3].

The microstructure of the butter samples was studied by the method of electronic microscopy. Sample for electron microscopic investigation was obtained by breaking the instantly frozen butter samples (–160°C) at freezing speed 1000°C/sec. The frozen butter samples were broken in deep vacuum. Thereafter a platinum-carbamide film was applied upon the broken surface at an angle of 30°C.

The influence of water phase on formation of crystal fat phase in butter was developed by DSC (differential scanning calorimetry). The curves of temperature of melting of butter represented the sum of the isotherm melting of the ice, obtained from the free water of the product, and from the discrete group of glycerides.

We first got the method of calculating the contribution of the phase change of water in the general curves of melting of the butter, the expression of this to the DSC thermogram, and the deduction of it from the curves of melting. Afterwards, the obtained curves of melting of the butter were distributed only for the discrete groups of glycerides. The distribution was based upon the Gauss theory of curve distribution. The description of data processing was performed by IBM computer.

RESULTS AND DISCUSSION

It was established that the introduction of inulin helped the increase of the concentration in butter of the adsorption moisture, both at monomolecular and polymolecular levels. The relative content of more firmly linked moisture (adsorptional) in butter sample with inulin additive made up 64%, in additive free butter sample 34%. The adsorption moisture was higher and stronger connected to the moisture itself. This moisture corresponded to the structural formation of butter with the determined coagulation activities.

The electron microstructure of additive free butter sample contained several destructed and partially damaged fat globules. Microstructure of butter sample with inulin additive contained lots of destructed and partially damaged fat balls. The size of fat globules in butter sample with inulin additive was larger than in additive free butter sample because their cover was more thick. The fat globule cover possesses complicated chemical structure.

Inulin formed the additiveal layer around fat globules due to hydrophillious and hydrophobous interactions with the cover materials, thus increasing the amount of adsorptially linked moisture and hardening the fat globules' strength. This corresponded to the formation of granular structure with plastic consistence in butter sample with inulin additive. The thickness of fat globule cover increaseed during the storage process at low negative temperatures. Lots of lamellar crystal formations in layer shapes during the storage process of additive free butter sample. This corresponded to the formation of crumbling butter consistence.

It was established through the method of differential scanning calorimetry that the interaction of the water out the inulin with the dispersion of the coloidal components in the structure of the butter had influence on the crystallization process of the fat phase. It slowed down the process of crystallization and differentiation of glycerides which

improved their package in mixed crystals; increased influence of media-melting glycerides on formation of crystal fat phase of butter sample with inulin additive. This corresponded to the formation of a more plastic consistency of the product in comparison with the butter without additives.

The results stated that inulin additive in butter influenced the state of its water phase, increased the amount of adsorptionally linked moisture, which corresponded to the formation of additional layer around fat globule cover thus increasing their strength. The water phase composition influenced the formation of crystal fat phase of butter. All this corresponded to the formation of plastic consistence of butter.

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