Semi-finished products made from fruits of *pirum Krasnoyarsk magnum L.* in production of flour confectionary

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Abstract. The object of the study is technologically mature fruits of a Siberian pear of *pirum Krasnoyarsk magnum L.* breed. The process of obtaining extracts from the fruits of the Siberian pear is made with the following parameters: extract agent concentration (ethanol)—40% with further mash ratio of the extracting agent—1:5, water bath temperature—56°C. The distillation parameters in the process of extract concentration: pressure—0.08 MPa; temperature: initial water bath temperature—28°C: flask rotation rate—75-90 rotations per minute. The biochemical composition of fruit extracts from a Siberian pear of *pirum Krasnoyarsk magnum L.* breed was studied under the following conditions: extraction time of 30, 60, and 90 minutes by 40% ethanol. A concentrate was made from the extract within 90 minutes concentration; the content of the main components in the extract increased by 1.5 and extraction agent concentration decreased from 40% to 0.5%. A recipe of rum baba confectionary in which a concentrated extract made from pear fruit of *pirum Krasnoyarsk magnum L.* breed is used as a functional ingredient was developed. The use of concentrated extract made from a Siberian pear fruit as an extract ingredient contributes to the improvement of the biological value of the finished product due to higher concentration and increased content of main biologically active components.

1. Introduction

At the present moment, both manufacturers and ordinary consumers are concerned about the issue of food quality. A healthy lifestyle encourages people to choose components of everyday diet thoroughly giving preference to natural products. Therefore, many manufacturers have started to add plant extracts to food, which enables to deliver the taste of food and improves human health. Many specialists study the structure of various flavour composition to use products in various spheres. In such a way, the range of manufactured products may be significantly extended [1].

All confectionery products are divided into two broad categories: flour and sugar. In sugar products, sugar, syrup, colourants, jams, and flavouring agents are used. In flour products, flour, sugar, fats, baking powders, fillers, flavouring extracts, and dairy additives are used. Raw components change in various ways when technologically processed: chemical bonds may break, amino acid and sugar concentration decrease, aldehydes are produced. These are all effects of product taste and flavour properties [1, 2].

The extracts positively affect the taste and have a whole range of healthy properties. They improve gassing power in the dough and make bread, biscuit, and bun crumb soft. The extracts increase the product amount. Many compounds contain maltodextrins that contribute to moisture retention, which
improves shelf life. In Krasnoyarsk Territory, numerous fruit and berry crops grow; however, their production may be increased by the cultivation of a Siberian pear [3].

A pear is a fruit of the tree named *Pirus communis* L. is rarely used in confectionery. Pear puree is used in fruit butter manufacturing. Conserves are made of pear, as well as jams and candied fruits. Pear as a crop is spread less than apples, especially in the south and partially central districts of the territory [2, 3].

In Siberia, only hybrid types of pear that are adapted to cold conditions are cultivated on the field. *Pirus Krasnoyarsk magnum* L. breed is one of the district-adapted and promising pear breeds for cultivating on the filed in northern areas of Siberia. *Pirus Krasnoyarsk magnum* L. breed is a tree of average height with thin pyramid crown. The tree is of average winter-resistance and gives a heavy yield of (6–12 kilograms and up to 75 kilograms per tree). The fruits are average and large (40-64 grams), of pear shape, green with light spots, soft, juicy, acidulously sweet. The fruits are ripe at the beginning of September and can be kept for up to three weeks[2, 3].

The average sugar content in the presented breed is 8,2%. When picked up, pears contain starch (0.3-2.4 %) that rapidly disappears within fruit ripening.

Pear fruits contain mainly apple acid on average of 0.15%, as well as citric acid in small quantities. Overripe soft pears contain lactic acid and acetic acid, while healthy fruits do not. The alcohol-insoluble remainder that includes grit cells and pectin is 5.1%. Ripe pears mostly contain soluble pectin, while protopectin is almost absent in them.

Pear fruits contain many tanning acids that make fruits taste astringent. On average, there is 77 mg of tanning acids in 100 grams of studied breeds. When a pear ripens, tanning acids transform into other compounds. Therefore pears do not taste astringent.

The arbutin content reaches up to 12–15 mg in 100 grams in pear fruits. Pear fruits are not valuable as a source of citric acid, and on average contain 4.7 mg of it in 100 grams. Pears are characterized by a higher content of chlorogenic acid than apples (30–70 mg/100 grams). Pears are not a good source of jelly products due to the low content of pectin compounds – 6.9% of dry weight on average. Therefore, due to its chemical composition pears are valuable food and should have a significantly higher actual weight in manufacturing of functional food products.

2. The purpose of the study

Extracts are naturally useful for improvement of flour confectionery taste, biological value, shelf life, as well as for giving it taste and flavour. They may be used instead of syrup to prevent syrup and fondant from crystallization [3, 4].

The purpose of the study was to analyze chemical composition and properties of an extract made from Siberian pear fruits in terms of its use as a concentrated ingredient in manufacturing functional flour confectionery. The other purpose is to develop a recipe for flour confectionery with a well-balanced composition based on the extract.

3. The object of the study

The object of the study is an aqueous-alcoholic extract of technologically mature fruits of a Siberian pear of *Pirus Krasnoyarsk magnum* L. breed and concentrate after extract processing in a rotational vacuum evaporator.

4. Materials and methods

Samples Samples made from Siberian pear fruit after ripening at the temperature of 22-25°C were used for making extracts. The fruits were chopped up to the size of 1–2 cm. Then an extract was made using ethanol in various periods to reach a maximum output of biologically active substances. The following process parameters were chosen to make the extract: extraction agent concentration (ethanol)—40% with further mash ratio of the extracting agent – 1:5, water bath temperature – 56°C [5].
In the result of studying the chemical composition of the extracts made from a Siberian pear of *pirum* Krasnoyarsk magnum *L.* breed, it is established that the content of vitamin B9, sugars, arbutin, higher alcohol is high (Figure 1).

Distillation method was used for making a concentrated extract from pear fruits. For that purpose, the solvent was evaporated using a piece of rotational equipment to increase solution concentration or to extract a substance that it contains.

The main principle of the rotational evaporator is that liquid boiling points decrease when pressure is decreased. It enables evaporation temperatures lower than boiling ones when pressure is regular. This process is achieved due to the use of a vacuum system that consists of a vacuum pump and vacuum regulator. A controller manages the vacuum pump, which stabilizes vacuum and maintains absolute pressure, which enables evaporation only of the solvent. After that, pressure may be lowered and stabilized to let other solvents evaporate. In the other part of the system, condenser turns gas back into the fluid that requires lower temperatures. Liquid nitrogen, dry ice or water are used for getting a cooling effect which allows condensed fluid gathering in a separate vessel. Evaporating vessel rotates continuously. This tactic is used for increasing the fluid surface area. Centrifugal force retains fluid that adheres to the internal vessel surface. It increases surface area and accelerates evaporation. The following distillation parameters were selected to concentrate extracts: pressure – 0.08 MPA; initial water bath temperature – 28°C; flask rotation rate – 75-90 rotations per minute[4-8].

5. Discussion of the results

Studied extract samples obtained in an experiment and made from a Siberian pear of *pirum Krasnoyarsk magnum* *L.* breed have similar qualitative composition but differ in the quantity of the main components. Development of extract and a concentrated extract obtainment technology, as well as study of the chemical composition of a Siberian pear of *pirum Krasnoyarsk magnum* *L.* breed was

![Figure 1](image-url)
made by the Institute of Foodstuffs Production of the Krasnoyarsk State Agrarian University at the Department named Technology and Equipment of Fermentative and Foodstuffs Production.

Depending on extraction time, chemical composition parameters of the obtained extracts differ excluding the parameter named ester. According to the obtained results, it can be assumed that the most optimal extraction time is from 30 to 90 minutes because all studied biologically active substances of a Siberian pear of *pyrus Krasnoyarsk magnum* L. breed were preserved.

After conducted studies, it was established that the main group components of the extract made from a Siberian pear of *pyrus Krasnoyarsk magnum* L. breed and that is a foundation of its flavour and taste are vitamin B₉, sugars, inverted sugar, arbutin, higher alcohols (Figure 1).

Sample 3 extract obtained within 90 minutes of extraction was concentrated. Chemical composition of the concentrated extract made from a Siberian pear of *pyrus Krasnoyarsk magnum* L. breed in terms of main components significantly differs from the extract, in particular, the volume ratio of ethanol decreased from 40% to 0.5% due to distillation in a vacuum evaporator. The main components of the extract were concentrated by 1.5 (Figure 2).

![Figure 2. Biochemical composition of the concentrated extract made from a Siberian pear of *pyrus Krasnoyarsk magnum* L. breed](image)

Based on the obtained results, it is considered that the extracts made from a Siberian pear of *pyrus Krasnoyarsk magnum* L. breed have multicomponent biochemical composition, which is a high-quality source of biologically active substances. The extracts are recommended to be added to functional food products, including flour confectionary named rum baba.

Development of the rum baba recipe and production technology using a concentrated extract made from a Siberian pear of *pyrus Krasnoyarsk magnum* L. breed as a functional ingredient was made by the Institute of Foodstuffs Production of the Krasnoyarsk State Agrarian University at the Department named Technologies of Breadmaking, Confectionary and Alimentary Products. The rum baba is made in compliance with GOST standard 5904-82[9, 10]. The principal diagram is presented in Figure 3.
The recipe of rum baba production using the concentrated extract from a Siberian pear of *pirum Krasnoyarsk magnum* L. breed as a functional ingredient is presented in Table 1.

**Table 1. The recipe of rum baba production**

| Raw material | Content of dry substances, % | Raw material quantity, grams |
|--------------|------------------------------|-----------------------------|
| The recipe of a semi-finished backed product to obtain 100 items of finished product, moisture of 22.0 ± 2 % | | |
| straight white wheat flour | 85.50 | 4118.0 |
| sanding sugar | 99.85 | 1029.0 |
| butter | 84.00 | 1029.0 |
| egg mélange | 27.00 | 823.0 |
| raisin | 80.00 | 515.0 |
| vanilla powder | 99.85 | 20.6 |
| salt | 96.50 | 96.50 |
| compressed yeast | 25.00 | 206.0 |
| The recipe of semi-finished syrup for soaking to obtain 100 items, moisture level is 50.00 ± 3.0% | | |
| sanding sugar | 99.85 | 262.0 |
| concentrated extract made from a Siberian pear of *pirum Krasnoyarsk magnum* L. breed | 60.25 | 5.0 |
| water | - | 24.4 |
| The recipe of semi-finished sugar fondant to obtain 100 finished items, moisture level is 12.00 ± 1.0% | | |
| sanding sugar | 99.85 | |
| starch syrup | 78.00 | 176.0 |
Finished products were studied in terms of their main quality properties. When concentrated pear extract is used, typical smell and taste of Siberian pear fruits of *pirum* *Krasnoyarsk magnum* *L.* breed was observed. Physical and chemical properties of rum babas are presented in Table 2.

### Table 2. Physical and chemical properties of rum babas

| Property            | Reference sample | The sample in which rum essence was substituted with concentrated extract made from a Siberian pear of *pirum Krasnoyarsk magnum* *L.* breed |
|---------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Taste and flavour   | Typical for the item | Typical for the item with pronounced pear flavour and taste                                                                 |
| Moisture, %         | 22.5             | 22.5                                                                                                                           |
| Acidity, in degrees | 2.1              | 2.5                                                                                                                            |

According to the obtained results presented in Table 2, it is proved that moisture of the finished product is not changed and stays of 22.5%, unlike acidity of 2.5 degrees that increase due to adding concentrated extract made from Siberian pear fruits.

After the concentrated extract made from a Siberian pear of *pirum* *Krasnoyarsk magnum* *L.* breed is added, the number of such substances as vitamins, sugars (standard and inverted), and volatiles, including higher alcohols, in the product increases.

### 6. Conclusion

The biochemical composition of the extracts made within 30, 60, and 90 minutes by 40% ethanol from a Siberian pear of *pirum* *Krasnoyarsk magnum* *L.* breed was studied. After 90 minutes of extracting, an extract was obtained while the main components in the extract increased by 1.5 and extraction agent concentration decreased from 40% to 0.5%.

The recipe of rum baba with the concentrated extract made from a Siberian pear of *pirum* *Krasnoyarsk magnum* *L.* breed as the functional ingredient was developed.

It is assumed that the biological value of the product increases due to the use of Siberian pear fruits as the concentrated ingredient by increasing concentration and content of main biologically active concentrate components.

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