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INFLUENCE OF THE COMBINED DRY OF ROSES OF HIPS ON THEIR CHEMICAL COMPOSITION AND PROPERTIES

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ABSTRACT

Currently, mankind is in great need of biologically active compounds of natural origin. Deteriorating environmental conditions, air pollution, soil depletion, climate change lead to a decrease in immunity, an increase in cardiovascular and oncological diseases, as well as damage to the gastrointestinal tract and respiratory system. The heyday of the chemical synthesis of vitamins and bioactive compounds is drawing to a close.

The solution to the problem may be the production of environmentally friendly biologically active additives (BAA) from plant materials. Among representatives of the flora of temperate latitudes, one of the most promising candidates for the creation of multivitamin preparations is rose hip.

Until the 1930s rosehip was considered a low-value food product due to the large number of seeds and hairs inside the hypanthium. In 1931, F. Gan indicated a high content of vitamin C in fruits [1]. This served as an impetus for large-scale studies of ecological and biological properties, systematics, growing conditions, breeding and agricultural technology, distribution areas of various types and forms of wild rose [2], as well as their chemical composition. Detailed analyzes were carried out by Yu.V. Branke, N.V. Saburov, V.A. Vadova, and mineral elements of fruits were studied [3]. It is established that they are extremely rich in potassium salts, contain a lot of iron, magnesium and phosphorus.

When creating therapeutic and prophylactic substances, the issue of bioavailability of components occupies an important place. A more affordable and cheaper way, in our opinion, would be to obtain a powder from whole rosehips, which would contain the sum of vitamins and antioxidants belonging to different classes of chemical compounds. The table below shows the content of biologically active substances of wild rose (table 1).

Table 1

The content of biologically active compounds in the fruits of the Rosaceae family Note: "-" - this component was not found in the extract

The content of biologically active substances, mg per 100 g of wet weight					
Type	lycopene	β- carotene	lutein	tocopherols	vitamin C
Dog rose	35,47±1,44	1,91 ±0,082	0,758±0,03	0,345±0,016	163,0±5,10
Rosehip smelly	83,6±3,21	12,8±0,55	-	1,304±0,033	78,93±2,20
Begger's Rosehip	141,75±8,10	34,09±1,30	0,380±0,01	3,74±0,12	361,69±12,20
Dogrose wrinkly	9,3±0,47	21,62±1,01	4,08±0,22	1,10±0,037	278,44±10,82

The antioxidant properties of the product depend not only on the feedstock, but also on production technology. In this regard, there is a need to choose a drying technology in which the antioxidant content and their activity in the final product will not only be preserved in the best way, but will also increase compared to the feedstock.

As the drying methods, the classic convective and combined drying method was chosen - a water heating dryer with IR. During the research, rosehips were used. To accurately evaluate the results, these objects were dried in natural conditions and production samples were added to the studies to study the composition after drying.

The effect of drying pomace was studied in two ways: convective and infrared drying at 60° C. For carrying out the process of convective drying and IR-drying, drying units developed by the authors were used until the studied samples reached equilibrium humidity. For IR drying, sampling was carried out every 45 minutes, for convective drying every 60 minutes [4-6].

For rosehips squeezed the following indicators were determined: total sugar content; titratable acidity; total phenolic content; total flavonoid content; total anthocyanins content (for grape marc extracts only); restoring force according to the FRAP method; antioxidant activity in the linoleic acid system; antioxidant activity according to the method of DPPH. The total sugar content was determined by the photocolorimetric method [7]. Titratable acidity was determined by visual method [8]. The total content of phenolic compounds is determined by the photocolorimetric method using the Folin-Ciocalteau reagent [9] and is expressed in gallic acid equivalent in mg per 100 g of feedstock using a calibration curve. The total flavonoid content is determined by the photocolorimetric method [10] and is expressed in catechin equivalent in mg per 100 g of feedstock using a calibration curve. The total content of anthocyanins is determined by the photocolorimetric method from the difference between the optical density of the extract solutions in buffer solutions of pH 1.0 and pH 4.5 at different wavelengths [11]. It is expressed in the equivalent of cyanidin-3-glycoside in mg per 100 g of feedstock. The restoring force according to the FRAP method is determined photocolorimetrically and expressed in mmol Fe^{2+} per 1 kg of feedstock using a standard curve obtained for various concentrations of Fe^{2+}. Antioxidant activity in the linoleic acid system is determined photocolorimetrically [12]. The result is expressed as a percentage.

Antioxidant activity by the method of DPPH determined photocolorimetrically; the inhibition concentration of 50% of the radicals (EC50, mg/ml) is calculated according to the schedule constructed on the basis of the obtained inhibition values at various concentrations of the studied extract.

The total drying time of rose hips for the convective method was 360 minutes, for infrared drying – 315 minutes. In both cases, the samples lost 80.8% of the initial mass. Rose hips dried by the IR method are slightly lighter in color compared to the fruits of the convective drying method.

The results of physico-chemical analysis of fresh and dried rose hips are presented in table 2.

Table 2

The results of the study of rose hips before and after drying

Type of research	Source data of rose hips	Convective drying, no more than 60^0 C	IR drying, no more than 60 ^{0}C
Acidity in terms of malic acid , %	0,40	2.17	1,83
Mass fraction of sugars , %	19,63	30,86	31,43
The total content of phenolic compounds, mg gallic acid, 100 g of feedstock	85	221	226
The total content of flavonoids, mg cagechin 100 g of feedstock	32	202	201
The restoring force by the method of FRAP, mmol Fe^{2+} 100 1 g of the original сырья	1,44	4,86	6,57
Inhibition of linoleic acid oxidation,%	51,5	74,3	50,5
E_{C50}, mg/ml	112	39	69

From the results it follows that drying by the IR method is more intense, the duration of the process for rose hips has decreased by 12.2%.

The lighter color of the apple pomace obtained by IR drying may be due to the lesser influence of the oxidizing effect of atmospheric oxygen on the product, because in the convective method, name-heated air is a drying agent washing the material to be dried.

The mass fraction of sugars and the acidity of the resulting products increased, which is explained by a significant decrease in the moisture content in dried fruits. However, the increase is disproportionate, but logical: with the convective method, the acidity is much higher than with infrared drying, and the sugar content is lower. This is explained by the fact that during the drying process, part of the sugars undergoes oxidation, while the products of incomplete oxidation are di- and tricarboxylic acids [9].

Sugar amine reactions and caramelization of sugars occur in an acidic environment under the influence of temperatures. Based on this, it can be said that the duration of the drying process had a significant effect on the sugar and acid accumulation in the final product: with the convective method, which was characterized by a longer duration, there were slightly less sugars, however, the titratable acidity of the product increased compared to the IR method. A significant decrease in the moisture content in the dried product led to an increase in the content of phenolic substances, flavonoids and anthocyanins.

The determination of the reducing force by the FRAP method is based on the ability of antioxidants of the studied raw materials to reduce the Fe^{3+} –2,4,6-tripyridyl-s- complex triazine to Fe^{2+} –2,4,6-tripyridyl s-triazine. It can be seen from the obtained data that the restoring strength of the sample is, on average, 3.97 times higher than that of the feedstock, but differs by 26% for the drying methods used. This may be due mainly to the negative effect of the drying time on the properties of the product.

From the data obtained it is seen that with convective drying of rose hips. the ability to inhibit linoleic acid increases by 44.3%, and with IR drying, on the contrary, decreases by 1.9%. This may be due not so much to a possible slight overheating of the upper layers of the product during the drying process, but to the negative influence of infrared radiation on the antioxidant properties of the raw material. 2,2-diphenyl-1-picrylhydrazyl (DPPH) is a stable free radical used to study the ability of the studied extracts to inhibit the chain reactions of radical oxidation. The antioxidants of the extracts give protons to the radical, discoloring the purple DPPH solution and reducing the degree of absorption. From the results of the study, it can be seen that the indices of the antioxidant activity of the powders increase 2.87 and 1.62 times for rose hips with a convective and infrared drying method. Perhaps, as in the case of inhibition of linoleic acid oxidation, a similar result can be associated with the destruction of some biologically active substances and the inactivation of the antioxidant ability of the material under the influence of infrared radiation. Despite the reduction in the duration of the process, the preservation of the light color of apple squeezes, and the increase in the content of antioxidant substances, IR drying negatively affects the ability of antioxidants of the studied product to inhibit various undesirable processes (inhibition of linoleic acid oxidation and capture of free radicals).

Thus, classical convective drying is the most suitable for obtaining powder from rose hips, which has the best antioxidant properties. However, the IR drying method can be used to intensify the convective drying process.

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