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INTENSIFICATION OF THE EXTRACTION PROCESS MANUFACTURE OF BITTER TINCTURES

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Abstract: *The article substantiates the relevance of the use of extracts of spicy aromatic raw materials in the production of bitter tinctures, such as cardamom, red bitter pepper and ginger. When choosing the type of spicy-aromatic raw material it was guided by its chemical composition, namely high content of vitamin C and phenolic compounds. The disadvantages of traditional technologies are considered and ways of solving these problems are determined with the purpose of intensification of the extraction process. A number of studies have been conducted to determine the kinetics of the extraction process, depending on the type of extractant, the size of the raw material particles, the phase ratio, the duration and temperature of the extraction process. The influence of temperature and mechanical refraction on the speed of passage of the extraction process of spicy -aromatic raw materials is considered. The influence of the phase ratio, the type of extractant and the raw material on the process of extracting vitamin C and phenolic compounds from spicy aromatic raw materials was established. Based on the foregoing, recommendations are made regarding the parameters of the extraction process for its intensification, and as a result is obtaining of bitter infusions of high biological value.*

Keywords: *extraction, aromatic raw materials, bitter tincture, infusion.*

INTRODUCTION

The production of bitter tinctures in Ukraine is becoming more popular to the use of various extracts from spiced aromatic vegetable raw materials, which give the finished drink harmonious organoleptic properties. At the same time, it can be noted that bitter tinctures have a positive effect on the human body. Tinctures are alcoholic beverages, which are obtained by blending the extracts of various raw materials. They contain 30-60% vol. alcohol, have a bitter, bitter-spicy or burning taste.

The traditional technology of producing bitter tinctures involves tensioning in containers for standing for 10-14 days on a water-alcohol mixture of 70% vol. Infusions are carried out with the help of two showers, the duration of which varies from 5 to 7 days each. Next, in the blend chink the infusions are mixed up and brought to a strength of 40%. The production of bitter tinctures is a

long-term process, therefore, the issue of sharpening it a rose sharply by replacing the process of infusion with the extraction process.

EXPOSITION

The driving force of the extraction process is the difference in the concentrations of the elongated substance in the liquid, which fills the pores of the solid, and in the main mass of the extractant that contacts the surface of the solid particles. The extraction mechanism itself involves the penetration of the extract in the order of the solid, the presence of target components there, extracted matter from the solid state to the phase separation phase through molecular diffusion or mass conductivity, and then the transfer of matter from the interface to the depth of the extractant through convective diffusion (*V., Bodrov V., Misyura T., Popova N., Zaporozhets Y., Dekanskiy V. 2015).*

The process of its soaking and swelling accompanies the process of extraction of extractive substances from plant raw materials. Therefore, a number of studies were conducted to determine the kinetics of absorption of the extractant, depending on the type of extractant and the size of the raw material particles. Figure 1 shows a graph of dependencies of water absorption capacity of raw materials with particle size of 1 mm on the duration of the extra-dredging process with a water-alcohol mixture of 40% vol. and water.

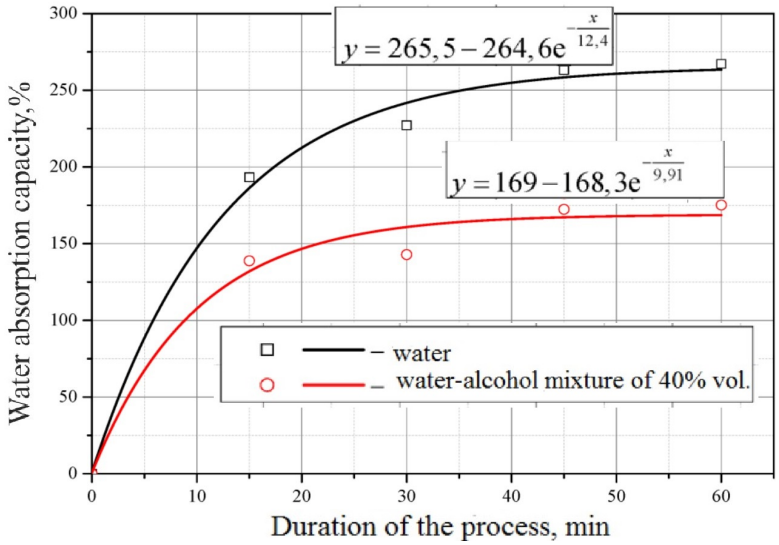

Fig. 1. Dependence of the water-absorbing capacity of the raw material on the length of the extraction process

Based on the graph, the swelling process lasts about 60 minutes. If the particle size of the raw material is 45 microns, then the swelling process is reduced to 15 minutes. The total extraction time will be 80 minutes. The excessive duration of the process (> 80 min) promotes the removal of concomitant compounds, whose diffusion rate is much lower than that of biologically active substances.

Because of in the production of bitter tinctures, raw materials containing vitamin C, which is destroyed under the influence of high temperatures, are used, the temperature of the extraction process of 40 °C was selected for research, which intensifies the process and preserves all the useful substances.

The extraction process was carried out in flasks on the vibrostend with a correlation of 10, 15 and 20. The mixing frequency was 100 rpm. As an extractant is selected water, water-alcoholic mixture of 40% and 70% vol. Guided by the chemical composition as a vegetable raw material was taken cardamom, ginger and red pepper bitter. These spices contain a significant amount of vitamin C and phenolic compounds and are used in the production of bitter tinctures (*W. Knöss and F. Stolte (2009)*. The chemical composition of extracts from dry vegetable raw materials is given in Table 1.

Table 1. The chemical composition of extracts from dry powders

Sample name	Indicator	Cardamom extract	Ginger extract	Red pepper extract bitter
Correlation 20, extractant - water	Concentration of phenolic substances, mg/dm^3	85,12	140,73	220,59
	Ascorbic acid content, mg/100 ml	8,36	7,92	16,28
Correlation 20, extractant – water-alcohol 40%vol.	Concentration of phenolic substances, mg/dm^3	105,08	374,59	421,65
	Ascorbic acid content, mg/100 ml	7,92	10,12	13,2
Correlation 15, extractant – water	Concentration of phenolic substances, mg/dm^3	154,99	231,99	395,98
	Ascorbic acid content, mg/100 ml	9,24	7,92	13,64
Correlation 15, extractant – water-alcohol 40%vol.	Concentration of phenolic substances, mg/dm^3	294,74	530,02	597,04
	Ascorbic acid content, mg/100 ml	11,44	11,0	8,8
Correlation 15, extractant – water-alcohol 70%vol.	Concentration of phenolic substances, mg/dm^3	73,70	434,48	143,58
	Ascorbic acid content, mg/100 ml	8,36	9,24	13,2
Correlation 10, extractant – water	Concentration of phenolic substances, mg/dm^3	177,81	377,44	621,28
	Ascorbic acid content, mg/100 ml	13,2	26,5	17,6
Correlation 10, extractant – water-alcohol 40%vol.	Concentration of phenolic substances, mg/dm^3	400,24	699,71	836,60
	Ascorbic acid content, mg/100 ml	11,0	17,73	14,96

Table 2. Chemical composition of extracts from fresh raw materials

Sample name	Indicator	Cardamom extract	Ginger extract	Red pepper extract bitter
Correlation 20, extractant – water	Concentration of phenolic substances, mg/dm^3	—	120,78	173,53
	Ascorbic acid content, mg/100 ml	—	7,92	10,56
Correlation 20, extractant – water-alcohol	Concentration of phenolic substances, mg/dm^3	—	361,76	542,85
	Ascorbic acid content, mg/100 ml	—	8,8	13,2
Correlation 15, extractant – water	Concentration of phenolic substances, mg/dm^3	—	249,10	172,10
	Ascorbic acid content, mg/100 ml	—	7,92	9,68
Correlation 15, extractant – water-alcohol	Concentration of phenolic substances, mg/dm^3	—	127,90	511,48
	Asco.acid cont, mg/100 ml	—	8,8	11,44

Table 3. Vitamin C from bitter tinctures

The correlation of the components of the formulation	Ingredients of the formulation			Content of ascorbic acid in extracts, mg / 100 ml	The content of ascorbic acid in water-alcohol mixtures is 40% vol., mg / 100 ml	Satisfaction in ascorbic acid,%
	Cardamom extract	Ginger extract	Red pepper extract bitter			
Correlation 20, extractant – water	2	1	3	12,25	5,25	5,6
	3	1	2	10,93	4,68	5,0
	4	1	1	9,61	4,12	4,39
	1	1	4	13,57	5,81	6,2
Correlation 20, extractant – water-alcohol 40%vol.	2	1	3	10,93	—	11,66
	3	1	2	10,05	—	10,72
	4	1	1	9,17	—	9,78
	1	1	4	11,81	—	12,59
Correlation 15, extractant – water	2	1	3	11,22	4,81	5,13
	3	1	2	10,49	4,49	4,79
	4	1	1	9,75	4,18	4,46
	1	1	4	11,95	5,12	5,46
Correlation 15, extractant – water-alcohol 40%vol.	2	1	3	10,05	—	10,72
	3	1	2	10,49	—	11,19
	4	1	1	10,93	—	11,66
	1	1	4	9,61	—	10,25
Correlation 15, extractant – water-alcohol 70%vol.	2	1	3	10,93	6,24	5,6
	3	1	2	10,12	5,78	5,0
	4	1	1	9,31	5,32	4,39
	1	1	4	11,73	6,70	6,2
Correlation 10, extractant – water-alcohol 40%vol.	2	1	3	17,20	7,37	11,66
	3	1	2	16,89	7,24	10,72
	4	1	1	16,16	6,92	9,78
	1	1	4	18,36	7,87	12,59
Correlation 10, extractant – water	2	1	3	15,04	—	16,04
	3	1	2	13,74	—	14,66
	4	1	1	12,45	—	13,28
	1	1	4	16,33	—	17,42

The data in table 1 indicate a higher entrance of phenolic compounds from spicy aromatic raw materials in a water-alcohol mixture of 40%vol.

It was considered the influence of the type of raw material on the chemical composition of extracts - in the first case, it is dry powders, the extraction data of which are given in table 1, as well as fresh raw materials. When using fresh raw materials in terms of dry matter, the data were given, which are given in table 2.

In this case, cardamom was not investigated, since this spice is used only in dry form. The correlation of 10 created hydrodynamic conditions that prevented the complete release of biologically active substances in the extractant and it was not appropriate to carry out. Summarizing the obtained data on the release of vitamin C and phenolic substances into the extractant, one can

conclude that there is no significant difference in the kind of raw material (dry, fresh), so that dry powders were used for saving and convenience for further research.

These tables show that, given the satisfaction with vitamin C, the hydromodule 10 is optimal. As for extractants, good indicators give a 40% water-alcohol mixture, and 70% water-alcohol mixture is not appropriate, since the percentage of satisfaction in vitamin C below 10%. Such an extractant as water is very interesting, as satisfaction with vitamin C is low, but there is a way to increase it, namely, to evaporate excess moisture and to obtain an aqueous concentrate.

CONCLUSION

To obtain qualitative extracts rich in vitamin C, from spicy aromatic vegetable raw materials, it is necessary to observe the following extraction conditions:

- the raw material must be of a particle size of 45 μm;
- the duration of the process should be 80 minutes at constant stirring at a frequency of 100 rpm;
- the extraction temperature should not exceed 40 °C.
- These conditions will enable us to intensify the extraction process and obtain extracts that will be used in the production of bitter tinctures.

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