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# Investigation of the Effect of Extraction Parameters on the Content of the General Phenolic Compounds and the Antiradical Activity of Extracts from dry Fruits Black Blueberry /Vaccinium Myrtillus L./And Black Currant /Ribes Nigrum L./

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## ABSTRACT

The purpose of the study is to develop a technology for the preparation extracts of dried fruits currant and black blueberry . Basic retrieval parameters are establishedof maximum total phenolic compounds. The influence of the technological parameters of the extraction process on the antiradical activity of the extracts is analyzed.
The results obtained suggest that 70% ethyl alcohol as an extractant, a temperature of 65° C, a duration of 3-4 hours and a 1:30 hydromodule are technologically sound choices for obtaining extracts with maximum total phenolic compounds and maximum antiradical activity.

***Keywords:*** *extracts, параметри на екстракция, dry fruits blackcurrant, dry fruits black bluiberries, total phenolic compounds,antiradical activity.*

## I. INTRODUCTION

Increasing the content of free radicals in the cells creates conditions for the so- oxidative stress in which free radicals oxidize vessel walls, protein molecules, DNA and lipids. These radicals actively interact with membranes of lipids containing unsaturated bonds and alter the properties of cell membranes [1].
In recent years, berries have received much attention because of their health benefits, including antimutagenesis and anticancer activity for the prevention of various cancers and age-related diseases [2].
Fruits of /*vacciniummyrtillus l.*/ and / *ribesnigrum l.*/contain powerful antioxidants and a proper balance of bioactive compounds. They are considered to be a good source of phenolic compounds, especially flavonoids and phenolic acids, which mostly contribute to their high antioxidant activity [3].
Beverages are an optimal form of food that can be used to enrich the nutritional portion of irreplaceable nutrients and biologically active substances that have a beneficial effect on metabolism and immune resistance of the body [4].

In order to increase the nutritional value and antioxidant properties of juice-containing beverages, extracts of wild-growing raw materials having a prophylactic and functional effect can be introduced into the production technologies.
The aim of the study is to develop a technology for obtaining extracts of dried fruits of black blueberries and blackcurrants. The basic extraction parameters have been established. The extracts obtained were analyzed for total phenolic compounds content and antiradical activity.

## II. Material and Methods

**A.Material.**The object of the study is the fruits of Vacciniummyrtillus L. and Ribesnigrum. In wild plants, there are a number of BAV that can affect the life processes of the human body.
Forest fruits are rich in phenolic compounds and have great antioxidant activity. This makes them a potential raw material for producing extracts that can be used to develop functional beverages.
Various variants of water and ethanol extracts of dried fruits currant and black blueberry have been developed for total phenolic compounds and their antiradical activity determined.
The aqueous and ethanol extracts of the fruits are respectively with the hydromodule 1:10, 1:20 and 1:30 fruit / extractant; obtained at an extraction temperature of 35 ° -80 ° C and an extraction time of 1, 2, 3 and 4 hours.

**B. Methods:**

- Determination of antiradical activity by DPPH radical - 2,2-diphenyl-1-picrylhydrazyl.
- General Phenol Compounds- spectrophotometric method with Folin-Denisa reagent,% as gallic acid [5].

## III. Results and discussion

The effect of phenolic compounds on the antiradical activity of the extracts obtained was investigated. It has been found that with increasing the content of total phenolic compounds, antiradical activity also increases.
The concentration of total phenolic compounds (Fig. 1) is higher when extracted with ethyl alcohol compared to extraction with water. It increases with increasing concentration of ethyl alcohol in the extracts, reaching its maximum in the extract with 70% ethyl alcohol.

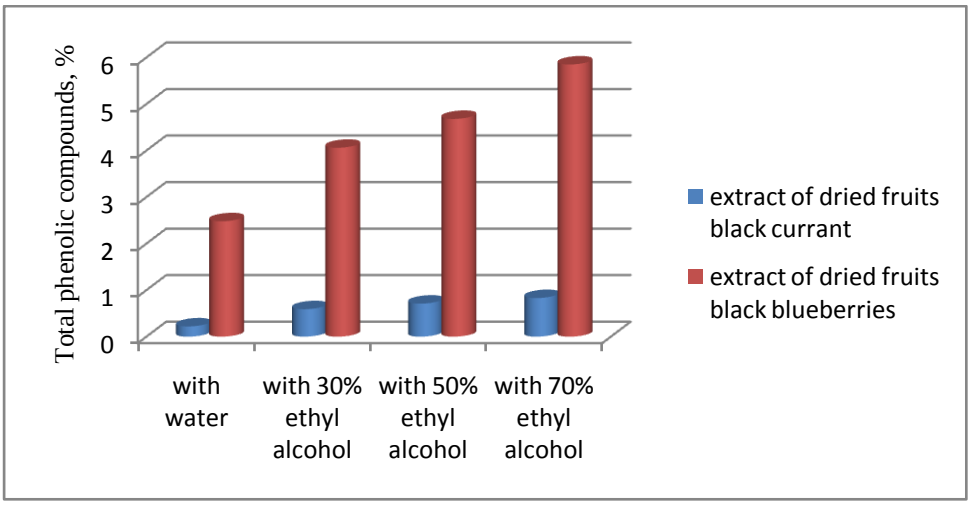


Fig.1. Effect of the extractant concentration on the the total phenolic compounds content in extracts of dried fruits black blueberry and black currant

When extracting of dried fruits blackcurrant with an increase in the concentration of ethyl alcohol from 30 to 50%, the amount of total phenolic compounds increased by 20%, and on extraction with 70% ethyl alcohol the total phenolic compounds increased by 41% - Fig. 1.
When extracting dried fruits blackblueberry with increasing ethyl alcohol concentration from 30 to 50%, the amount of total phenolic compounds increased by 15%, and at extraction with 70% ethyl alcohol the total phenolic compounds increased by 44% - Fig. 1.
The concentration of phenol carboxylic acids upon extraction dried fruits blackblueberrywith 30%, 50% and 70% ethanol is higher than the aqueous extracts and is respectively 2.2; 2.3 and 2.4 times higher. For flavonoid phenolic compounds the increase in concentration was 1.8; 2.1 and 2.2 times(fig. 2, 3).

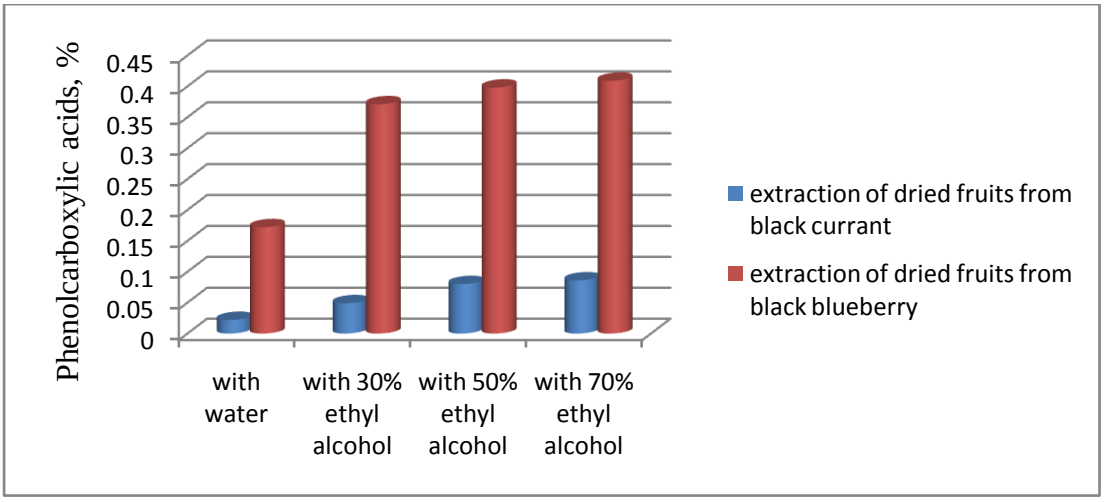


Fig.2.Effect of extractant concentration on phenolcarboxylic acids content in extracts of dried fruits black blueberryand black currant

Concentration of the phenolic acids by extraction dried fruits black currantwith 30%, 50% and 70% ethanol is higher, respectively, of 2.2; 3.6 and 3.9 times compared to their concentration in the aqueous extracts.For flavonoid phenolic compounds the increase in the concentration is 2,1; 3.3 and 3.5 times higher (fig.2, 3).

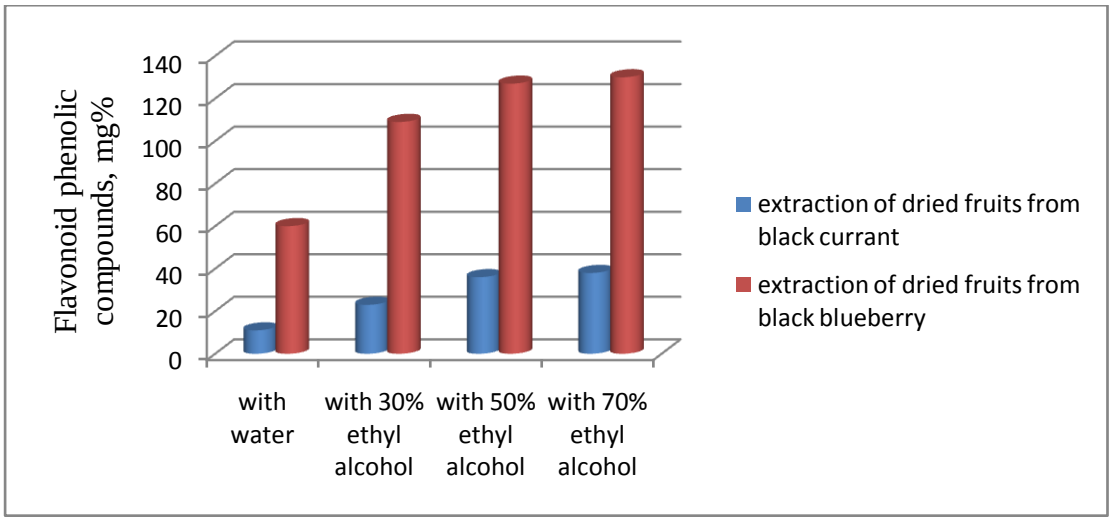


Fig.3. Effect of extractant concentration on flavonoid phenolic compounds content in extracts of dried fruitsblack blueberryand black currant

The antiradical activity of the extracts against the DPPH radical (Fig. 4) corroborates the literature data for the high anti-radical activity of blackcurrant and black blueberry due to the high content of phenolic compounds. The ethanol extract shows the highest activity against the DPPH radical.

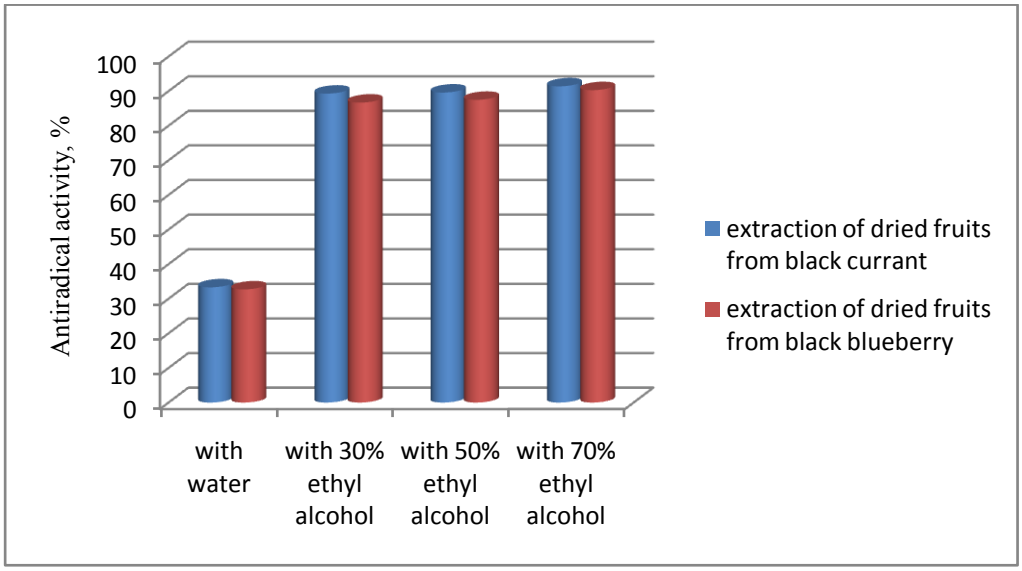


Fig. 2. General antioxidant activity by DPPH method for the effect of type and concentration of the extractant on antiradical activity

Not only phenolic substances and flavonoids but also vitamins C, A and E have antioxidant activity, but when heated, these antioxidants are partially destroyed and the antioxidant activity inherent in the phenolic complex remains.

The blackcurrant and black blueberry may also contain components other than the phenolic compounds, which also exhibit antiradical activity.

The highest DPPH inactivation value was reported in the extract obtained with 70% ethyl alcohol and the lowest in the extract with water - Fig. 4. After storage, the antiradical activity decreased between 54 and 72%, with the highest reduction observed in the extracts obtained with 20 and 90% ethanol. The smallest reduction was observed in the extracts with 70% ethanol.

Figure 3 shows the content of total phenolic compounds of the extracts obtained at a temperature of 35-80°C with 70% ethyl alcohol.

The content of total phenolic compounds in the extracts varies from 3.87% at 50 ° C to 4.78% at 65°C for black blueberries and from 0.40% at 50 ° C to 0.71% at 65 ° C for the currant. The technologically justified extraction temperature is 65$^{o}$C - Fig. 5.

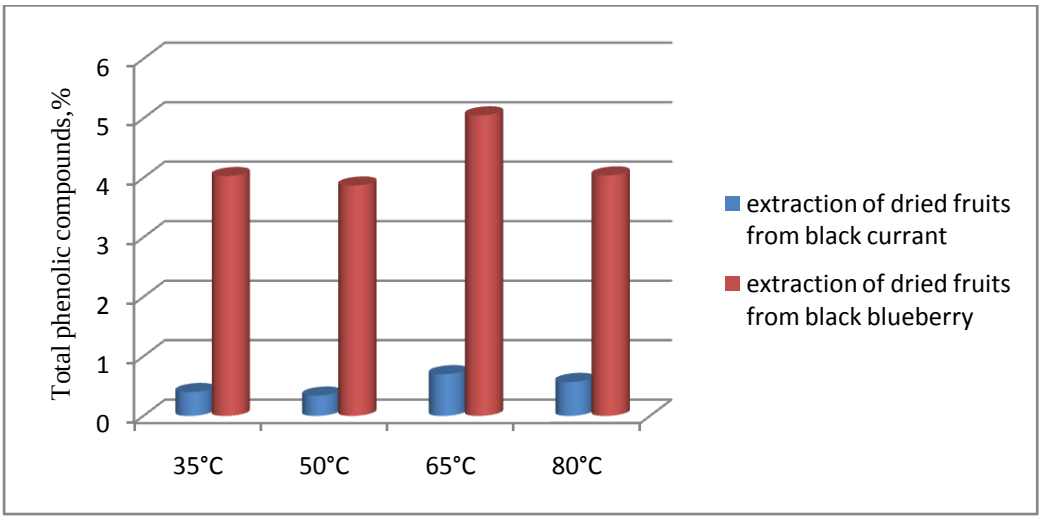


Fig. 5. Influence of the extraction temperature on the total phenolic compounds content in extracts of dried fruits black blueberry and black currant

The trend in the content of phenol carboxylic acids is similar to that of the flavonoid phenolic compoundsin extractsof dried fruits black blueberry and black currant. Favorable extraction temperature is 65°- 80°C (fig. 6 and fig. 7).

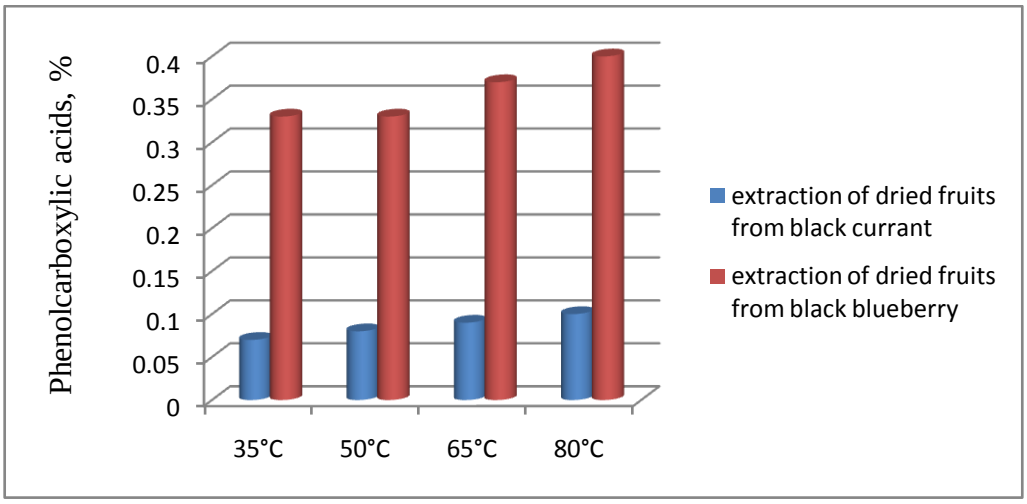


Fig. 6. Influence of the extraction temperature on phenolcarboxylic acids content in extracts of dried fruits blackblueberryand black currant

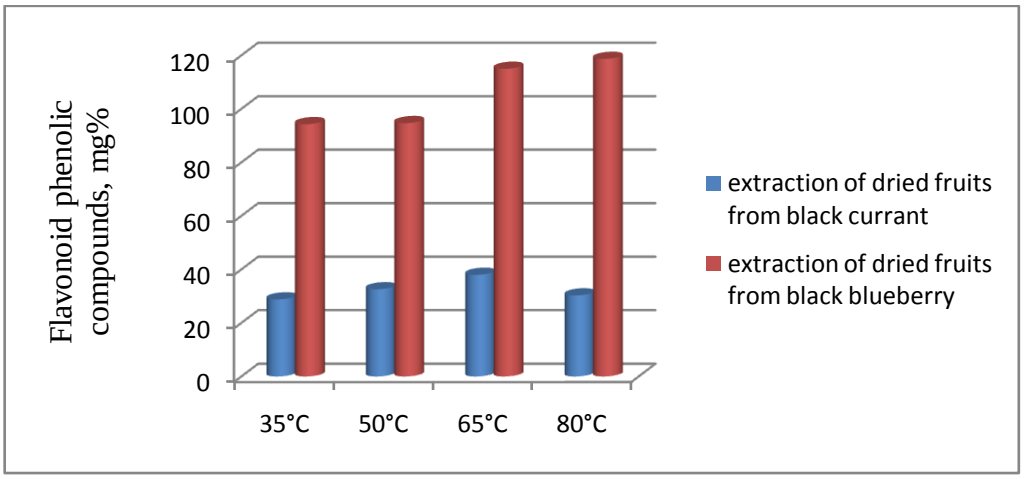


Fig. 7. Influence of the extraction temperature on flavonoid phenolic compounds content in extracts of dried fruits black blueberry and black currant

Figure 8 shows the indicators for the antiradical activity of the extracts obtained at a temperature of 35-80°C with 70% ethyl alcohol.

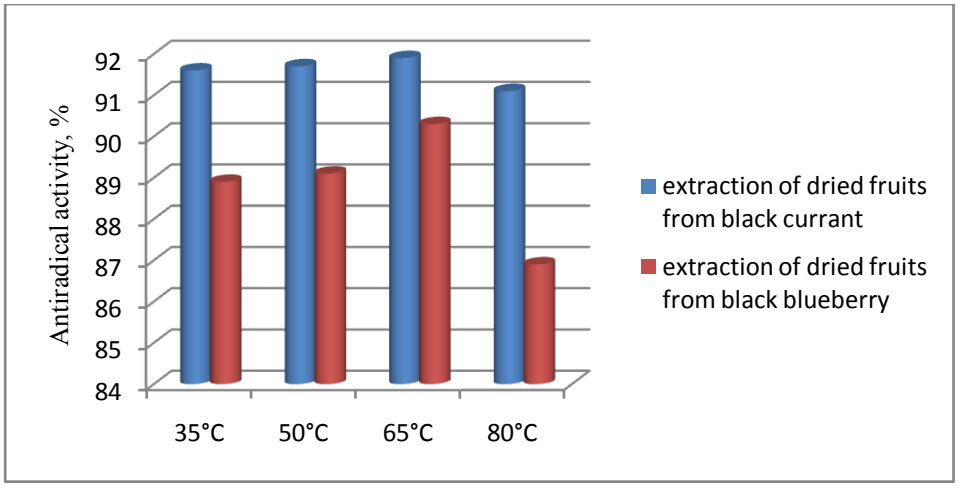


Fig. 8. Total antioxidant activity by DPPH method for the effect of extraction temperature on antiradical activity

Based on the results obtained for the effect of extraction temperature, the following conclusion can be drawn:

- The DPPH free radical capture ability is 65°C.

Figure 8 shows the results for the total phenolic compounds of the extracts obtained at a temperature of 65 ° C with 70% ethyl alcohol at different duration of the extraction process.

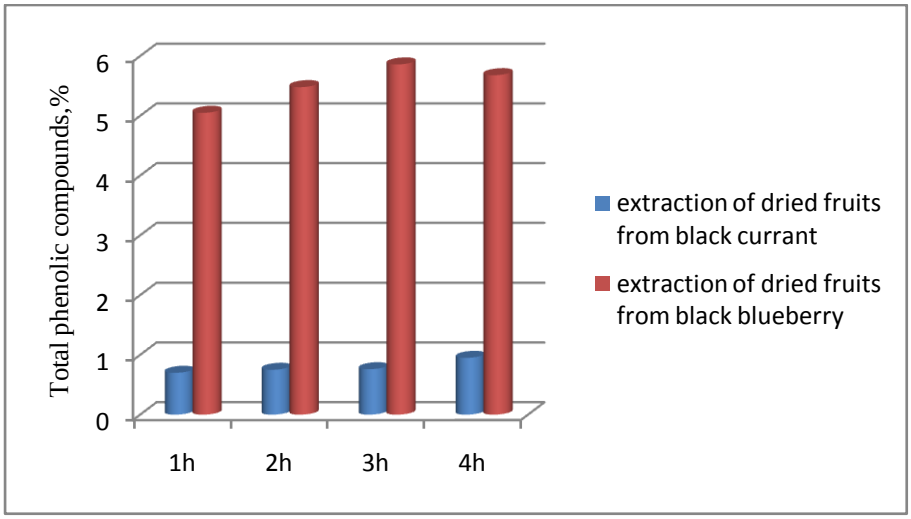


Fig. 9. Influence of the duration of extraction on the content of the total phenolic compounds in extracts of dried fruits black blueberry and black currant

The concentration of total phenolic compounds in black blueberry extracts varies with different time-temperature extraction regimes- fig. 9. With an extraction duration of 1 hour to 3 hours, it increases from 5.22% to 5.86% by 12.3%. By increasing the extraction time to 4 hours, the content of total phenolic compounds decreases by 3.1%

This dependence is different when extracting from the dried fruits of the black currant. The concentration increased steadily from 0.68% for 1 hour to 0.95% for 4 hours by 39.7% - Fig. 9.

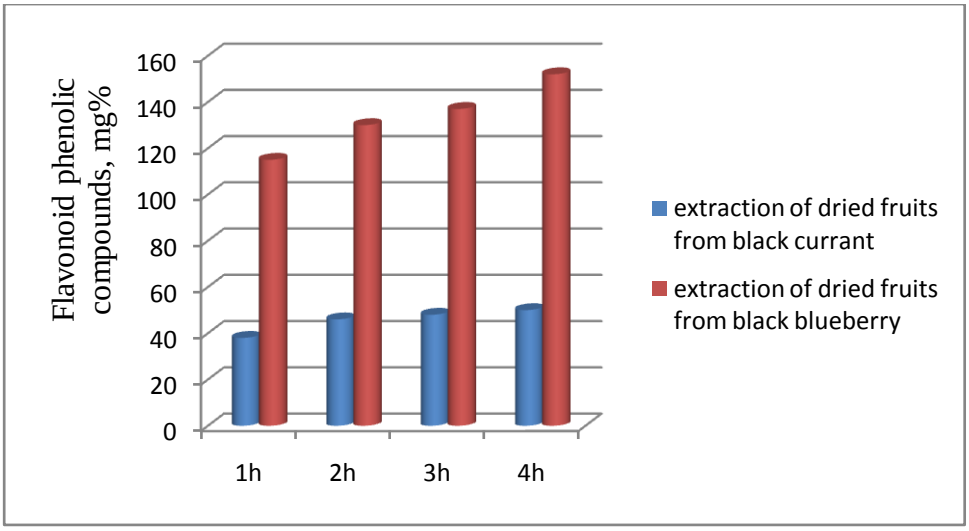


Fig. 10. Influence of the duration of extraction on the content of flavonoid phenolic compounds in extracts of dried fruits black blueberry and black currant

A similar tendency is observed in the flavonoid phenolic compounds. Their concentration ranges from 115 mg% to 152 mg% in black blueberry extracts. The increase is in the order of 32.2%. The content of the flavonoid phenolic compounds increased by 31.6% with an extraction time of 1 to 4 hours (fig.10).

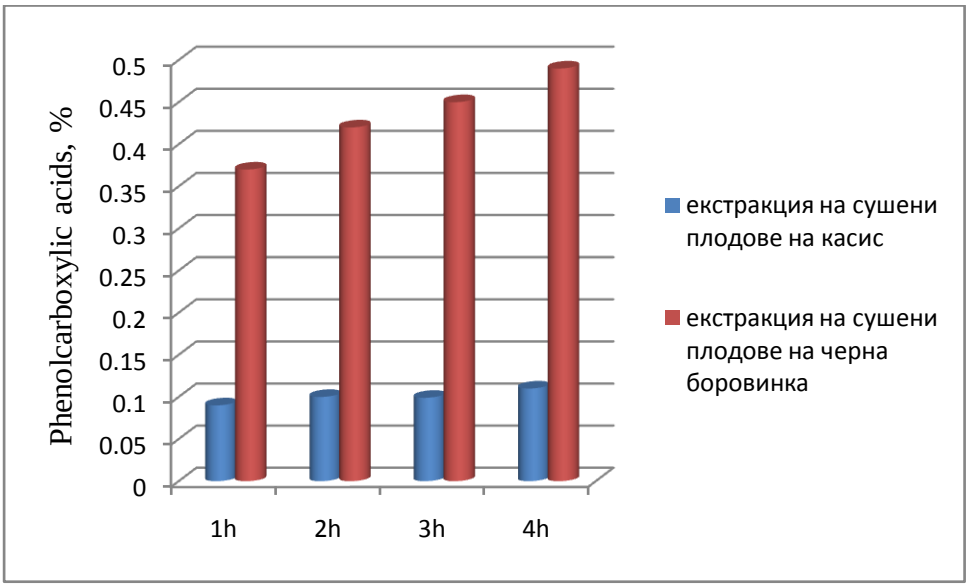


Fig. 11. Influence of duration of extraction on the phenolcarboxylic acids content in extracts of dried fruits black blueberry and black currant

The content of phenolcarboxylic acids extracted from the dried fruits of the black blueberry varies from 0.37% with an extraction duration of 1 hour to 0.49% with an extraction lasting 4 hours. The increase is 32.4%. The amount of phenolcarboxylic acids extracted from the dried fruit currant by extraction of different duration does not lead to a significant difference (fig. 11).

Figure 12 shows the results for the antiradical activity of the extracts obtained at a temperature of 65°C with 70% ethyl alcohol at different duration of the extraction process.

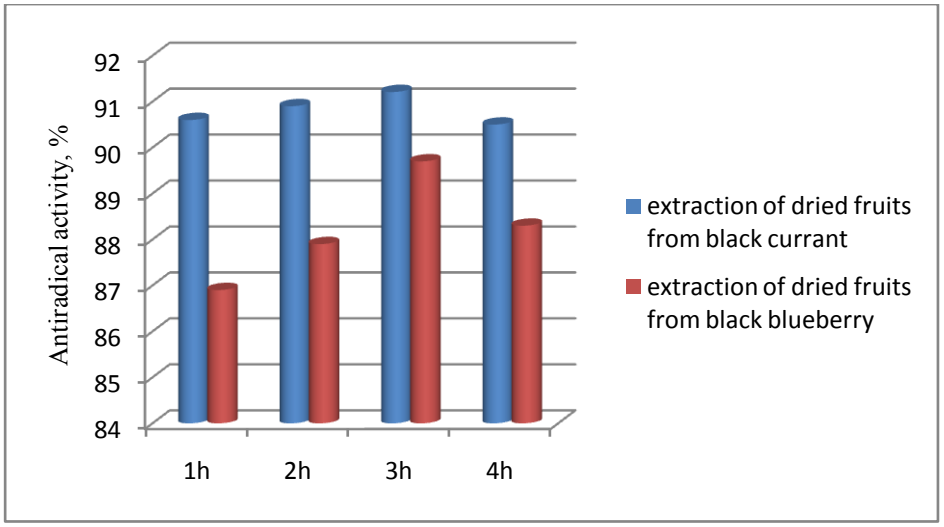


Fig. 12. Total antioxidant activity by DPPH method for the effect of extraction duration on antiradical activity

The content of total phenolic compounds in the extracts varied for different hydromodules from 5.86% for hydromodule 1:10 to 6.27% for hydromodule 1:20 and 7.34% for hydromodule 1:30 for black blueberry and 0.76, respectively. % for hydromodule 1:10 to 1.02% for hydromodule 1:30 for black currant. The technologically justified extraction hydromodule is 1:30 - Fig.13.

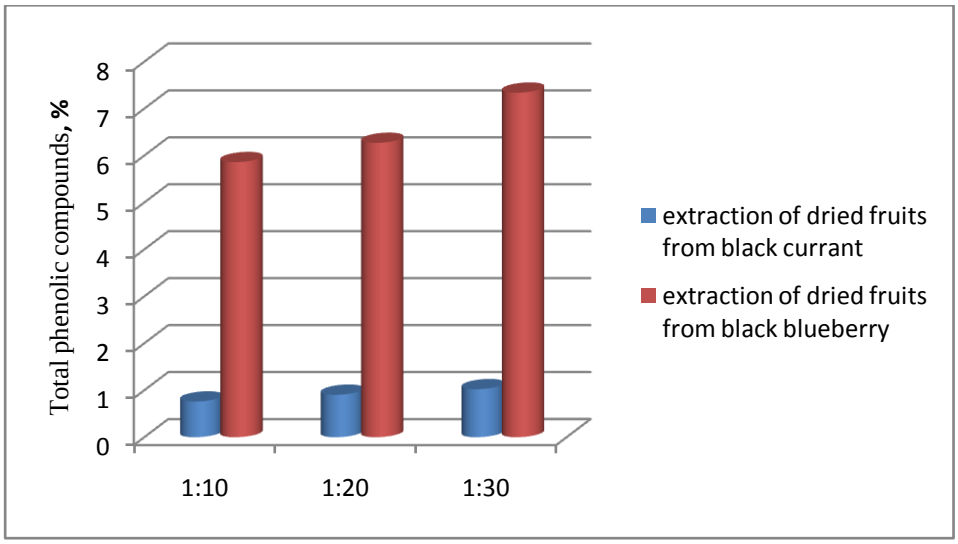


Fig. 13. Influence of the extraction hydromodul on the content of the total phenolic compounds in extracts of dried fruits black blueberry and black currant

The content of the flavonoid phenolic compounds in extracts of dried fruits black currant increased by 31.6% with an extraction time of 1 to 4 hours (fig.14).

A similar tendency is observed in the flavonoid phenolic compounds in extracts of dried fruits black blueberry. Their concentrations ranged from 137 mg%, 176 mg% to 194 mg%, respectively, for hydromodule 1:10, 1:20 to 1:30. The increase is in the order of 28.5% and 44.8% relative to the hydro modul 1:10 (fig. 14).

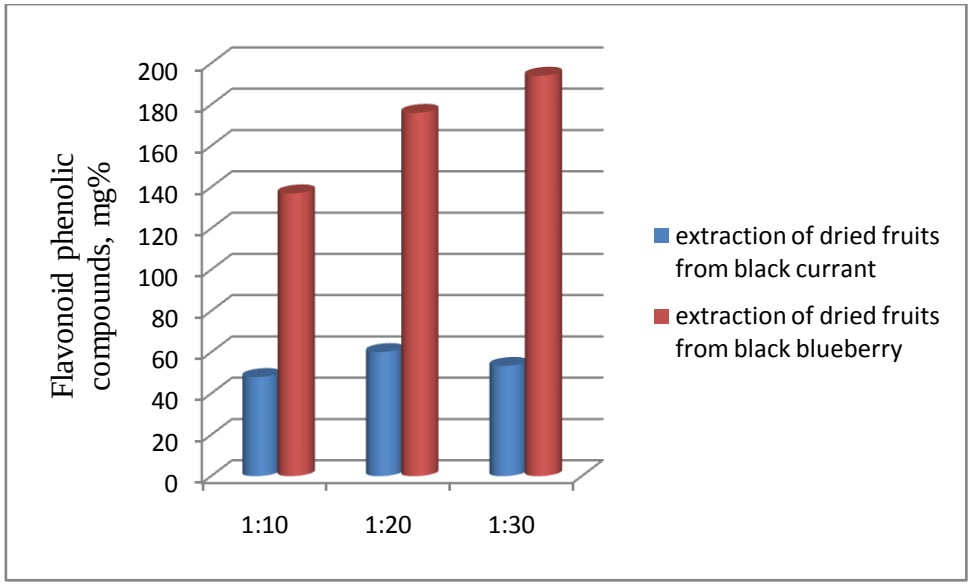


Fig. 14. Influence of the duration of extraction on the content of flavonoid phenolic compounds in extracts of dried fruits black blueberry and black currant

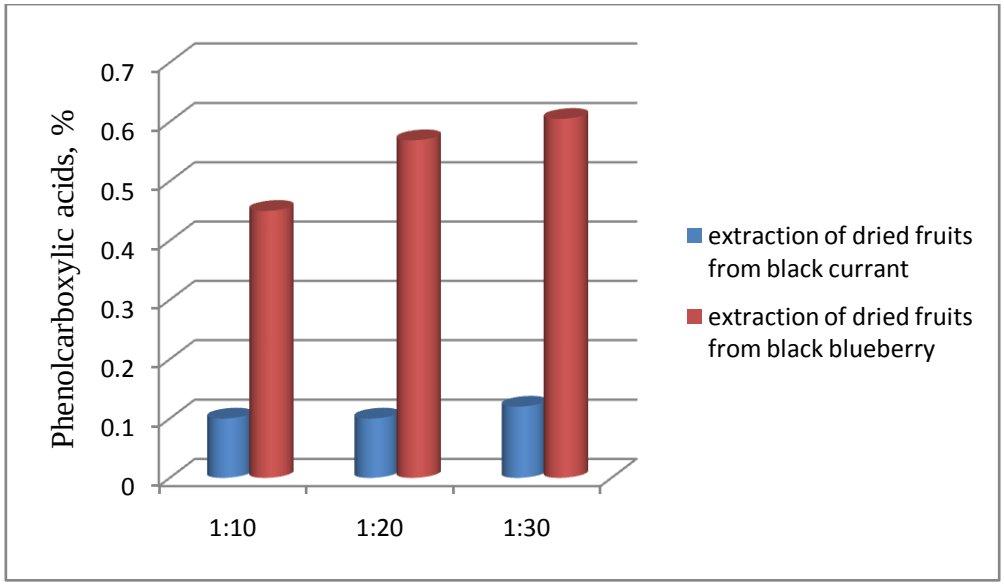


Fig. 15. Influence of duration of extraction on the phenolcarboxylic acids content in extracts of dried fruits black blueberry and black currant

The phenolic carboxylic acids content extracted from the dried black blueberry fruits ranged from 0.45% with hydromodule 1:10 to 0.61% with hydromodule 1:30. The increase is by 35.5%. The amount of phenolcarboxylic acids extracted from the dried fruit currant by extraction of different duration does not lead to a significant difference (fig.15).

In Fig. 16 shows the variation of the antiradical activity of black blueberry and black currant extracts depending on the hydromodule.

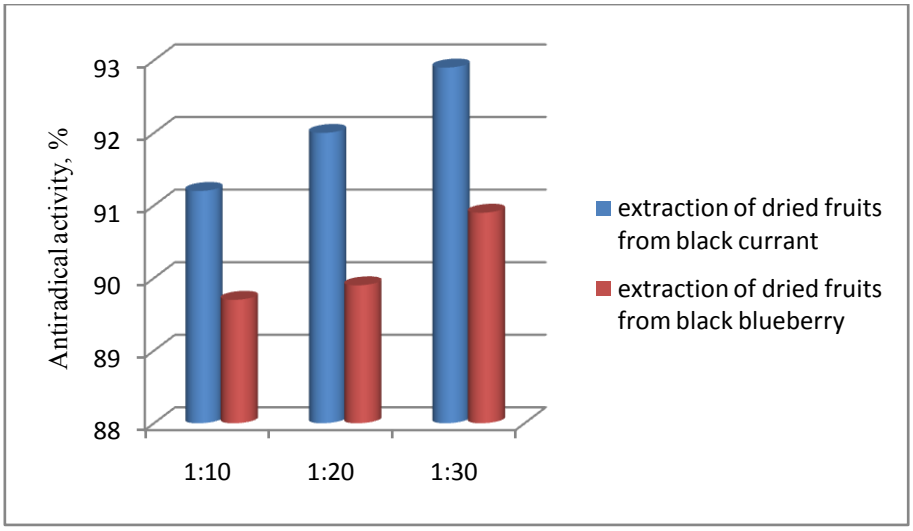


Fig. 7. Total antioxidant activity by DPPH method for the effect of hydromodule extraction on antiradical activity

The results obtained testify to this that by indicator restorative power the optimal hydromodule for carrying out the extraction is 1:30.According to the indicator, the extract exhibits the highest antiradical indicators for the given hydromodule.

Based on the results obtained for the influence of the extraction duration on the phenolic complex content of the dried fruits black currant and black blueberry extracts, the following conclusion can be drawn:

- The ability to capture DPPH free radicals is maximal at a technological extraction time of 3 hours.

## Conclusions

1. Technology for obtaining extracts with maximum content of common phenols has been developed.
2. The results obtained suggest that 70% ethyl alcohol, temperature 65 ° C, duration 3-4h and 1:30 hydromodule are technologically reasonable choices for obtaining extracts with a maximum content of common phenolic compounds.
3. It has been experimentally shown that by increasing the content of total phenolic compounds, the antiradical activity of the extracts increases.
4. The highest is the antiradical activity of the extracts with 70% ethyl alcohol, 65-80 ° C, extraction duration 3-4 hours and hydromodule 1:30.

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