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THE INFLUENCE OF PROCESSING ON ACTIVE - BIOLOGICALLY COMPOUNDS OF SOME BERRIES – A REVIEW

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Abstract

Berries are forest fruit characterized by rich content on active - biologically compounds (phyto-hormones, plant pigments - carotenoids, flavonoids and indole quinone pigments etc., metabolic products - derivatives of carbohydrates, lipids, proteins, glycosides, lignin, tannins, essential oils, resins, balsams, alkaloids, antibiotics and other fitoncide substances). This article aims to present the results of several studies regarding the determination of the influence of processing on active - biologically substances of eco-berries. In preparing this article, a review of the state of the art literature has been done and based on it a synthesis of the research results obtained by specialists will be presented. In general, the transformation of fresh berries in food products (juice, natural syrups etc.) is done through a specific technology which consists of the concentration of active - biologically substances from fruit and removing a significant amount of water. Active - biologically substances existing in raw fruit, consisting of vitamins, minerals, enzymes, hormones etc. remain in a big proportion in juices, after cold processing. Absence of thermal processing of fruit protects many nutrients and catalytic compounds which should be finding also in final juices. Berries processed at 100^0C, for up to 20 minutes, retains important amount of active - biological compounds, then their bioactivity decreased significantly with the time. Berry juices with pulp contain important components of the raw fruit and maintain good flavour and aroma of raw material.

Key words*: berries, active - biologically compounds, cold processing, juice, natural syrups.*

INTRODUCTION

Natural products made from berries, cold pressed, supplements are complex in terms of active - biologically compounds (phyto-hormones, plantpigments - carotenoids, flavonoids and indole quinine pigments etc., metabolic products - derivatives carbohydrates, lipids, proteins, glycosides, lignin, tannins, essential oils, resins, balsams, alkaloids, antibiotics and other substances).

Transforming fresh berries in various products, in this case the juice, natural syrups that is through a specific technology which consists of the concentration of biologically - active fruit and removing a significant amount of water.

The main goal in the production of berries juices is extracting as many potentially biologically - active components of the feed stock, such as: vitamin C, total phenolics, anthocyanins, carotenoids and other antioxidants. The main source of antioxidants is fresh fruit, especially berries and vegetables, but their consumption does not provide even half of the body's biological needs. Thus it is possible to compensate for this deficiency by consuming biological fruit juices.

MATERIALS AND METHODS

In preparing this literature review, the merit of the work is to synthesize and assemble of research results obtained in this field by researches. This paper is a review of research regarding the influence of processing on active - biologically compounds of some berries.

Juices which have a very high level of active - biologically compounds that are: sea buckthorn *(Hippophae rhamnoides)*, black berries *(Ribes nigrum)* and blue berry (*Vaccinium myrtillus)*, which contains, first, a large amount of vitamin C (Казаков А. В., 2009).

Preserving specific natural flavour of fruit in hand is another important aspect that gives

sensory qualities of juices and enhances their quality. Therefore, it attaches importance to fresh fruit hand ling from harvesting to processing.

Harvesting the fruit is the first step to obtain juices and syrups technological nature, but paramount importance. Fruit juices or syrups for harvested fully ripe but not too late to prevent degradation of quality and quantity. This period is influenced by the area and the local weather conditions. After harvesting, fresh fruits are stored for not more than 12 hours, as it can begin the process of natural fermentation, which degrades the physic-chemical and sensory qualities of the products.

In practice, appropriate methods should be selected for fruit harvesting and cold processing, so as to maintain a favourable ratio between the price of fruit and final price for products from berries on the open market.

RESULTS AND DISCUSSIONS

1. The influence of processing on the antioxidant activity of berries

A relevant study on antioxidant activity of bioactive compounds from berries was made by a team of researchers led by Ana Slatner, Slovakia (Slatner Ana, Jerneja J., Franci S., Robert V. and Polona J., 2012). In this research were determined the antioxidant activity in vitro and in vivo fruit juices containing large amounts of phenols. The juice was extracted from 5 species of berries in several locations in Slovakia: mountain cranberry, blue berry crop, black berry, elderberry and aronia. Types of phenols (anthocyanins, flavonols, flavones) were determined by HPLC method.

The antioxidant activity in vitro was determined by the method of DPPH free radical scavenging and in vivo using Saccharomyces cerevisiae. The largest number of phenols was found in cranberry juice.

The greatest power in vitro antioxidant found in black berry (Slatner A., Jerneja J., Franci S., Robert V. and Polona J., 2012).

The results show significant differences in antioxidant activity in vivo and in vitro berry juices. The key factor determining the antioxidant activity was the ratio of compounds. It was found a high content of anthocyanins and flavonols, low concentration of the hydroxyl acids, which resulted in a lower intracellular oxidation. Intracellular oxidation increased with higher consumption hidroxicinamic acids and a lower intake of anthocyanins in cells (Slatner A., et. al., 2012).

Their concentration is usually higher in the epidermis and sub-dermal tissue and lower central part of the fruit (Prior R.L.,et. al., 1998).

In the group of the hydroxyl acids were identified three compounds: chlorogenic acid - determined in all analysed juices, crypto-clorogenic acid detected only in blue berry juice and caffeic acid in black berry juice (Milivojevic J., et. al.2012).

A group of flavonoids is characterized by phenolic diversity; were identified 20 different compounds. The greatest diversity of flavonols was found in black berry juice, but the concentration of individual compounds was low. A high concentration of anthocyanins was found in aronia, then blue berries, black berry and then the shock (Benvenuti S., et. al., 2004).

The anthocyanins are between 25 and 92% of analysed phenolsin berries juice (Moyer R. A., et. al., 2002). Due to the huge antioxidant activity, black berry ensuring of human balance by effective action of numerous compounds found in the product (Suryakumar G., Gupta A., 2011).

Sea buckthorn fruits were harvested from a higher altitude presents a more intense colour and are rich in biologically - active compounds, showing a stronger antioxidant activity. (Korekar G., et al, 2014).

Another study confirmed a smaller loss of vitamin C during pasteurization and concentration of black berry juice against sea buckthorn juice (Lydia P., 2012).

The antioxidant activity of anthocyanin is associated with the biological properties of berries (blue berries and black berries).

The anthocyanins helps neutralize free radicals which are unstable molecules and are responsible for the development of many degenerative diseases (Deividas B., et. al., 2009).

The antioxidant activity of phenols and anthocyanins time is from 4.18 to 5.27 mmol/100g of product. Between phenols and anthocyanins content on the one hand and on the other antioxidant activity are closely connected (Giovanelli G., Buratti S., 2009).

2. Influence of processing in preserving biological properties of berry juices.

In a series of studies (Avila A. P., 2012) were tested different techniques of processing berries cold and hot. Also, were made comparisons between the antioxidant activities of blue berry juice, obtained in different thermal conditions. Juice after pressing warming caused an increase in antioxidant activity. The study was done on three samples of berries pressed at: 22 ^{0}C, 75 ^{0}C and 43 ^{0}C. *The results* confirmed the most powerful antioxidant in blue berries pressed at 75 ^{0}C.

Purpose of the studies was carried out by means of high hydrostatic pressure to 400 MP for 10 minutes, 20 minutes and 30 minutes. The results were within the juice obtained by hot pressing with the highest antioxidant power, followed by juice pressed at 43 ^{0}C, then finally pressed juice at 22 ^{0}C. Juice samples pressed at 75 ^{0}C gave the highest values of anthocyanin, total phenolics and antioxidant capacity.

There was a substantial difference in the level of anthocyanin and phenols in samples processed using high pressure equipment. The most effective from the point of view of the pressing antioxidant activity was pressed for 30 minutes. Juice pressed at 75 ^{0}C for 30 minutes was the most accepted by the consumer for that retained the best sensory qualities, then juice pressed at 43 ^{0}C.

Study on keeping sensory qualities of hot - pressed juices (75 ^{0}C) was made by another team of researchers, aiming to preserve the colour purple - blue very attractive to the consumer (Ju Z.Y., Howard L.R., 2003).

The team led by Buchert experienced pectolytic enzyme processing, adjusting the pressure and temperature in order to increase the extraction efficiency and enhancing the quality of the juice. Have the following steps: crushing fruit, partial maceration with pectolytic enzymes, adjustment of temperature and pressure during processing (Buchert J., 2005).

Gorinstein team has experimented influence of thermal processing times at 100 °C on the quality of berries. The juice extracted in three different solvents: water, acetone and hexane. The correlation between total phenols, flavonols and antioxidant activity was found to be higher in water, medium in acetone and low in hexane. By processing reduces biological substances - active. In this experiment, the fruit were thermally processed for 10, 20, 40 and 60 minutes at a temperature of 100 ^{0}C.

Only thermal processing for 10 and 20 minutes keep the content of bioactive compounds.

Thermal processing for 40 and 60 minutes show significant decreases in bioactivity fruit.

After 20 minutes of thermal processing content of bioactive products in berries juice was reduced at: polyphenols - 97.5%; flavonoids - 95.7%; flavonols - 98.7%; tannins - 91.1%; anthocyanins - 95.2%; ascorbic acid - 97.4%.

After 60 minutes, the loss of anthocyanin was: 60% polyphenols, 57.7% flavons, 49.5% flavonoids, 58,6% anthocyanins, 59% tannins.

Conclusion: thermally processed fruits less than 20 minutes demonstrate bioactivity (Gorinstein S., 2010).

3. The influence of technological process on biological - active substances

The technological process of obtaining berry juice begins with the selection of fresh fruit, fruits departing it, sick, other parts of the plant (leaves, stems). Then wash the fruit, which is important in removing dust and dirt. Wash the air tank (pressurized water). The best washing temperature is 400 ^{0}C (Zhang W., 1989).

Sea buckthorn juice can be prepared by conventional extraction techniques or by supercritical CO_2 extraction (Beveridge T., 1999)

Juice extraction by cold pressing technology is based on pressing for removal of the sheath fruits juice. The presses are made of canvas, trapped in the screw or strip. The best are the press fabric in the form of grid which gives a yield of 67%. Then the juice is allowed to settle and it is centrifuged at high speed.

The removal of oil leads to a product called soda pulp with the aqueous phase. If allowed to settle 1-2 days will be separated into 3 phases: a phase that floats a clear liquid in the middle and at the bottom a residue. Then go to pulp removal by filtration and centrifugation. The product obtained is the juice itself. Sea buckthorn juice may contain particles in suspension between 0.5 and 800 μm (micrometers) (Knekt P. T., et. al., 1996).

An alternative method has been experimented by Heilschet team using frozen sea buckthorn. The process starts with flushing, thawing and grinding in a mill of the fruit. Cold fruits are

passed through a system of sieve from 2 mm to 0.8 mm. Last sieve retains the seed and skin from which is extract oil. The remaining sheaths are heated to 50 - 55 ^{0}C and mixed with crystalline sugar. Allow1-3 hours and then are centrifuged. The slurry is treated with a proteolytic enzyme for 46 hours at 55 ^{0}C and then heated to 95 ^{0}C, followed by centrifugation. The obtained juice can be used for the preparation of several beverages.

CONCLUSIONS

The largest amount of phenols of berries is mountain blue berries (*Vaccinium myrtillus*), followed by fruits of blackberry (*Ribes nigri*).
The largest amount of ascorbic acid is in black berries and then followed by blue berry and sea buckthorn. There is a relationship between the content of anthocyanin and other phenolic constituents, on the one hand, and antioxidant power, on the other hand. The high content of anthocyanin and low of flavanols and hidroxicinamic acids caused an intracellular oxidation lower than the high level of hidroxicinamic acids and low levels of anthocyanins (Slatner A., et. al., 2012). Anthocyanin content is higher in fruit peel and lower in the central part of the fruit (Prior R. L., et. al., 1998). The anthocyanin are present in the plant cell vacuole. Buckthorn berries harvested from a higher altitude presents a more intense colour and richer content in bioactive substances, including total phenols were found to have a stronger antioxidant activity (Korekar G., et al, 2014). Heating juice, cold or hot pressed, increase antioxidant power. Research has shown that the most powerful antioxidant had cranberry juice obtained by hot pressing at 75 ^{0}C, compared with 43 ^{0}C and 22^{0}C. The samples pressed at this temperature had the highest values of anthocyanin, total phenolic and antioxidant activity. With regard to the effective time of the pressing was carried out in 30 minutes (Avila P., 2012). Processed fruits heat to100 ^{0}C, and the time up to 20 minutes retains bioactive compounds (Gorinstein S.,2010).

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