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INFLUENCE OF TECHNOLOGICAL PROCESSES ON NUTRITIONAL PARAMETERS IN NATURAL FRUIT JUICE (APPLES, RASPBERRIES, STRAWBERRIES AND CHERRIES)

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ABSTRACT

The production of juice as natural as possible, without adding water but only containing raw materials and fruits, is of great importance in nutrition, while on the other hand, to enrich the juice with the highest nutritional values as the final product in this study are used a mixture of fruits: apples, raspberries, strawberries and cherries. The impact of technological processes on the nutritional parameters of the natural juice produced with a mixture of fruits (apples, raspberries, strawberries and cherries), aims to follow the technological processes and their impact on the preservation of nutritional values. Research methods in this work juice production and analysis of some physical, chemical and nutritional parameters, for each type of fruit that was used, in the unpasteurized mixed juice and the final juice with pasteurization heat treatment at three different temperatures at 75° C,78°C and 85°C. The aforementioned physical, chemical and nutritional parameters that have been analyzed are: pH scale, density, total acidity, total dry matter, soluble dry matter °Brix, vitamin C and total anthocyanins. The purpose of this study is the adequate application of the technological process of juice production, in particular pasteurization to preserve as much as possible the nutritional values in the natural fruit-based juice as identical as possible to the raw materials from which it was produced. Although there are changes the same should be at a minimum.

Key words: fruit juice density, °Brix, pH, vitamin C, total anthocyanin.

INTRODUCTION

The production of fruit juices is a highly developed and promising industry worldwide. According to the European Association of Fruit Juices (AIJN) in the European Union every year about 11 billion and 500 million liters of fruit juice are produced (AIJN, 2014), while in Kosovo alone in 2015, statistics show that over 1.8 million euros of juices with 100% fruit content and over 1.7 million euros of fruit drinks with additional sweeteners were imported (Dogana e Kosovës, 2015). Today in the markets is offered a wide range of products of this group. Non-alcoholic beverages are produced from natural ingredients but rather various chemical substances are added to improve their propertie,s. Fruit juice is a product obtained by appropriate processing of fresh, healthy and ripe fruit or by processing of dense fruit puree or dense fruit juice, without additives or with the addition of sugar, organic acid. Fruit juice is also obtained by diluting the concentrated juice of the fruit with water, mineral water, dried water or soda-water. Fruit juice can be produced from one, two or more fruit cultivars *(*AIJN, 2014*).* Fruit juice is the product, which is obtained from fruits by mechanical process, which

can be fermented, but which is not fermented, which has the characteristic color, aroma and taste of the fruit, from which it is produced (Kongoli, et al., 2007). Despite the great capacities that Kosovo has to produce and export liquids, it is still not able to meet its own needs for this type of product (MBPZHR, 2016). Usually the group of manor fruits grown for consumption and further processing are classified as "manor fruits", none of these fruits really fit the botanical meaning. Cranberries and blueberries are false manor fruits because they are considered fruit with red berries due to derivation from the inferior ovary rather than the superior ovary, while blackberries, raspberries and strawberries are classified as aggregate fruits (Mitcham, 2007). Research shows that the consumption of manor fruits has shown to have a positive effect on health, such as aging, obesity, cardiovascular and neurodegenerative diseases. These desirable characteristics are often attributed to the high flavonoids, vitamins, minerals and fiber content in berries. Berries also contain high amounts of phenolics including flavonoids, tannins and hydrolyzable tannins. It is worth noting that phytochemicals have been found in berries and their synergistic effects bring a wide range of biological and physiological properties (Seeram, 2008).

MATERIAL AND METHODS

Material

The following raw materials were used for the production of natural mixed fruit juice: apple, raspberry, gooseberry and cherry. The technological process of production and final production was carried out from the raw materials, where special emphasis was placed on the influence of the pasteurization temperature on the researched parameters. The raw materials in the study were selected in combination with the sole purpose of enriching the final product with nutritional values characteristic of the production. The experimental production was carried out at the plant for the production of liquids in MOEA-Kosovo.

a. Apple b. Cherry c. Raspberry d. Strawberry

Figure 1. Raw materials for juice production

Methods

As experimental methods for analyzing raw materials and the final product, the following were used: Determination of soluble dry matter (with the Refractometric method, °Brix, ISO 2173:2003), determination of total dry matter (Gravimetric determination), determination of total acidity (titrimetry, ISO 750:1998), determination of the pH scale (digital pH meter, ISO 1842:1991), density determination with pycnometer (AOAC 945.06), determination of vitamin C (iodine titration method), determination of total anthocyanins (spectrophot ometric method AOAC 2005.02).

Technological chart of juice production

The technological process of juice production is realized with the following processes: inspection, washing, grinding, squeezing, filtering, waste removal, pulping, pasteurization and filling of the final natural juice. As a characteristic, we highlight that for squeezing apple juice, a continuous press in the form of rollers is used, the advantage of which is faster squeezing than with pressure press methods, the principle of which is that the ground mass passes through 15 rollers that rotate at high speed the same with air pressure 6-8 bar. The

same apple juice goes through the filtering process. While for small fruits (raspberries, cherries and cherries), after cleaning and inspection, the process of de-seeding and refining the fruits follows. The so-called corers are used whose principle is to remove the hard part (seeds, peel and cores), the same pass through 3 mm sieves where they then pass to the machine called Pulper. The part of the pulp extracted from the fruit is sent to the standardization tanks and mixed with the produced cloudy apple juice. The standardization of the juice from the 4 participating fruits together is done in the mixing tank with a powerful butterfly electric motor from the ratio of the fruits with: 13% raspberry pulp, 2% cherry pulp, 2% cherry pulp and 83% squeezed apple juice. The pasteurization of the juice is done in the so-called pasteurizer with two-layer tubes, in one tube the fruit juice passes, outside it passes the water that heats the juice up to the pasteurization temperature from the water vapor heat exchanger, where it controls the temperature of the juice through sensors. Pasteurization in the experiment was carried out at three temperatures of 75°, 78° and 85°C with a duration of 60 seconds. The filling or filling line is an automatic monobloc line, the bottles are preheated with steam until they reach a temperature of 60 degrees Celsius, they enter the washing machine, where they return to the back, are sprayed with water treated with reverse osmosis, return to the right side, enter the filling in the form of a carousel, after filling, the caps are pre-sterilized with steam at 160°C both from the front and back, the bottle is corked and enters the cooling tunnel with cooled water with a cold air compressor in the shape of a raindrop, and then the bottle after filling, capping, washing and cooling the packaging from the outside passes to the last part of drying the water on the outside of the packaging and labeling the packaging in the thermo tunnel until palletizing.

Figure 2. Juice production technology

Figure 3. Samples of final juice produced

RESULTS AND DISCUSSION

Table 1. Results obtained for physical and chemical parameters

Products / Parameters	pH	Total acidity (g/L)	Density (g/cm^3)
Apple juice	3.61±0,06	3.37±0,07	1.083±0,10
Raspberry pulp	3.33±0,06	15.70 ±0,07	1.080±0,10
Strawberry pulp	3.44±0,06	7.50 ±0,07	1.074±0,10
Cherry pulp	3.17±0,06	15.00±0,07	1.800±0,10
Unpasteurized juice mix.	3.46±0,08	4.20 ±0,07	1.047±0,10
Pasteurized juice in 75 °C	3.52±0,08	3.67±0,07	1.048±0,10
Pasteurized juice in 78 °C	3.54±0,08	3.90 ±0,07	1.048±0,10
Pasteurized juice in 85 °C	3.56±0,08	3.90 ±0,07	1.048±0,10

The results obtained in table 1, the pH scale in the raw materials fruits is different characteristic for the fruits, in the juice mixed before pasteurization the pH value was lower while the higher value resulted in the juice pasteurized at 85°C, the total acidity of overall resulted in different values in the raw materials, in the unpasteurized juice it resulted in a high value, while the lowest value was in the pasteurized juice at 75°C, the density in the raw materials had different but minimal values, in the juice mixed without pasteurization resulted in a lower value, while at the three pasteurization temperatures the same resulted in the same values.

Table 2. Results obtained for nutritional content

Products /Parameters	Total dry matters (%)	Soluble dry matters (°Brix)	Vitamin C (mg/L)	Total Anthocyanins (mg/L)
Apple juice	16.00 ±0,10	15.10 ±0,09	24.668 ±0,06	6.00±0,10
Raspberry pulp	12.00 ±0,10	10.38 ±0,09	21.144 ±0,06	45.70±0,10
Strawberry pulp	9.50 ±0,10	8.00±0,09	19.382 ±0,06	15.00±0,10
Cherry pulp	17.08 ±0,10	16.00 ±0,09	79.290 ±0,06	19.33±0,10
Unpasteurized juice mix.	13.00 ±0,10	11.80 ±0,10	40.526 ±0,06	29.59±0,10
Pasteurized juice in 75°C	13.04 ±0,10	12.00 ±0,10	40.526 ±0,06	24.27 ±0,10
Pasteurized juice in 78°C	13.04 ±0,10	12.00 ±0,10	39.684 ±0,06	23.06 ±0,10
Pasteurized juice in 85°C	13.07 ±0,10	12.05 ±0,10	30.242 ±0,06	20.86 ±0,10

The results obtained in table 2, the total dry matter resulted in different values in the raw materials, in the mixed unpasteurized liquid it resulted in a lower value while the liquid pasteurized at a temperature of 85°C resulted in a higher value. Soluble dry matter also resulted with small changes in the raw materials, in the unpasteurized juice the value was lower compared to the pasteurized juice, where the highest value was at the applied temperature of 85°C. Vitamin C resulted in a higher value in the unpasteurized mixed juice, while in the juice pasteurized at 85°C it resulted in a lower value, so pasteurization has affected the reduction of the value of vitamin C, but it was minimal. Total anthocyanins were also lower at 85°C compared to unpasteurized juice.

CONCLUSIONS

Based on the selection and control of raw materials, the technological process applied and the results obtained, we can conclude that the dry matter in the raw materials had different characteristic values for the same, while after the pasteurization process the change

of the same parameter was very small. Soluble dry matter °Brix in the raw materials was different while in the pasteurized liquid it was identical. The content of vitamin C in the raw materials resulted in higher values, while in the purified juice there was a loss of vitamin C. Total anthocyanins in the analyzed raw materials resulted in higher values, while in the pasteurized juice the values were lower. Final conclusion: although the pasteurization process had an impact on the reduction of nutritional values, the final product as a result of mixing with different fruits was rich in the studied nutritional values. Recommendation: for the production of juices rich in nutritional value, it is recommended to mix different fruits.

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