UDC: 663.813.053.63:634.11
Professional paper

QUALITY AND SAFETY PARAMETERS BEFORE AND AFTER PASTEURIZATION OF APPLE JUICE

Namik DURMISHI[1]*, Janina PELAJ[2]

[1*]*University of Tetova, Faculty of Food Technology and Nutrition, Tetovo, R.N.Macedonia*
[2] *University for Business and Technology, Faculty of Food Science and Biotechnology, Pristina*
[*]*Corresponding Author: e-mail: namik.durmishi@unite.edu.mk*

Abstract

The research was carried out in September (2023) on the premises of the "Kosovo Agricultural Institute" in the city of Peja. The purpose of this research was to show the influence of pasteurization on the physical, chemical, and organoleptic characteristics of apple juice. During the study, several analyses of the physical, chemical, and sensory parameters of apple juice were
carried out. The parameters that have been realized include: °Brix value, Total acidity, Vitamin C, pH and SO2, sensory parameters:
aroma, color, taste, and clarity-turbidity. The purpose of this research is the importance of knowing the influence of some parameters on apple juice before and after pasteurization. Pasteurization of apple juice is of great importance due to various factors related to food
safety, storage, and consumer health. In the analysis of sensory parameters, the juice before pasteurization had a milder and lighter
aroma, had a lighter yellow color, tasted less sweet, less fresh, and had low acidity. Clarity was present but contained some turbidity. In the analysis of sensory parameters, the evaluation of physicochemical parameters and sensory parameters should contribute to valuable knowledge on the physicochemical transformations caused by pasteurization in apple juice. Understanding these changes is very important for maintaining product quality and ensuring customer satisfaction. The study provides a basis for optimizing pasteurization processes to minimize unwanted changes in juice characteristics.

Keywords: Apple juice, pasteurization, physical, chemical parameters, sensory parameters, pH, °Brix, SO_2

1. Introduction

Apple juice is a beverage widely recognized for its refreshing taste and one of the most consumed fruit juices worldwide. The quality of apple juice is affected by various factors, and a critical aspect is the processing method. Among the various processing techniques, pasteurization stands out as a common method used to increase shelf life and ensure microbial safety without compromising the sensory attributes of the liquid. Pasteurization of apple juice is of great importance due to various factors related to food safety, storage, and consumer health. This study deals with the physical, and chemical parameters and organoleptic properties of apple juice, aiming to clarify the changes that occur before and after pasteurization. Apples are a deciduous variety of fruit that grows on trees in mostly temperate regions around the world. Apple is one of the most popular and healthy fruits. The apple fruit was originally from Central Asia and over time spread throughout the world. Apple has many health benefits as it contains vitamins and minerals in it. It's a good proverb that says an apple a day keeps the doctor away (World Atlas, n.d.). The product can also be obtained with concentrated fruit juice, through the addition of water extracted from the juice at the moment of concentration. With the addition of water, the juice has the appropriate chemical, microbiological, and sensory characteristics. Also, the main qualities of the juice are guaranteed by re-giving the aroma with aromatic substances, which are recovered at the moment of concentration of the same fruit juice or fruit juices of the same type (Journal of Agricultural, Food and Environmental Sciences (JAFES). The production of apple juice involves several processes such as preparation, grinding or crushing, pressing,

https://doi.org/10.62792/ut.jftn.v7.i13-14.p2697

clarification, filtration, pasteurization, concentration, the addition of food additives, and packaging. (Golding, 2012). Apple juice is a mixture of sugars (mainly fructose, glucose, and sucrose), oligosaccharides, and polysaccharides, together with malic acids, tannins, amides and other nitrogen compounds, vitamin C, pectin, minerals, and a diverse range of esters, that give the juice a typical apple flavor. (Pina-Pérez). Apple juice is a source of natural polyphenols that help the body fight disease. It is also rich in boron and other nutrients. (Ultrasound for Fruit Juice Preservation, 2018). It is a complex colloidal system where the fine particles of the pulp are dispersed in the serum macro-molecules (pectin, proteins, etc.) dissolved colloidally in a true solution of low molecular weight components (sugars, organic acids, etc.). (Mihalev,2004)

2. Materials and Methods

This research was carried out during September (2023) on the premises of the "Kosovo Agricultural Institute" in the city of Peja. In this Institute, namely in the Food Quality Control Laboratory, several analyses of the physicochemical and sensory parameters of apple juice have been carried out. The parameters that have been realized include: °Brix Value (Sugar), Total Acidity, Vitamin C, pH, and SO_2, as well as some of the sensory parameters: aroma, color, taste, and clarity-turbidity. The purpose of the research for this case study is the importance of knowing the influence of some parameters of apple juice before and after pasteurization. The samples were taken at X company for the processing and production of various fruit juices. Two types of apple juice samples were provided, one before pasteurization (filled before treatment directly from the tank), and the other sample after pasteurization of the juice. Both samples have been sent/accepted to the Institute to continue further with their complete analysis, and the process of analyzing the samples has begun. The samples, for reasons of accuracy and safety, were repeated and tested twice during the analysis for each parameter.

3. Results and Discussion

3.1 Results of sensory parameters analyses:

Characteristics of the aroma of samples X1 and X2

Sample X1 has a pronounced and clean aroma that reflects the natural aroma of apples, a sweet and very fresh aroma, which contributes to the perception of this juice as a good and quite refreshing drink. The X2 sample, compared to the X1 sample, has a softer, lighter and less refreshing scent.

Color characteristics of samples X1 and X2

The X1 sample has a golden and bold hue making the liquid a more appealing drink choice. The X2 sample has a slightly lighter shade which leans more towards the light-yellow color compared to the X1 sample.

Taste characteristics of samples X1 and X2

Sample X1 is characterized by a combination of sweet, sour and refreshing taste. The level of sweetness is present enough to make the juice palatable for consumption. The presence of freshness is typical of apple juice, while sourness and acidity are less present but complete the final taste of apple juice. Sample X2 tastes less sweet and is less fresh, while the acidity and sourness are almost no noticeable at all.

Turbidity characteristics of samples X1 and X2

Apple juice sample X1 is completely clear and has no turbidity at all, while in contrast, apple juice sample X2 is almost clear but contains little turbidity.

3.2 Results of physical and chemical analyses

Figure 1. Vitamin C analysis

Figure 2. pH of sample X_1, X_2

Figure 3. Total Acidity

Figure 3. SO_2

Figure 3. °Brix

Table 1. Physical and chemical results in sample X1

Apple juice before pasteurization No. X₁			
The analyzed parameter	***The measure***	***Result Sample X₁***	***Method***
°Brix value	*%*	*7.8±0.02*	*AOAC950.30*
Total acidity	*10ml/0.1N NaOH/100g*	*5.0±0.1*	*AOAC 942.15*
pH	*pH-value*	*4.02±0.1*	*EN 1132:1994*
Vitamin C	*mg/100g*	*17.6±0.01*	*Titrimetri(Jod-J2)*
SO_2	*mg/L*	*0.64±0.1*	*AOAC 950.30*

Table 2. Physical and chemical results in sample X2

Pasteurized apple juice No. X2			
The analyzed parameter	***The measure***	***Result Sample X_1***	***Method***
°Brix value	*%*	*8.0±0.02*	*AOAC 950.30*
Total acidity	*10ml/0.1N NaOH/100g*	*4.8±0.1*	*AOAC 942.15*
pH	*pH*	*4.32±0.1*	*EN 1132:1994*
Vitamin C	*mg/100g*	*3.52±0.01*	*Titrimetri(Jod-J2)*
SO_2	*mg/L*	*1.92±0.1*	*AOAC 950.30*

When analyzing the °Brix value in sample X_1, this resulted in a value of 8.0%, this result shows that the sample in comparison with the average values of the °Brix degree of other apple juices is a little lower, i.e. below average. While, during the analysis of the X_2 sample, this value resulted in 7.8%, this result which shows that the value is relatively smaller than the general average of the °Brix scale. Total acidity in juices, including apple juice, is a measure of total acid content and is expressed as % citric acid or malic acid. In the sample X_1, the total acidity was 5.0 g/L, while in the sample X_2 it was 4.8 g/L. The pH in apple juice usually ranges from 4.02 to about 4.32, but this depends on many different factors. When measuring the pH in both juice samples, sample X_1 resulted in 4.02, and this means that the juice is more acidic, while sample X_2 resulted in 4.32, where it can be seen that in the juice sample before treatment (X_2) the acidity is littler expressed. When analyzing the content of Vitamin C in both juice samples, sample X_1 resulted with a content of 3.52 mg/100g, while sample X_2 with 17.6 mg/100g. These results show that Vitamin C had a fairly high reduction after pasteurization of the juice, since this vitamin is sensitive to heat, the processing process and the pasteurization process used in the production of juices. All these factors affect the reduction of Vitamin C. SO_2 is widely used in the production of fruit juices such as apple juice. It serves various purposes, as a preservative, antioxidant and antimicrobial agent. In the context of apple juice, sulfur dioxide helps prevent browning, preserves color and inhibits the growth of microorganisms. During the analysis of SO_2 in the samples, sample X_1 resulted with a content of 1.92 mg/L SO_2, while sample X_2 with 0.64. From the results we notice that in this case sample X_1 is safer for consumption than sample X_2 due to the higher content of SO_2.

4. Conclusions

Pasteurization of apple juice is of great importance due to various factors related to food safety, storage, and consumer health. Some of the main reasons why pasteurization is essential for apple juice include: microbial safety, pathogen inactivation, extended shelf life, quality maintenance, and compliance with food regulations.

Unpasteurized and freshly squeezed apple juice may contain harmful microorganisms such as bacteria, mold, and yeast. Pasteurization before bottling helps to eliminate or significantly reduce these microorganisms, ensuring that the juice is safe for consumption. After initial

pasteurization, there is a risk of recontamination during processing, packaging, or even during distribution. After the pasteurization step, secondary pasteurization can act as an additional safety measure, reducing the microbial load and extending the shelf life of the product. Before pasteurization, raw apple juice may undergo quality degradation, such as leaching due to enzymatic reactions. Pasteurization helps preserve the natural color, flavor, and nutritional content of the juice. Pasteurization can contribute to preserving the sensory attributes and overall quality of the juice, ensuring that consumers receive a product that meets their expectations. Food safety regulations often require liquids to be pasteurized to ensure they meet specific microbiological standards before being placed on the market. Pasteurization may be necessary to comply with additional regulations and quality control measures, depending on specific industry requirements or regulatory authorities. In summary, the importance of pasteurization is great in the role of ensuring the quality, safety, and extended shelf life of apple juice. These measures are essential for both consumer health and the commercial viability of apple juice products on the market. The study shows that the juice before and after pasteurization has a difference in the results obtained, but they are minimal and by regulations. The juice studied is of high quality and safe.

References

[1] Reboli, E. (2020, November 12). What is Malic Acid? Uses, Benefits, & Types. Retrieved from Ingredi.com: https://ingredi.com/blog/what-is-malic-acid-uses-benefits-types/

[2] AGICO. (2023). Retrieved from Apple Juice Processing Plant: https://www.juicemakingmachine.com/complete-line/apple-juice.html;

[3] Amount of Vitamin C in Apple juice. (2023). Retrieved from Diet and Fitness today: http://www.dietandfitness today.com/vitamin-c-in-apple-juice.php;

[4] Raswant, L. (2023, March 15). 5 Facts on Ph Of Apple Juice : Types, Factors And Reasons. Retrieved from PhScales : https://phscales.com/phscale/ph-of-apple-juice/;

[5] The Editors of Encyclopædia Britannica. (2023, September 30). Sulfur dioxide. Retrieved from Britannica: https://www.britannica.com/science/sulfur-dioxide;

[6] Ultrasound for Fruit Juice Preservation. (2018). Retrieved from ScienceDirect: https://www.sciencedirect.com/topics/ agricultural-and-biological-sciences/apple-juice Van der Sluis et al., 2., & Alonso-Salces et al., 2. (n.d.).;

[7] Walls, T. (2023, September 8). 14 Facts About Apple Juice Concentrate. Retrieved from FACTS.NET:https://facts.net/lifestyle/food/14-facts-about-apple-juice-concentrate/;

[8] R.P. Bates J.R Morris P.G Crandall. (n.d.). Principles and practices of small - and medium - scale fruit juice processing.;

[9] M.C. Pina-Pérez, D. R. (n.d.). Using natural antimicrobials to enhance the safety and quality of fruit- and vegetable- based beverages. Retrieved from Science Direct: https://www.sciencedirect.com/science/article/ abs/ pii/ B97817 82 42 0347000165;

[10] Mihalev, K. S. (2004). Effect of mash maceration on the polyphenolic content.;

[11] Lindsey DeSoto, R. L. (2023, March 13). What Is Citric Acid? Retrieved from Verywellhealth: https://www.verywellhealth.com/what-is-citric-acid-7111742;

[12] Lea, A.G.H.,Van der Sluis et al. , 2002; Alonso-Salces et al., 2004. (1992). Flavor, color, and stability in fruit products: the effect of polyphenols.;

[13] Bastien Vallée Marcotte, Marie Verheyde, Sonia Pomerleau, Alain Doyen,Charles Couillard. (2022). Health Benefits of Apple Juice Consumption: A Review of Interventional Trials on Humans. Retrieved from PMC: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8879758/;

[14] Bevardi,M.,Petrović,M.,Markov,K. & Bošnir,J. (2018). How sulphur dioxide and storage temperature contribute to patulin degradation in homemade apple juice. Archives of Industrial Hygiene and Toxicology. Retrieved from https://doi.org/10.2478/aiht-2018-69-3097;

[15] Delta Sport. (2023). Mollët - përbërja kimike, përfitimet dhe dëmet në trup. Retrieved from Delta Sport: https://sq.deltaclassic4literacy.org/2509-apples-chemical-composition-benefits-and-harms-to-th.html;

[16] Curley, K. (n.d.). Juices That Contain Citric Acid. Retrieved from LIVESTRONG: https://www.livestrong.com/article/134508-juices-that-contain-citric-acid/

[17] Jacky. (2023, May). Colorscombo.com. Retrieved from What Color Is Apple Juice: https://colorscombo.com/what-color-is-apple-juice/

[18] Antioxidants Explained in Simple Terms. (2023, July 12). Retrieved from Healthline: https://www.healthline.com/nutrition/antioxidants-explained
[19] Jolicoeur, C. (2022). Acidity and pH of apple juice. Journal of Agricultural, Food and Environmental Sciences (JAFES). (n.d.).