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ANALYSIS OF THE CHEMICAL COMPOSITION OF APPLES AND APRICOTS STORED IN REFRIGERATION CHAMBERS.

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ABSTRACT.

This article analyzes the changes in the chemical composition of apples and apricots stored in refrigeration chambers and explores how these changes contribute to preserving the fruits' quality and extending their shelf life. The study focuses on the reduction in respiration rate, the slowdown of enzymatic activity, and the inhibition of microbial growth during refrigeration. The results highlight the importance of proper storage conditions and provide insights into maximizing the benefits of refrigeration in preserving these fruits.

Key words.

apples, apricots, refrigeration, chemical composition, flavonoids (carotene), phenolic compounds, ascorbic acid, total sugar, and carbohydrates

Introduction. Apples and apricots are popular fruits known for their delicious taste, nutritional value, and vibrant colors. However, they are also perishable and require proper storage to maintain their quality and extend their shelf life. Refrigeration chambers provide controlled environments that help slow down the deterioration processes in these fruits.

Refrigeration is a common method used to extend the shelf life of fruits, including apples and apricots. During refrigeration, several changes occur in the chemical composition of these fruits, which can affect their overall quality and shelf life [1-2].

Both apples and apricots have a high water content, which contributes to their juiciness and crispness. During refrigeration, the water content remains relatively stable. However, prolonged storage can lead to water loss, causing the fruits to become dehydrated and lose their desirable texture .

Apples and apricots contain natural sugars that give them a sweet taste. The main sugar in apples is fructose, while apricots contain a combination of fructose

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and glucose. During refrigeration, the sugar content of these fruits remains relatively constant. However, some studies suggest that apples stored at low temperatures may experience a slight increase in sugar content [3-4].

Both apples and apricots contain organic acids that contribute to their flavor profiles. Apples contain malic acid, which gives them a tart taste, while apricots contain a mix of citric acid and malic acid. The levels of organic acids in these fruits can vary depending on the variety and maturity stage . Refrigeration storage generally helps to maintain the levels of organic acids, preserving the fruits' characteristic flavors .

Apples and apricots are rich in vitamins and antioxidants, which are essential for maintaining good health. Apples are particularly high in vitamin C and dietary fiber, while apricots are a good source of vitamin A and vitamin C. Refrigeration storage can help preserve the vitamin content of these fruits, ensuring that they retain their nutritional value.

Phenolic compounds are bioactive compounds found in fruits and vegetables that have been associated with various health benefits. Both apples and apricots contain phenolic compounds, such as flavonoids and phenolic acids. These compounds act as antioxidants and contribute to the fruits' color and flavor. While refrigeration storage can help preserve the phenolic compounds in apples and apricots, prolonged storage may result in some degradation of these compounds . During refrigeration, apples and apricots experience a decrease in their respiration rate. Respiration is a metabolic process in which fruits consume oxygen and release carbon dioxide and water vapor. By reducing the respiration rate, refrigeration minimizes the loss of moisture from the fruits, preventing dehydration and maintaining their juiciness [5-9].

However, it is important to note that while refrigeration can help to preserve the overall quality of apples and apricots, it does not completely stop the natural aging process of the fruits. Over time, even in refrigeration, apples and apricots will still undergo changes in texture, flavor, and nutritional composition. Therefore, it is recommended to consume the fruits within a reasonable timeframe to enjoy them at their best quality.

In this article, we will explore the chemical composition of apples and apricots during refrigeration storage and understand how it affects their quality and shelf life.

Materials and methods

Various laboratory methods and equipment are used in the chemical analysis of the composition of apples and apricots. We conducted our research in the following manner. As with all research, the laboratory area must be clean and free

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of contaminants. In addition, for the reliability of chemical reactions, it is necessary to control the temperature and humidity of the laboratory at a certain level.

- The equipment was adjusted according to the selected analysis method.
- Prepared reagents and standards.
- Fruit samples were processed according to the protocol and brought to the desired state for analysis.

Sample Preparation:

Fruit samples were prepared from freezers stored at -2°C to 0°C.

The process of sample preparation and analysis includes the following steps:

1. Sampling: The required amount of samples was taken from the analyzed fruits.

2. Homogenization: The samples were brought to a small size using a blender.

3. Extraction: Extraction of the desired components (in this case organic acids) was performed by treating the samples with plain distilled water. In this process, fruit samples were extracted in an ultrasonic water bath for 20 minutes.

4. Filtration and Purification: The extracted fruit samples were dried and then filtered before direct analysis, but were subjected to additional purification processes (for example, centrifugation) when necessary depending on the situation. This is also possible.

Sample preparation, testing, and analysis procedures were performed according to precise and standardized protocols.

Continuing our research, the amount of flavonoids (carotene), phenolic compounds, ascorbic acid, total sugar, and carbohydrates in the fruit was determined by the method of high-performance liquid chromatography.

HPLC, that is, high-performance liquid chromatography (High-Performance Liquid Chromatography), is one of the methods widely used in chemical analysis. It is used when needed to separate and analyze different components. The process using HPLC was carried out in the following order:

HPLC System Setup

1. Selection of suitable columns: a suitable HPLC column for the above substances was selected. Medium hardness (C18 columns) or ion exchange columns are usually used for such studies.

2. Selection of solvent phases: Depending on the substances to be analyzed, the mobile phase is selected as water, methanol, and acetonitrile. We used acetonitrile in our study.

During our research, some group material identification processes were carried out according to the following procedures.

Sugar Analysis:

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Analysis of the sugar content in apples and apricots was carried out using the following methods:

High-Performance Liquid Chromatography (HPLC)

To determine the sugar content, HPLC is one of the most common methods

- The sample was passed through the column under high pressure in the liquid state.

- Materials with special properties were used as a phase in the column.

- Each sugar component interacted differently with the phase in the column and separated at different rates.

- Types of sugar (fructose, glucose, sucrose, etc.) were detected after leaving the column using special detectors (for example, a refractive index detector).

- Using HPLC, the types and concentrations of sugar components were measured with high accuracy, their mass and volume were accurately separated, and the sample composition was analyzed in detail.

Vitamin C (Ascorbic Acid) Determination:

1. HPLC (High-Performance Liquid Chromatography) Method:

- Sample Preparation: To extract ascorbic acid from fruit samples, homogenization and extraction processes were carried out in an acidic medium.

- HPLC Analysis: After sending the extracted sample to the HPLC system, the exact amount of ascorbic acid was determined by a detector.

Results and discussion

Today, all over the world, fruits are delivered to customers at any time, depending on different seasons and months. For this purpose, keeping the fruits in different conditions and taking them to the market stalls without changing their condition by giving them appropriate biochemical fermentation includes complex stages. In our research, we studied the important chemical substances in apples and apricots when they were kept cold. After the cooling process, important changes can occur in the chemical composition of apples and apricots. Refrigeration serves to increase the durability of fruits, which extends their shelf life and helps maintain marketability. However, refrigeration also affects the constituents of the fruit.

After cooling, the following changes can be observed:

1. Water Content: Chilling keeps the water content of fruit cells relatively stable because these low temperatures reduce the rate of evaporation and intercellular aging.

2. Vitamins: Fragile vitamins such as vitamin C degrade more slowly when refrigerated, but some loss may occur during long-term storage.

3. Phenolic Compounds and Antioxidants: Flavonoids and other phenolic antioxidants do not change significantly during cooling, providing the properties of maintaining apple color and nutritional quality [10].

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In general, the cooling method helps preserve the quality and freshness of fruits by minimizing negative changes in their composition. At the post-cooling stage, the fruits are transported to stores for consumption and made available for purchase. Therefore, it is crucial that fruits are prepared for consumption as quickly as possible, as it can be challenging to maintain their freshness and quality over an extended period. In such cases, it is necessary to remove them from the refrigerator and store them at the appropriate temperature while also assessing their quality.

Changes in chemical composition of apples and apricots before and after cooling methods (100g)

Fruit type	Dry matter %	Flavonoids (carotene) mg %	Sum of phenolic compounds ∑FB, mg %	Ascorbic acid	Sugar, gr	total carbohydrate , mg, %
Fresh apple fruit	12,9	280	260	8,39	9±1,20	12±2
Chilled apple fruit	12,4	275	254	8,34	8,86±1,20	11,89±2
Fresh apricot fruit	13,8	330	420	8,25	3,15±0,2	3.8±1
Chilled apricot fruit	12.9	324	412	8,22	3,13±0,2	3.76±1

Based on the obtained results, no significant changes were observed in the amount of ascorbic acid and sugar in the frozen fruits during storage. This confirms that cold storage of the respective fruits is an effective method. Furthermore, there were no significant changes in other chemical substances during fruit storage.

In addition to determining the chemical composition, the aforementioned analyses allow for the evaluation of the impact of storage conditions on the quality and shelf life of fruits. The analysis results hold great importance in the development of strategies for ingredient control, measures to prolong the freshness and quality of fruits, and the maintenance of their nutritional value.

Conclusions The analysis of the chemical composition of apples and apricots stored in refrigeration chambers reveals that refrigeration induces changes that contribute to preserving the fruits' quality and extending their shelf life. The reduction in respiration rate helps maintain juiciness, the slowdown of enzymatic activity preserves color, flavor, and texture, and the inhibition of microbial growth prevents spoilage [10]. Proper storage conditions, including temperature, humidity, packaging, ethylene control, and a suitable environment, are crucial for maximizing the benefits of refrigeration. By understanding these changes and following recommended practices, consumers and producers can ensure the longevity and quality of apples and apricots.

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