



## FACTORS AFFECTING THE QUALITY OF FRUITS AND VEGETABLES IN STORAGE CONDITIONS.

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### ABSTRACT

*This article analyzes the main factors affecting the quality indicators of fruits and vegetables during storage processes. Fruits and vegetables are biologically active products that continue physiological processes such as respiration, transpiration, and ethylene production even during storage. Temperature, relative humidity, composition of the gaseous environment, presence of microorganisms, and mechanical damage during storage directly affect the shelf life and quality of products. The study examined the advantages of storage technologies under modified and controlled atmospheres, measures to prevent microbiological hazards, and methods aimed at preserving the physical properties of the products. The final results indicate the necessity of a comprehensive approach to maintain quality stability and reduce losses. This work holds both theoretical and practical significance in the development of efficient storage technologies for agricultural products.*

Uzbekistan's climatic and agroecological conditions provide favorable opportunities for high-yield cultivation of agricultural products, particularly fruits and vegetables. However, significant losses are observed during the delivery of these products to consumers, particularly during the storage stage. According to global experience, 20–40% of fruits and vegetables become unfit for consumption during the postharvest period due to various factors [1]. Therefore, a thorough study of the factors affecting quality during the storage of these products is of both scientific and practical importance. Agricultural products, particularly fruits and vegetables, serve as a source of biologically active compounds, vitamins, and minerals essential for the human body. In addition to cultivation, the storage process plays a crucial role in preserving product quality, reducing losses, and enhancing economic efficiency. Therefore, studying the factors affecting the storage of fruits and vegetables remains one of the pressing issues. Fruits and vegetables, as living organisms, continue physiological processes such as respiration, ethylene production, transpiration, and enzymatic changes. The high water content (85–95%) and richness in nutrients make them highly susceptible to microbiological spoilage [2]. The aforementioned factors cause fruits and vegetables to lose their quality attributes

within a short period before storage. Therefore, it is essential to maintain a balance between their physiological state and the surrounding environment during storage. Temperature is one of the most critical physical factors in the storage process. As temperature decreases, the rate of respiration slows down, and enzymatic processes are reduced. For example, the optimal storage temperature for apples is 0–1°C, whereas for tomatoes it is 12–13°C. Temperatures below the recommended range can cause “cold injury,” while higher temperatures increase microbial activity [3]. The relative humidity (RH) surrounding the products affects the rate of water loss in fruits and vegetables. The optimal RH should be maintained at 85–95%. Low RH leads to product dehydration and surface shriveling, while high RH creates favorable conditions for mold growth and decay [4]. Modified Atmosphere Packaging (MAP) and Controlled Atmosphere (CA) technologies extend shelf life by regulating O<sub>2</sub>, CO<sub>2</sub>, and ethylene levels around the product. These methods reduce respiration rates and slow down physiological aging. For example, elevated CO<sub>2</sub> levels (3–5%) and reduced O<sub>2</sub> concentrations (2–3%) significantly slow down the ripening process in apples and pears [5]. The primary cause of product deterioration during storage is microorganisms. They mainly develop in mechanically damaged areas. Pathogens such as *Botrytis cinerea* (gray mold) and *Penicillium expansum* (blue mold) rapidly render products unfit for consumption. Methods such as disinfection, ultraviolet (UV) treatment, hot water processing, and the use of biological agents against microorganisms have shown good results. Impacts, scratches, and bruises that occur during transport and storage compromise the integrity of product tissues, creating “entry points” for pathogens. These deteriorations lead to decay and the development of off-odors during storage.

To ensure the quality storage of fruits and vegetables, special attention must be given to factors such as temperature, humidity, gas composition, microbiological safety, and mechanical damage. Modern technologies, including Modified Atmosphere (MAP) and Controlled Atmosphere (CA) systems, enable the long-term preservation of product quality. In the future, a deeper study of these factors will expand opportunities for more effective preservation of products. The long-term quality storage of fruits and vegetables remains one of the key directions in modern agrotechnology. Balanced regulation of temperature, humidity, and gas composition, along with the prevention of microbiological hazards and reduction of mechanical damage, enhances storage efficiency. On this basis, it is promising to develop energy-efficient and biologically safe storage technologies for local producers.

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