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PROCESSING STONE FRUITS USING VARIOUS METHODS

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Abstract: This article analyzes the technologies for processing stone fruits—apricot, plum, and cherry—using various methods. The efficiency of processing techniques, including drying, canning, jam production, juice production, and nutritional supplements, along with their impact on nutritional properties, energy consumption, and environmental sustainability, is examined. Special attention is given to the applicability of these methods in Uzbekistan's agricultural context and their significance in the export market. The study is based on scientific literature, Uzbekistan's normative-legal documents, and practical data. The article provides a comparative analysis of the advantages and limitations of these processing methods and offers recommendations for advancing stone fruit processing in Uzbekistan.

Keywords: Stone fruits, apricot, plum, cherry, processing, drying, canning, jam, juice, nutritional supplements, agriculture, food industry, export, environmental sustainability.

Introduction

Stone fruits—apricot, plum, and cherry—are pivotal in agriculture and the food industry due to their high nutritional properties (vitamins A, C, E, antioxidants, dietary fiber, potassium, magnesium) and versatility for processing into various products, making them highly sought after in local and international markets. In Uzbekistan, stone fruit processing is a key agricultural sector, with regions such as the Fergana Valley, Samarkand, and Surkhandarya producing over 100,000 tons of processed products annually (Uzbekistan Statistics Agency, 2024).

Stone fruit processing in Uzbekistan is regulated by a robust legal framework. The Law of the Republic of Uzbekistan "On Food Safety" (2021) mandates compliance with microbiological and chemical safety standards and sanitary norms. The Law "On the Development of Agriculture" (2004) supports the adoption of modern technologies in processing and export preparation of agricultural products. Standards such as DSt 3302:2015 (for dried fruits) and DSt 3285:2014 (for jams and preserves), approved by the "UzDavStandart" agency, establish requirements for moisture content, organoleptic properties, and storage conditions of processed products.

This article examines various methods for processing stone fruits, including drying, canning, jam production, juice production, and nutritional supplements. The study aims to analyze the efficiency of these methods, their impact on nutritional properties, energy consumption, and

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environmental sustainability, as well as their applicability in Uzbekistan's agriculture. Based on scientific literature, practical data, and Uzbekistan's experiences, the advantages, limitations, and prospects of these methods are evaluated.

Main Body

1. Characteristics of Stone Fruits and the Importance of Processing

Stone fruits—apricot, plum, and cherry—are distinguished by their unique nutritional and organoleptic properties. Apricots are rich in vitamin C (10–12 mg per 100 g) and antioxidants, plums are a source of dietary fiber and potassium, and cherries are valued for their anthocyanins and vitamin A content. Processing extends the shelf life of these fruits to 12–18 months, preserves their nutritional properties, and enhances competitiveness in export markets. In Uzbekistan, apricot and plum processing is traditional, while cherry processing has gained popularity in recent years, particularly in premium markets. The choice of processing method affects product quality, nutritional properties, and economic efficiency. Improper processing can lead to a 20–40% loss of vitamin C and .

2. Drying Methods. Drying is the most common method for processing stone fruits, reducing moisture content to 10–15% and extending shelf life.

2.1 Natural Drying (Sun Drying). Natural drying involves drying apricots, plums, and cherries in open air under sunlight and natural ventilation. Uzbekistan's dry climate (3000 hours of sunshine annually) makes this method viable. Its advantages include zero energy consumption and environmental friendliness. In the Fergana Valley, over 20,000 tons of apricots are sun-dried annually for local markets. However, the process takes 7–14 days and is weather-dependent. Risks include dust, insects, and microbiological contamination, with a 20–30% loss of vitamin C. The delicate structure of cherries makes quality maintenance challenging.

2.2 Mechanical Drying. Mechanical drying is conducted in drying chambers at controlled temperatures (50–70°C) and humidity levels, taking 2–4 days. It ensures consistent quality and low contamination risk. Apricots and plums retain 80–85% of vitamin C, while cherries retain up to 75% of anthocyanins. Enterprises like "AgroExport" in Uzbekistan process over 10,000 tons of products annually using mechanical drying (Uzbekistan Statistics Agency, 2024). Energy consumption is high (500–700 kWh per ton), but hybrid solar-powered equipment can reduce costs by 30–40%.

2.3 Modern Drying Methods

- Infrared Drying: Dries in 4–6 hours, retaining 85–90% of nutritional properties, ideal for apricots and cherries (Zhang et al., 2022).
- Microwave Drying: Dries in 1–2 hours but may reduce antioxidants in cherries.
- Lyophilization (Freeze-Drying): Retains 95% of nutritional properties, suitable for premium markets but costly and less common in Uzbekistan.

3. Canning. Canning involves preserving stone fruits in syrup, packaged in glass jars or plastic containers. Apricots and cherries are widely used for canning, while plums are less common.

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The process includes pasteurization (80–100°C) or sterilization to ensure microbiological safety. Advantages include preservation of natural taste and texture. However, high sugar content and a 15–25% loss of vitamin C are limitations. In Uzbekistan, canning is primarily used by small enterprises for local markets, but standardization is needed for export.

4. Jam and Preserve Production Jam and preserves are commonly made from apricots and plums, with cherries used less frequently. The process involves cooking fruits with sugar. Nutritional properties are partially lost (30–40%), but shelf life extends to 12–24 months. Enterprises like "Samarkand Fruit" export apricot jam to Russia and Kazakhstan (Uzbekistan Statistics Agency, 2024). Demand for eco-friendly packaging (glass jars) and sugar-free jams is increasing.

5. Juice and Nectar Production. Juice and nectar production from apricots and cherries is widespread, with plum juices valued for their high dietary fiber content. The process involves crushing, filtering, and pasteurizing the fruits. Pasteurization results in a 20–30% loss of vitamin C, but 70–80% of antioxidants are retained (Smith et al., 2020). In Uzbekistan, enterprises like "Fergana Juice" produce 5,000 tons of apricot juice annually.

6. Nutritional Supplements and Other Products. Processing dried fruits into flour (e.g., apricot flour), granules, or nutritional supplements expands product diversity. Apricot and cherry flour are used in bakery products and desserts, while plum granules are suitable for nutritional bars. These products are in demand in premium markets.

7. Prospects for Stone Fruit Processing in Uzbekistan. Stone fruit processing is a significant contributor to Uzbekistan's export market. In 2023, over 50,000 tons of dried apricots and plums and 5,000 tons of cherry products were exported. Modern technologies (lyophilization, infrared drying) and organic certification can increase export prices by 20–30%. Solar-powered equipment reduces costs by 30–40%, while farmer training and eco-friendly packaging (biodegradable materials) enhance market demand.

Conclusion

Various methods for processing stone fruits—drying, canning, jam production, juice production, and nutritional supplements—are crucial for advancing Uzbekistan's agriculture and export potential. Natural drying is cost-effective but limited in quality consistency. Mechanical and modern methods offer high quality but require significant investment. Canning, jam, and juice production meet both local and international demand. Recommendations include adopting hybrid technologies, solar energy, organic certification, and farmer training to enhance processing efficiency and competitiveness.

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