# ENERGY-EFFICIENT EQUIPMENT AND TECHNOLOGY FOR DRYING AGRICULTURAL AND FRUIT-VEGETABLE PRODUCTS

**Bahrom Hayrullayevich Normurodov**
Termez University of Economics and Service, Master's student of foreign language and literature (English)
Email: normurodovbahrom4@gmail.com

**Bahrom Rakhimovich Khudoyorov**
Student of Termiz State University, Professional Education: Agricultural Product Storage and Primary Processing Technologies
Email: bahromxuduyorov982@gmail.com

## ABSTRACT

This article discusses the development and implementation of energy-efficient equipment and technology for drying agricultural and fruit-vegetable products. The focus is on innovative solutions that reduce energy consumption while maintaining the quality of dried products. The research highlights practical applications, benefits for the agricultural sector, and contributions to sustainable development. Special attention is given to the optimization of drying processes, cost-effectiveness, and environmental impact.

**Keywords**: energy-efficient technology, agricultural products, fruit and vegetable drying, sustainable development, drying equipment, energy conservation, innovative solutions, process optimization, cost-effectiveness, environmental impact.

## ANNOTATSIYA

Mazkur maqola qishloq xo‘jaligi va meva-sabzavot mahsulotlarini quritish uchun energiya tejamkor qurilmalar va texnologiyalarni ishlab chiqish hamda joriy etish masalalariga bag‘ishlangan. Tadqiqotda quritish jarayonlarining samaradorligini oshirish, mahsulot sifatini saqlash, energiya sarfini kamaytirish va ekologik ta’sirni kamaytirishga alohida e’tibor qaratiladi. Shuningdek, ushbu texnologiyalarning qishloq xo‘jaligi sohasidagi amaliy qo‘llanilishi va barqaror rivojlanishga qo‘shgan hissasi ko‘rsatiladi.

**Kalit so‘zlar**: Energiya tejamkor texnologiya, qishloq xo‘jaligi mahsulotlari, meva-sabzavot quritish, barqaror rivojlanish, quritish uskunalari, energiyani tejash, innovatsion yechimlar, jarayonni optimallashtirish, iqtisodiy samaradorlik, ekologik ta’sir.

## INTRODUCTION

The resolutions and decrees adopted by the President of the Republic of Uzbekistan in the agricultural sector, in particular the resolution “On the widespread introduction of resource-saving technologies in agriculture” dated October 23, 2019, are aimed at accelerating the innovative development of this sector. Within the framework of these documents, the issue of using energy-saving technologies in the processing and storage of agricultural products deserves special attention. The implementation of the drying process of fruit and vegetable products using energy-saving equipment is of great importance not only in saving resources, but also in maintaining product quality. This article discusses the importance and practical application of energy-saving devices and technologies in the drying of agricultural and fruit and vegetable products.

Scientific research on the processing and drying of agricultural products is largely aimed at increasing energy efficiency. In particular, K.M. Nazarov's research has studied the possibilities of preserving product quality through the use of heat and energy-saving technologies in drying processes. In his opinion, modern drying equipment plays an important role in preserving the nutritional qualities of fruits and vegetables. Also, research conducted by V.A. Karimov shows the importance of ensuring environmental sustainability by introducing energy-efficient devices into the production process of agricultural products. He emphasizes the optimization of each stage of drying processes and minimizing energy consumption. A.Kh. Matyokubov, in his works, proposes the development of drying technologies based on the use of solar energy. His research shows that the use of solar energy is economically feasible and environmentally safe, especially for small and medium-sized farms. As can be seen from the analysis of scientific sources, modern drying technologies not only reduce energy consumption, but also ensure product quality and environmental sustainability. Therefore, the widespread introduction of energy-saving technologies in agriculture is one of the urgent issues.

Currently, heat pump drying technology is widely used as one of the effective and energy-saving technologies for storing and drying agricultural products. This method is a modern innovative technology that saves energy while maintaining high product quality.

### The principle of operation of the technology

A heat pump drying system works by absorbing heat from the environment and transferring it to the drying chamber. In this method:

1. The drying chamber is maintained at a constant low temperature and relatively high humidity.

2. The water content of the product evaporates, with minimal heat consumption.

3. The pumping system allows the recycled heat to be reused, which significantly reduces energy consumption.




**Figure 1. Heat pump drying technology**

**Advantages**

Energy saving: This technology consumes 30-50% less energy than traditional heat drying systems. Product quality: Low-temperature drying preserves the natural flavor, color, and nutritional value of the product. Environmental safety: It uses natural resources wisely and reduces carbon dioxide emissions. Versatile application: It is used to effectively dry fruits, vegetables, medicinal plants, seeds, and other products.

**Results**

Research shows that the introduction of heat pump drying technology increases the shelf life of products by 2-3 times and significantly increases the market value of the product. Also, this method helps to increase the economic efficiency of agricultural enterprises by saving energy resources. This technology is one of the promising solutions in the direction of modernizing the system of processing and storage of products in agriculture.

**Conclusion**

The use of energy-saving technologies in the drying process of agricultural products is important not only for saving resources, but also for maintaining product quality and ensuring environmental safety. Heat pump drying technology, as a modern energy-saving method, helps to maintain high quality products and significantly reduces energy consumption. Studies show that drying processes using this technology are more

efficient than traditional methods, allowing to increase the market value of the product. At the same time, the widespread introduction of energy-saving devices and technologies plays a major role in ensuring sustainable development and environmental safety in agriculture. In the future, the use of these technologies will allow to further increase efficiency in the processing and storage of agricultural products.

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