European Journal of Research Development and Sustainability (EJRDS)
Available Online at: https://www.scholarzest.com
Vol. 2 No. 5, May 2021,
ISSN: 2660-5570

SOLAR DRYING OF AGRICULTURAL RAW MATERIALS AND TYPES OF SOLAR DRYERS

Nazirova Rakhnamokhon Mukhtarovna
Doctor of Technical Sciences (PhD), Associate Professor of the Department "Technology of storage and primary processing of agricultural products",
Fergana Polytechnic Institute;
Tursunov Saidumar Islomjon ugli
Master student of the Department of "Technology of storage and primary processing of agricultural products",
Fergana Polytechnic Institute;
Usmonov Nodirjon Botiraliyevich
Lecturer at the Department of "Technology of storage and primary processing of agricultural products", Fergana Polytechnic Institute;
Fergana, Republic of Uzbekistan.

Article history:

Received: April 10th 2021
Accepted: April 26th 2021
Published: May 28th 2021

Abstract:

Agriculture is one of the important sectors of the economy of Uzbekistan, and it is necessary to pay great attention to the development of processing and ensuring the safety of agricultural products. The article discusses the issues of natural drying of agricultural raw materials and types of solar dryers.

Keywords: Drying, dehydration, air temperature, solar dryer, circulation, solar panel, residual moisture.

Under the leadership of the President in our country are conducted development of the practical use of alternative or renewable energy sources (solar energy, wind energy, hydraulic energy, biomass, geothermal resources, and others) as an important factor in sustainable development and increasing the competitiveness of the economy in the context of a reduction in global reserves of hydrocarbon raw materials. Drying is one of the effective ways to solve the problem of long-term storage and preservation of the nutritional properties of agricultural products.Drying is the simplest and most effective way to preserve raw materials. At the same time, for the implementation of this method, special devices, methods and complex skills are not required. Solar-air drying takes place in natural conditions in the open air. Drying of fruits and vegetables occurs due to the evaporation of the moisture contained in them. In order for this process to proceed intensively, it is necessary to ensure a constant supply of dry air, and in the dryers - heated air, and the removal of air already saturated with moisture.

This process is based on the removal of moisture from agricultural products by evaporation and removal of the formed vapors, which should to ensure not only the preservation of the quality indicators of products, but even to improve them. Therefore, the choice of methods and a rational mode of the drying process should be based on the scientific foundations of the drying technology - from studying the properties of the product as a drying object, and to identifying highly efficient and combined methods of energy supply. The latter should provide an intensification of the drying process and create favorable conditions for the implementation of scientifically based norms of energy consumption in the processing and food industries.

For these purposes, renewable energy sources are widely used, and solar energy is dominant in our country. Compared to canned fruits and vegetables, relatively small capital investments are spent on the production of a dried product, but this process requires the development and implementation of resource-saving technologies in this area.To obtain one kilogram of dry product, from 4 to 11 kilograms of moisture should be removed, while the specific energy consumption is from 2.7 to 7.4 kilowatt-hours. This leads to the fact that the energy intensity of drying processes in the agricultural sector is about 20 percent of its total fuel balance.

In the natural and climatic conditions of Uzbekistan, to solve the scientific and technical problem under consideration, the most promising is the use of solar drying plants. Their advantages include: saving fuel and energy resources, ecological cleanliness of production, favorable natural and climatic conditions, in which the season of ripening and processing of agricultural products coincides with the period of the greatest activity of solar radiation.

The internal structure of solar dryers has special drying zones, so that the drying process of food is the most efficient. There are differences in the shape and location of each of these zones depending on the model. In some models, several zones may be located in the same place, have similarities, and may not have delineated boundaries. The key areas are:

Absorption area - the area that receives direct solar radiation and converts it into heat, with which food is to be dried.

Drying area - the place where the product is to be dried.

Moisture exit area - the place where air saturated with moisture is vented into the atmosphere.

Fresh air inlet area - the point through which air enters to replace the one that has been etched away.

Air circulation system - The circulation of air around the product to be dried is extremely important as it corrodes moisture already extracted, maintaining a dry environment that speeds up drying.

Depending on technology used to move air, there are two systems: - Natural convection is a natural movement leading to the rise of hot air. Air, when heated, decreases its density, and tends to move upward through the dense medium. This phenomenon is called convection. In solar dryers, this natural movement of air is used to pass through the area where the product is to be dried and then expelled from the system. The air outlet creates compression, which forces external air into the system, and is reheated by recirculating the process. Convection circulation is maintained for the entire period as long as the sun's heat is on. This method is suitable for small air drying systems. The advantage is that it does not have the costs and disadvantages of complex dryers, but the force of the air traffic may not be sufficient to achieve the level of renewal of a suitable environment.

- Forced circulation - the use of electrical equipment such as an exhaust fan, where the fan serves as a means to move air.This system is suitable for large and complex systems. The disadvantage is that a power source is required, although if the user uses photovoltaic panels, the power supply of the entire system can be obtained from the sun. There are a large number of solar dryers. From the simplest outdoor to the most sophisticated industrial drying to medium sized for small businesses or home use.

Solar collectors and chamber dryers.

These dryers are composed of solar a collector, where the air is heated and rises into the cabinet, where the elements are placed for drying.

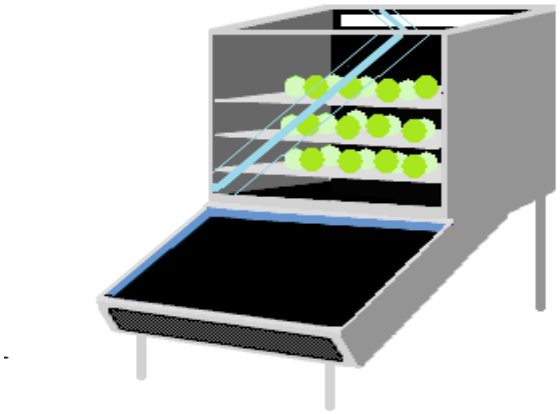

Figure 1. Chamber dryer

The solar dryer carries a solar panel kit The solar collection area is its own air collector, although there are some models that also have a transparent surface to capture solar radiation in the cabinet ... The ability to open the cabinet to capture solar radiation depends on the substances to be dried. If these are products that are sensitive to ultraviolet light, the appearance of which may be spoiled, then closed systems should be chosen. The air inlet is located at the bottom of the manifold, while the air outlet is located at the top of the cabinet.

The type of air circulation is natural due to convection. The location of the manifold at the bottom of the equipment has some slope, and along with the air outlet at the top, facilitates the movement of air, which is faster than in the case of a chamber dryer. These dryers are suitable for food, herbs, flowers, etc. in small and medium volumes, depending on the size and capacity of the equipment. By combining several modules of this type, it is possible to dry production volumes at industrial levels.

Solar dryers with accumulator (bunker) - this system is similar to the chamber type systems using panels, the only difference is in the large size. Instead of a cabinet, you will have a drying bin for much larger volumes. In addition, some of the collectors will be larger, since much more heat needs to be generated. This type of equipment has a forced air circulation system, since a larger volume of products to be dried makes air movement by natural convection.

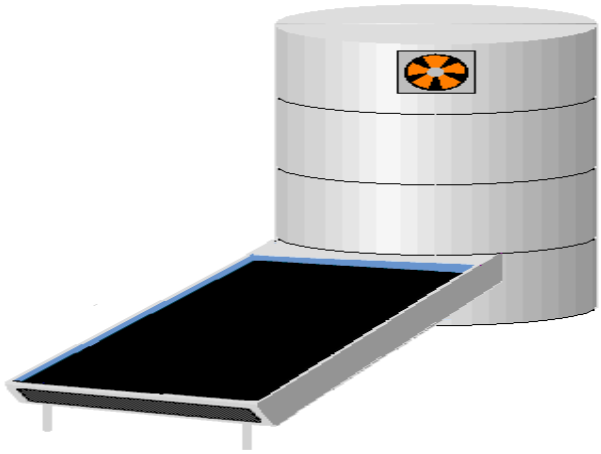

Figure 2. Solar Dryer with Battery (Bunker)

Greenhouse Dryers - This system consists of a large greenhouse, similar to that used in agriculture. In this case, the heat generated in the greenhouse is used to dry the food. By itself, it represents the same scheme as the chamber-type model, the only difference is in the proportions and materials that are used in the construction of the greenhouse.

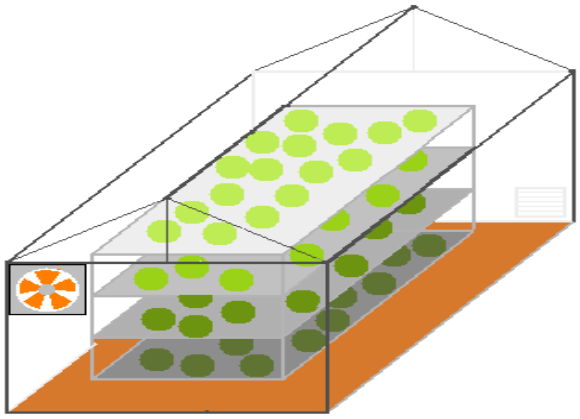

Figure 3. Greenhouse Dryer

These designs have forced circulation systems to achieve a level of adequate air replenishment that the system alone cannot reach by convection.

Closed collector dryers - these types dryers have separate solar air collectors and a drying chamber. Hot air passes through the collectors into the chamber through the corresponding air ducts. It has a forced air circulation system, which must have a high power. Closed collector solar dryer

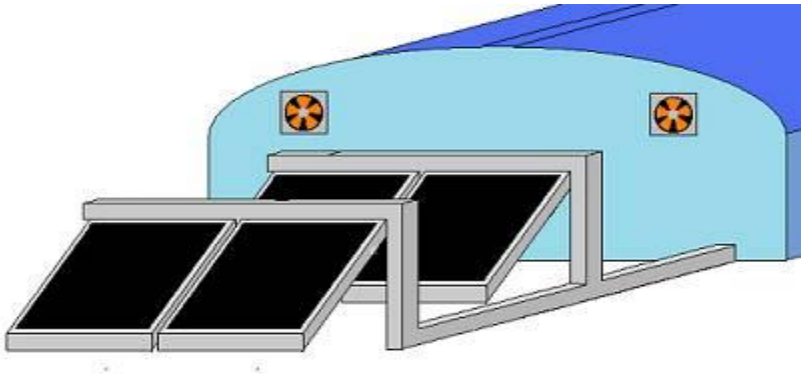

Figure 4. Closed collector dryer

The introduction of solar installations created by scientists in our country with the rational use of solar energy for drying and growing various types of agricultural products contributes to expanding the possibilities of their use in farms farms.

REFERENCES:

1. Nazirova R. M., Sulaymonov O. N., Usmonov N. B.//Qishloq xo'jalik mahsulotlarini saqlash omborlari va texnologiyalari// O'quv qo'llanma. Premier Publishing s.r.o. Vienna - 2020. 128 bet.
2. Nazirova, R., Xamrakulova, M., Usmonov, N. (2021). Moyli ekin urug'larini saqlash va qayta ishlash texnologiyasi. O'quv qo'llanma. https://doi.org/10.36074/naz-xam-usm.monograph
3. Назирова Р.М., Усмонов Н.Б., Тухташев Ф.Э., Сулаймонов Р.И// Влияние температуры хранения на сохранность и химический состав плодоовощного сырья// "Проблемы современной науки и образования" научно-методический журнал. Издательство «Проблемы науки». Москва,2019. № 11 (144). Часть 2 стр 10-12. URL: https://cyberleninka.ru/article/n/vliyanie-temperatury-hraneniya-na-sohrannost-i-himicheskiy-sostav-plodoovoschnogo-syrya
4. Назирова Р.М., Курбанова У.С.,Усмонов Н.Б.//Особенности обработки озоном некоторых видов плодов и овощей для их долгосрочного хранения// Universum: химия и биология: научный журнал. – № 6(72). М., Изд. «МЦНО», 2020. стр 6-9. URL: – https://cyberleninka.ru/article/n/osobennosti-obrabotki-ozonom-nekotoryh-vidov-plodov-i-ovoschey-dlya-ih-dolgosrochnogo-hraneniya
5. Nazirova R.M., Usmonov N.B., Askarov H.H.// Technology of storing grain in a cooled state// Do desenvolvimento mundial como resultado de realizacoes em ciencia e investigacao cientifica: Colecao de trabalhos cientificos «ΛΌГОΣ» com materiais da conferencia cientifico-pratica internacional. vol 1, page 93-95 URL: https://ojs.ukrlogos.in.ua/index.php/logos/article/view/4923
6. Nazirova R.M., Usmonov N.B., Bakhtiyorova D// Innovative technologies for grain storage of different crops// Academicia an international multidisciplionary research journal. 2020. vol 10.issue 6, june, pages 222-228. URL: https://saarj.com/academicia-past-issue-2020/
7. Назирова Р.М., Усмонов Н.Б., Тухташев Ф.Э., Тожиев Б// Значение процесса предварительного охлаждения сырья в повышении сохраняемости плодоовощной продукции// Научно-методический журнал "Вестник науки и образования". Издательство «Проблемы науки». Москва, №20 (74), часть 1, 2019, с 35-38. URL: https://cyberleninka.ru/article/n/znachenie-protsessa-predvaritelnogo-ohlazhdeniya-syrya-v-povyshenii-sohranyaemosti-plodoovoschnoy-produktsii
8. Назирова Р.М., Усмонов Н.Б., Зокиров А.//"Изучение влияния обработки на сохранность плодоовощного сырья ингибиторами образования этилена"//, научно-теоретический журнал "Вопросы науки и образования" №7 (53), Москва, 2019, стр 13-19. URL: https://cyberleninka.ru/article/n/izuchenie-vliyaniya-obrabotki-na-sohrannost-plodoovoschnogo-syrya-ingibitorami-obrazovaniya-etilena/
9. Назирова Р.М., Усмонов Н.Б., Сулаймонов Р.И.//Изменение химического состава клубней картофеля в процессе хранения// "Проблемы современной науки и образования" научно-методический журнал. Издательство «Проблемы науки». Москва, 2020. № 6 (151). стр 19-22. URL: https://cyberleninka.ru/article/n/izmenenie-himicheskogo-sostava-klubney-kartofelya-v-protsesse-hraneniya
10. Nazirova Rakhnamohon Mukhtarovna, Mamajonov Gaybullo Gayratjon ugli, and Asqarov Hasanboy Kholdoraliyevich, "Technology of long-term storage of some types of fruits and vegetables using sorbents", *IEJRD - International Multidisciplinary Journal*, vol. 5, no. 5, p. 4, Aug. 2020. http://www.iejrd.com/index.php/%20/article/view/1109
11. Abdurakhimov Akramjon Samiyevich**,** Usmonov Nodirjon Botiraliyevich. Effectiveness of co-planting crops in sandy soils./Plant cell biotechnology and molecular biology., 2020 volume 21, issue 61-65. https://www.ikppress.org/index.php/PCBMB/article/view/5688
12. Abdurahimov A.C., Usmonov N.B. Effective agrotechnology for extreme conditions. "Биология ва экология журнали". 2019 йил. Тошкент. 2-сон.37-40
13. Nazirova R.M., Maksudova G.U., Usmonov N.B.//Modern technologies for processing soy and the use of Processing by-products// Novateur publications JournalNX-A Multidisciplinary Peer Reviewed Journal ISSN No: 2581 – 4230, volume 7, issue 1, Jan. -2021. page 172-175. https://www.neliti.com/publications/336289/modern-technologies-for-processing-soy-and-the-use-of-processing-by-products
14. Nazirova R.M., Akhmadjonova M.M., Usmonov N.B.// Analysis of the state of vine growing and wine making in the republic of uzbekistan// Novateur publications JournalNX- A Multidisciplinary Peer Reviewed Journal ISSN No: 2581 – 4230, volume 7, issue 1, Jan. -2021. page 168-171. https://www.neliti.com/publications/336288/analysis-of-the-state-of-vine-growing-and-wine-making-in-the-republic-of-uzbekis
15. Nazirova Rahnamokhon Mukhtarovna, Akhmadjonova Marhabo Makhmudjonovna, & Usmonov Nodirjon Botiraliyevich. (2021). Analysis of factors determining the export potential of vine and wine growing in the republic of Uzbekistan. Euro-Asia Conferences, 1(1), 313–315. http://papers.euroasiaconference.com/index.php/eac/article/view/99