Solar Drying Technologies for Agricultural Produce– An Overview

Preeti
Ph.D. Scholar, Department of Renewable Energy Engineering, College of Agricultural Engineering and Technology, Dr. BSKKV, Dapoli (MS)
*Corresponding Author: preetihj039@gmail.com

Conversion and utilization of solar energy is one of the most important strategies being proposed to mitigate the foreshadowed global energy crisis and environmental issues. Agricultural produce is the backbone of food security and economic stability for many regions around the world. However, a significant portion of this produce is lost due to inadequate post-harvest handling and preservation techniques. Solar dryer has a significant potential in the agricultural sector, where it used for drying vegetables, fruits and medicinal plants. Solar energy translates to heat during the drying process, so whether product is laid out in the sun (ambient) or placed in a dryer, the heat for drying comes from the same source. In traditional drying methods, agricultural produce is exposed to direct sunlight or air-dried in open fields, which is not only time-consuming but also susceptible to contamination, pests, and unpredictable weather conditions. Solar drying provides an efficient and controlled environment for dehydration, ensuring that the produce retains its quality and nutritional value. In this article, we will explore various solar drying technologies and their applications in agricultural sector. In recent years, with the rapid development of drying technology and the application of drying equipment, drying industry is making great development.

Solar Energy

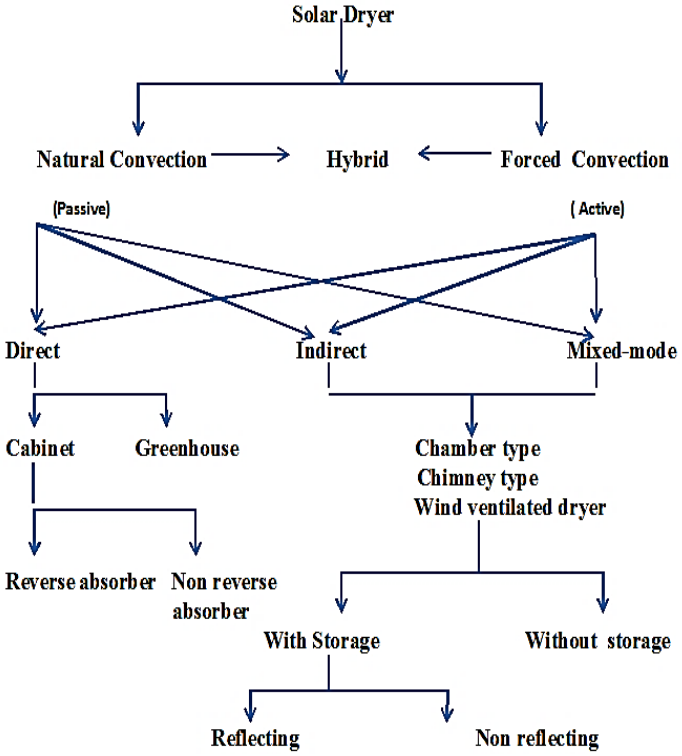
Depletion of natural fuel resources, rising fossil fuel costs and emission have led to use renewable energies. Various innovations are undergoing to make the use of sources of renewable energy like wind, solar, tidal etc. Among these sources, solar energy is available in enormous quantity and can be directly used which is continuous, safe, free and environment friendly. Increasing population is the major problem of the entire world. Increase in the population increases the consumption of food. To fulfil this demand either that amount of food must be produced on a regular basis or produced food can be stored after some processing. Therefore, continuous production is not possible but food can be stored for a certain period by drying it. For drying agricultural and non-agricultural products, solar energy can be used directly or indirectly (Singh *et al.,* 2018).

Solar dryer

Solar dryer has a significant potential in the agricultural sector, where it used for drying vegetables, fruits and medicinal plants. Thereby minimize dependency on sun drying and industrial drying, hence save huge quantities of fossil fuels (Agrawal and Sarviya, 2016). Drying involves extraction of moisture from the product by heat and removal of that moisture by a flowing air mass. Solar dryer is the best alternative option to avoid disadvantages of conventional drying methods (Sontakke, and Salve, 2015). Traditionally all the agricultural products were dried only by utilizing solar energy which requires large area for drying and availability of the sunlight throughout the day. The chances for contamination of the drying product with dust, insects, birds, fungi etc. are more in the open sun drying. The above said challenges have led to the development of solar drying systems. Many solar driers have been developed in the past two decades for drying various products by utilizing the solar energy efficiently and innumerable studies has been reported on solar drying of agricultural products (Leon *et al.*, 2002). Agricultural products, especially fruits and vegetables require hot air in the temperature range of 45–60˚C for safe drying. When any agricultural product is drying under controlled condition at specific humidity as well as temperature it gives rapid superior quality of dry product (Gutti *et al.*, 2012; Sontakke, and Salve, 2015). Solar drying is one of the best methods to preserve crops for a long time. Greenhouse solar dryer operating in active mode is better as compared to passive mode. Quality, taste, colour, and nutritious value of the dried product are better in greenhouse solar drying than open sun drying.

Types of solar dryers

Solar dryers are mainly classified into natural convection dryers, forced convection dryers and hybrid type. In natural convection or active solar dryer, the circulation of solar heated air is through buoyant force. A forced convection or passive solar dryer utilizes motorized fans or pumps for forced circulation of the drying air in to the solar dryer in which solar energy is used to heat the pumped air. In a Hybrid dryer solar energy is combined with conventional or auxiliary source of energy for heating the air. Classification of solar dryers (Fudholi *et al.*, 2010).



Conclusion

To capture and efficiently utilize the solar energy in today's energy market requires multistage integration of several factors, including proper matching of the solar energy resources and energy demands of a particular region. Use of solar energy for drying is one of the most effective methods due its renewable nature and availability. Solar drying technologies represent a significant advancement in agricultural post-harvest handling and preservation. By harnessing the sun's energy, farmers can reduce post-harvest losses, improve the quality of their produce, and contribute to a more sustainable food system. In recent years, with the rapid development of drying technology and the application of drying equipment, drying industry is making great development. With proper training and support, solar drying has the potential to revolutionize the way we approach food preservation, benefiting both farmers and consumers alike.

References

Agrawal, A. and Sarviya, R.M., 2016. A review of research and development work on solar dryers with heat storage. *International Journal of Sustainable Energy*, 35(6):583-605.

Fudholi, A., Sopian, K., Ruslan, M.H., Alghoul, M.A. and Sulaiman, M.Y., 2010. Review of solar dryers for agricultural and marine products. *Renewable and sustainable energy reviews*, *14*(1):1-30

Gutti, B., Kiman, S. and Murtala, A.M., 2012. Solar dryer-an effective tool for agricultural products preservation. *Journal of Applied Technology in Environmental Sanitation*, *2*(1).

Leon, M.A., Kumar, S. and Bhattacharya, S.C., 2002. A comprehensive procedure for performance evaluation of solar food dryers. Renewable and Sustainable Energy Reviews, **6**(4):367-393.

Singh, P., Shrivastava, V. and Kumar, A., 2018. Recent developments in greenhouse solar drying: A review. *Renewable and Sustainable Energy Reviews*, *82*: 3250-3262.

Sontakke, M.S. and Salve, S.P., 2015. Solar drying technologies: A review. *International Journal of Engineering Science*, *4*(4): 29-35.

* * * * * * * *