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Development of Solar Poly House Tunnel Dryer (STD) for Medicinal Plants

Authors : N. C. Shahi, Anupama Singh, E. Kate

Abstract : Drying is practiced to enhance the storage life, to minimize losses during storage, and to reduce transportation costs of agricultural products. Drying processes range from open sun drying to industrial drying. In most of the developing countries, use of fossil fuels for drying of agricultural products has not been practically feasible due to unaffordable costs to majority of the farmers. On the other hand, traditional open sun drying practiced on a large scale in the rural areas of the developing countries suffers from high product losses due to inadequate drying, fungal growth, encroachment of insects, birds and rodents, etc. To overcome these problems a middle technology dryer having low cost need to be developed for farmers. In case of mechanical dryers, the heated air is the main driving force for removal of moisture. The air is heated either electrically or by burning wood, coal, natural gas etc. using heaters. But, all these common sources have finite supplies. The lifetime is estimated to range from 15 years for a natural gas to nearly 250 years for coal. So, mankind must turn towards its safe and reliable utilization and may have undesirable side effects. The mechanical drying involves higher cost of drying and open sun drying deteriorates the quality. The solar tunnel dryer is one of promising option for drying various agricultural and agro-industrial products on large scale. The advantage of Solar tunnel dryer is its relatively cheaper cost of construction and operation. Although many solar dryers have been developed, still there is a scope of modification in them. Therefore, an attempt was made to develop Solar tunnel dryer and test its performance using highly perishable commodity i.e. leafy vegetables (spinach). The effect of air velocity, loading density and shade net on performance parameters namely, collector efficiency, drying efficiency, overall efficiency of dryer and specific heat energy consumption were also studied. Thus, the need for an intermediate level technology was realized and an effort was made to develop a small scale Solar Tunnel Dryer . A dryer consisted of base frame, semi cylindrical drying chamber, solar collector and absorber, air distribution system with chimney and auxiliary heating system, and wheels for its mobility were the main functional components. Drying of fenugreek was carried out to analyze the performance of the dryer. The Solar Tunnel Dryer temperature was maintained using the auxiliary heating system. The ambient temperature was in the range of 12-33oC. The relative humidity was found inside and outside the Solar Tunnel Dryer in the range of 21-75% and 35-79%, respectively. The solar radiation was recorded in the range of 350-780W/m2 during the experimental period. Studies revealed that total drying time was in range of 230 to 420 min. The drying time in Solar Tunnel Dryer was considerably reduced by 67% as compared to sun drying. The collector efficiency, drying efficiency, overall efficiency and specific heat consumption were determined and were found to be in the range of 50.06-38.71%, 15.53-24.72%, 4.25 to 13.34% and 1897.54-3241.36 kJ/kg, respectively.

Keywords : overall efficiency, solar tunnel dryer, specific heat consumption, sun drying
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