

Preservation of Tomatoes in Developing Countries Using Solar Dryer

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Abstract

Preservation of farm produce is one of the major problems faced by farmer in the developing nations of the world. A lot of farm produce perish before reaching the final consumer due to inadequate preservation method in these countries. These countries do not have constant power supply and technology to process there farm produce which will help make it last longer. They result in sun drying which is not efficient due to unsteady nature of the solar radiation. This work focused on using solar dryer to preserve tomatoes in developing countries. The experiment was done in University of Nigeria, Nsukka during the winter period to ensure that solar radiation was steady and to get a better result. The experiment showed that solar dryer could be used to preserve tomatoes produced in developing countries and as well make it reach the final consumers in good condition. The maximum atmospheric temperature recorded during the experiment was 31°C. The result achieved weight reduction of tomatoes used in the experiment from 30Kg to 4.5Kg.

Keywords: Preservation, Farm produce, tomatoes, solar radiation, developing countries

1. Introduction

Solar drying is a potential decentralized thermal application of solar energy particularly in developing countries ^[1]. However, so far, there has been very little field penetration of solar drying technology ^[2]. In the initial phase of dissemination, identification of suitable areas for using solar dryers would be extremely helpful towards their market penetration ^[3]. Preserving fruits, vegetables, grains, and meat has been practiced in many parts of the world for thousands of years. Methods of preservation include: canning, freezing, pickling, curing (smoking or salting), and drying. Food spoilage is caused by the action of molds, yeasts, bacteria, and enzymes. The drying process removes enough moisture from food to greatly decrease these destructive effects. The moisture content of fresh foods ranges from 20% to 90%. Foods require different levels of dryness for safe storage ^[4]. For example: the moisture content of rice must be reduced from 24% to 14% of the total weight. Therefore, drying 1,000 kg of rice requires the removal of 100 kg of water. Safe storage generally requires reducing the moisture content to below 20% for fruits, 10% for vegetables, and 10-15% for grains ^[5]. If food is properly dried, no moisture will be visible when it is cut. During a typical harvest period, tomatoes are extremely plentiful within the country and local markets are overwhelmed with their abundance ^[6]. A lot of resources are spent by farmers in crop cultivation but at the end, some of these farm produce are being wasted due to lack of food preservation system ^[7]. As a result, tomato prices are depressed and farmers who rely on them as a source of income receive low returns for their efforts. In addition, the lack of paved roads increases the time that it takes to get the product to markets in populated centres and often results in produce being damaged during transportation. While unsold tomatoes in the markets spoil and must be discarded, some tomatoes may remain unharnessed and left in the fields literally rotting

on their vines due to unfavourable market conditions ^[8]. At the end of the growing season, supplies of tomatoes diminish rapidly. Within a few weeks there is a shortage of fresh local tomatoes, and throughout the period until the next harvest, tomatoes must be imported to meet the country's demands. To pay for these imports, funds must be transferred to offshore suppliers thereby reducing the domestic financial resources of the country as it is forced to import tomatoes and other perishable crops. While overcoming the reliance on food imports is recognized as a priority for the country's development, finding a solution to the problem may not be an easy task. The problem itself is relatively easy to define: there are simply too many tomatoes ripening in a very short time period. In more developed countries these excess tomatoes would be processed into tomato sauce, tomato paste, or ketchup; or they might be processed and canned whole, sliced, or diced. However, canning requires abundant, reliable energy to supply heat for retorts and other thermal processing equipment. These energy supplies are often lacking in developing nations. Even in countries where there is electricity in the major centres, there may be no power grid to distribute it to outlying areas. Drying of the tomatoes was considered to be one of the few processing options that could be utilized under the constraints imposed in this country. The use of conventional forced-air dryers or ovens was considered not to be feasible in many areas. Once again, this was due to the lack of energy to power fans and appropriate instrumentation, as well as fuel to provide heat to the dryers. Since this country, like many of the nation's facing these problems, is in a tropical or sub-tropical area, solar energy was viewed as an attractive alternative for drying food products. Numerous projects have been undertaken to investigate the potential for solar drying of crops such as tomatoes. Dried tomatoes could then be stored in a relatively shelf-stable form for use until the next harvest of fresh tomatoes. An international assistance

project was focussed on assessing food preservation at the individual farm level to provide shelf-stable products between harvests [9]. It was reasoned that transferring food preservation technology such as solar drying to farming families would provide them with the means to set aside a portion of their crop for personal use during the period between harvests; thereby reducing their reliance on imported fresh tomatoes. Solar drying of tomatoes is not a novel idea [10]. Indeed, it continues to be practised successfully on a commercial scale in several countries where conditions are suitable. However, the real issue in this example is the applicability of solar drying at the individual farm level [11]. There are numerous drawbacks associated with solar drying that must be considered. In order to understand the situation, it is necessary to examine a combination of factors including: the drying properties and kinetics of the product; prevailing environmental conditions; finished product storage, usage, and attributes; and the potential for technology uptake by the target user group.

2. Materials and Method

Collection of material

The tomatoes used in this work are collected from tomato farm in Crop Science Development University of Nigeria, Nsukka. The tomatoes were harvested from the farm and some spoilt ones that have been affected by disease were handpicked from the fresh tomatoes and thrown away.

2.1 Experimental Method.

The quantities of tomato collected were measured to ascertain the weight of the tomatoes before putting it inside the solar dryer. This is to determine the loss in weight after drying using solar dryer. Thermometer was inserted inside the dryer to determined temperature inside the solar dryer. The other thermometer was mounted outside the drying chamber of the solar dryer to record the atmospheric temperature.

3. Results and Discussion

Table 1

Time(Days)	1	2	3	4	5	6	7	8	9	10
Weight(Kg)	30	27	25	23	19	17	14	9	5	4.5

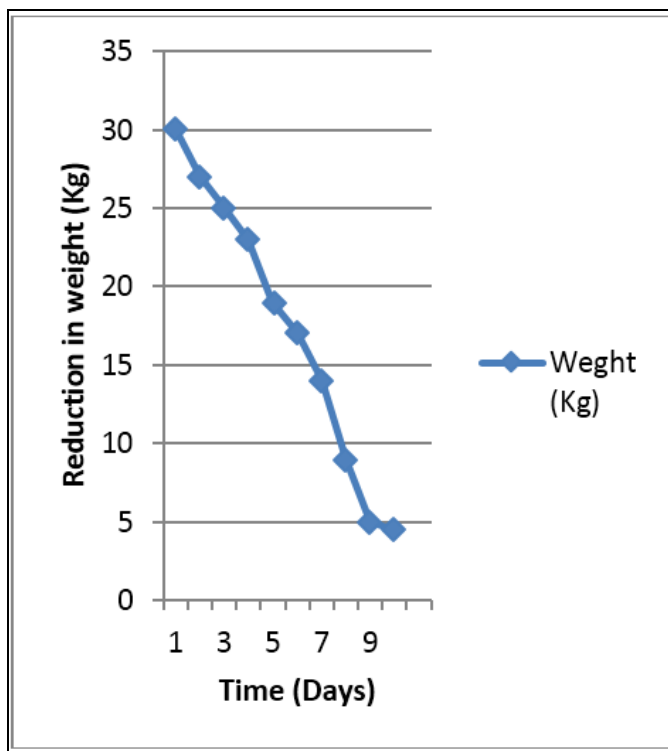


Fig 1: A graph of weight (Kg) versus Time (Days)

Table 2

Time (Days)	1	2	3	4	5	6	7	8	9	10
Weight (Kg)	31	29	28	30	31	27	28	30	27	26

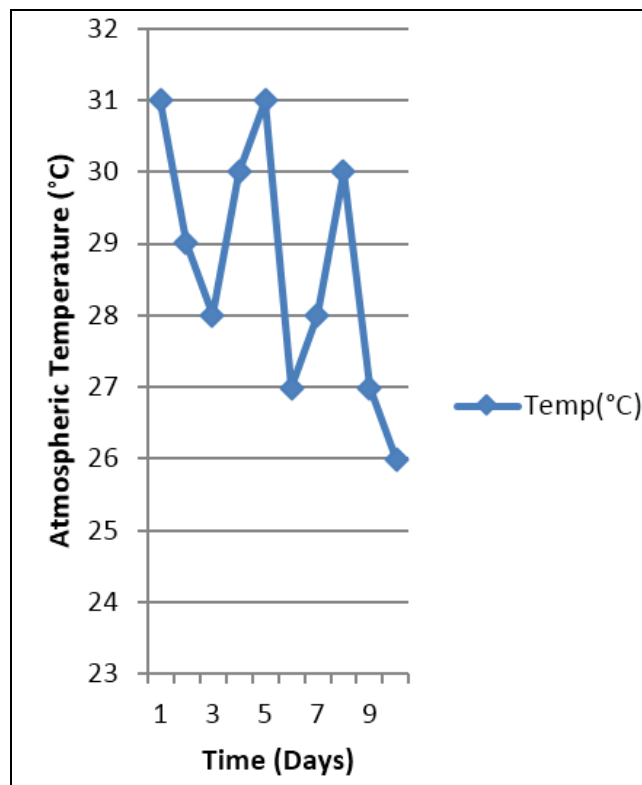


Fig 2: A graph of Atmospheric Temperature versus Time (Days)

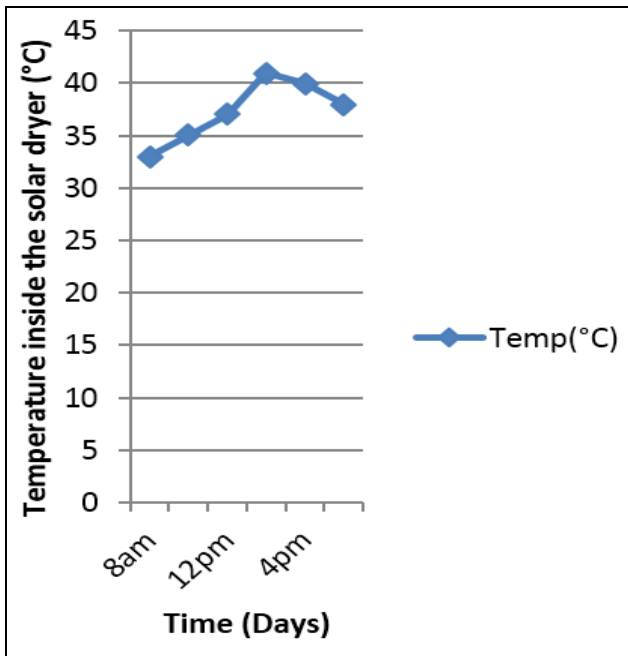


Fig 3: A graph of Temperature inside the solar dryer versus Time (hrs) on day 1

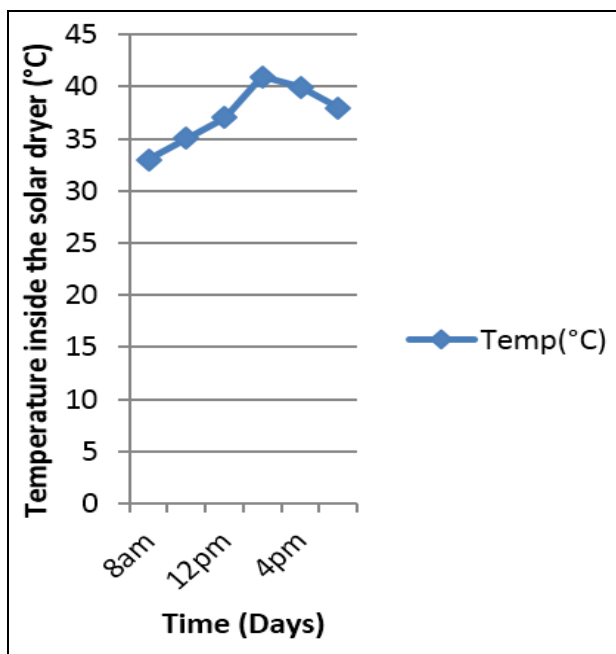


Fig 4: A graph of Temperature inside the solar dryer versus Time (hrs) on day 10.

The experiment presented one of the ways of tomato preservation using solar dryer. The tomato was measured to know the initial weight. The weighed tomatoes were poured inside the solar dryer and the solar dryer was exposed to the open space to receive appropriate solar radiation. The experiment was performed at University of Nigeria, Nsukka. It was observed that the weight of the tomatoes gradually reduced from day 1 to day 10 depending on the intensity of solar radiation. The maximum atmospheric temperature of each day was recorded and plotted in fig 2 above against number of days. The maximum solar dryer temperature recorded was 39°C.

4. Conclusion

The fruits and vegetable produced in the developing countries could be preserved for longer period by the use of solar dryer. The experiment performed indicated that tomatoes and other perishable farm produce in the rural area could be made to reach the final consumer without damaging it through solar dryer preservation method.

5. References

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