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SOLAR DRYING OF JACKFRUIT JUICE BY DEVELOPED HOHENHEIM TYPE DRYER

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ABSTRACT

The Hohenheim type solar dryer was invented by the Hohenheim University of Germany. Professor B.K. Bala, Department of Farm Power and Machinery, BAU, Mymensingh, Bangladesh was developed and constructed this dryer with locally available material in the country. This dryer was used for drying fruits, vegetables and fishes. In this paper the jackfruit juice were dried in four experimental runs. The total 22.60 kg of fresh juice were dried in two ways; 15.16 kg was dried inside the dryer and another 7.44 kg was dried in the open sun light outside the dryer. The moisture contents for both cases were 76.84% (wb). The dried weights of jackfruit leather were 3.42 kg and 2.62 kg with moisture contents of 13.23% (wb) and 26.47% (wb) respectively after 3 to 4 days of drying operations. The temperature raised 10^{o} C to 39^{o} C over ambient temperatures at the range of solar radiation of 0 to 350 W/ m^2. The moisture removal rates were 124.96 gm/hr by the dryer and 65 gm/hr from the sample kept outside the dryer. The jackfruit juice for first three runs were extracted by the electric blender machine and the juice for run 4 by traditional hand method used. The dried leather from electric blender machine was seen more attractive. This study was done in Farm Machinery work shop, BAU, Mymensingh in 2002.

Keywords: Jackfruit leather, Moisture content, Moisture removable rate and Hohenheim type dryer

INTRODUCTION

A variety of different fruits such as banana, jackfruit, pineapple, mango, melon, guava, papaya etc are produced in large quantities in different seasons in Bangladesh. The jackfruit is secured the second position as its yield (BBS 1997). About 265 tons of jackfruit is produced in the country (BBS 1998). The harvesting period of jackfruit is started from April to August in the year. Until the present days there is very little attention were paid on the systemic research and study of drying jackfruit juice in the country. There are three types of jackfruit e.g., Khaja, Ghila and fairly sweet (Haque, 1994). The jackfruit bulbs of last two types are preferred for making leather. The first one may consider for making jelly because of crispy bulbs. Jackfruit is highly perishable fruit that requires careful handling and quick marketing. No modern storage facilities have been developed yet in the country. As this fruit rotten soon and need time to reach the consumer; good storage therefore becomes a compulsion- so selling of jackfruit at reasonable price and at desirable time are the major problems.

Solar drying is the least alternative to the sun drying that carried out by the use of solar energy but a process for producing product of required quality. The quality of the dried products reflects the market price and thus increases the economy of the country. In the past there is no significant study on making diversified products of jackfruits in the country. Making dried jackfruit leather from juice is one of the new examples of diversified food. It is also generated the employment opportunity and helps to develop related new small industries. In Bangladesh the household people who are illiterate mainly will perform the process of drying jackfruit leather. There may rise of complain about quality and hygienic aspects of the product. Lack of proper amenities like proper handling during loading and unloading of the product. Sufficient knowledge of scientific and hygienic method of handling from the time of catch until to the processed finished product contributes significantly to the loss of quality.

The objectives of this work were:

- To analyze the experimental result of the Hohenheim type solar dryer beside the traditional drying under Bangladesh conditions.

- To see the quality of leathers extracted by the electric blender machine and traditional hand method used.

MATERIALS AND METHODS

The original design was redeveloped by the Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh. This work was done at the same campus in 2002 and the dryer had been modified to make it economic and simple in construction by using locally available materials.

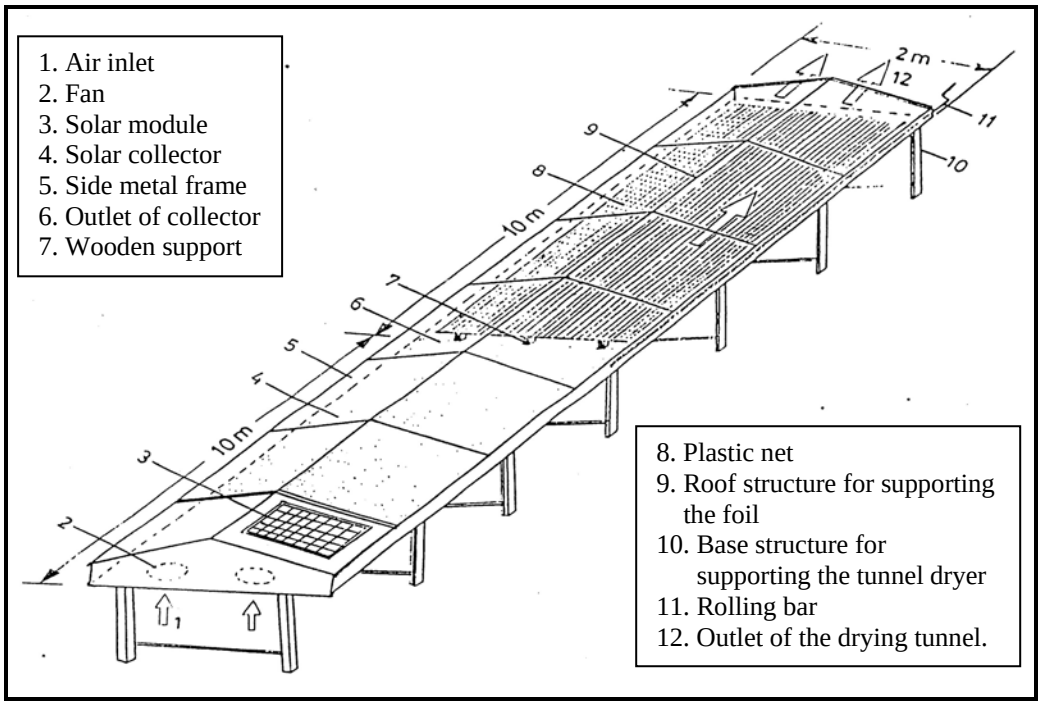

Fig.1. Hohenheim type solar tunnel dryer

The test of solar tunnel dryer for drying of jackfruit leather were carried out at the yard of the department of farm power and machinery Workshop, BAU, Mymensingh. Four sets of drying experimental runs were performed. Jackfruit juice with steel trays were weighed and placed into the dryer at 10 m to 13.3 m positions as in fig. 1. The average thickness of jackfruit juice was approximately 7-10 mm and about 15.16 kg of fresh juice was loaded in four batches. But the actual capacity of the dryer was 120- 150 kg of fresh fruit could be dried. Drying was started after loading usually at 8 am to 4 pm. Weight loss of the experimental product during drying period were measured with an electric balance with an accuracy of ± 0.1 gm. Afterwards, the sample were kept in polyethylene bags. These samples were again put into the dryer next morning. To compare the performance of the tunnel dryer with that of sun drying, weighed control samples of jackfruit leather about 7-10 mm thick were placed outside on three steel trays beside the dryer. Both experimental and control sample were dried under same weather conditions. The experiment would run until the desired moisture content below 15% (wb) of the dryer samples.

Moisture content of jackfruit juice is determined by oven drying method at 80^0 C temperatures. About 10 gm of jackfruit juice sample were measured in five crucibles and kept in the electric oven until the weight of the sample became constant which was after approximately 24 hours.

The processing technique of jackfruit juice and leather was followed by the following steps in Fig. 2.

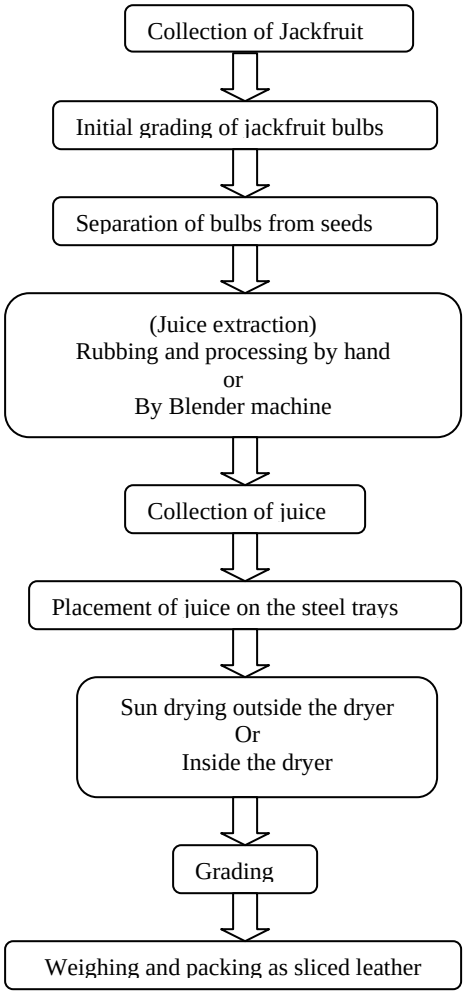

Fig. 2. Flowchart for preparation of jackfruit leather by hand method or by blender machine

The formulae required for analysis were:

(a) The initial moisture constant (wet basis)

$$M_1 = \frac{(W - W_1) \times 100}{W}$$

(b) The final moisture content (wet basis)

$$M_2 = \frac{M_1 W - 100X}{W - X}$$

Where, W = initial weight of the product

W_1 = final weight of the product

X = Amount of moisture removed

RESULTS AND DISCUSSION

In four runs jackfruit juice samples were dried below 15% MC (wb) reduces the sample weight from 15.16 kg to 3.42 kg by tunnel drier. On the other hand in four runs the control sample in sun drying retained the moisture content of 26.80 % (wb) and reduces the weight from 7.44 kg to 2.62 kg of jack fruit leather.

In four runs in Table.1, 1.62 kg, 1.40 kg, 2.18 kg, 0.67kg and 9.29 kg of jackfruit juice were dried for making leather in the drier and 1.54 kg, 1.55 kg, 2.12 kg and 2.23 kg of juice were dried simultaneously by sun drying. But the capacity of the dryer was higher. This study could not run the experiment with such a big amount of fruit product. However the moisture removal rate were 62.93 gm/hr, 51.02 gm/hr, 90.84 gm/hr, 26.42 gm/hr and 393.58 gm/hr by the dryer and 58.02 gm/hr, 56.09 gm/hr, 85.98 gm/hr and 59.90 gm/hr by the traditional sun drying.

In all cases the quality of dried jackfruit leather in the tunnel dryer was of quality dried product as compared to sun dried leather. This study demonstrates the potentiality of the solar tunnel dryer for drying of jackfruit leather in Bangladesh. The blender made juice was seen better than hand made juice, the leather was looking honey brown colored with homogeneous texture and most attractive than sun drying samples and hand made samples.

From above results and the discussion in this paper work the following conclusion may be drawn;

- The diversified items of food from jackfruit are an appropriate step of analysis work.
- The sufficient knowledge of scientific and hygienic method of handling juice to the finished leather is most important.
- The leather is seemed more attractive in blender extraction method.
- The steps should be taken for ensuring good environment for storage.

Table 1. The output summary of four experimental runs

Run No.	Sample type	Weight (gm)	Total weight (gm)	% MC	Drying time and method	Final wt. (gm)	Total final wt. (gm)	Final MC (%)	Average MC (%)	MRR (gm/hr.)
One										
28/05/02 to 30/05/02	S_1	442.30	1620.10	77.44	3 days of 19 hrs. tunnel drying	105.20	424.50	5.15	12.92	62.93
	S_2	564.80				157.30		18.99		
	S_3	613.00				162.00		14.63		
	C_1	377.90	1540	77.44	3 days of 19 hrs. sun drying	88.10	437.55	3.23	17.73	58.02
	C_2	576.60				174.50		25.46		
	C_3	585.50				174.95		25.50		
Two										
30/05/02 to 02/06/02	S_1	465.00	1400	76.41	4 days of 20 hrs. tunnel drying	127.60	379.52	14.03	12.95	51.02
	S_2	455.40				121.40		11.50		
	S_3	479.60				130.52		13.32		
	C_1	462.00	1550	76.41	4 days of 20 hrs. sun drying	130.40	428.19	16.42	14.59	56.09
	C_2	508.70				136.60		12.15		
	C_3	579.30				161.19		15.22		
Three										
05/06/02, 06/06/02 and 10/06/02	S_1	758.90	2180	75	3 days of 17 hrs. tunnel drying	200.40	635.68	5.33	14.03	90.84
	S_2	696.20				216.30		19.53		
	S_3	724.90				218.97		17.24		
	C_1	675.90	2120	75	3 days of 17 hrs. sun drying	212.70	658.42	20.55	19.44	85.98
	C_2	705.70				211.60		16.62		
	C_3	738.40				234.12		21.15		
Four										
12/12/02 to 14/12/02	S_1	195.10	667.10	78.49	3 days of 19 hrs. tunnel drying	48.30	165.10	13.11	13.01	26.42
	S_2	253.00				63.40		14.16		
	S_3	219.00				53.40		11.78		
	S_4 to S_{16}	700×11=7700	9290	78.49	3 days of 19 hrs. tunnel drying	S_4 to S_{14}=1437	1812	-	13.01	393.58
		880×1=880				S_{15} =120				
		710×1=710				S_{16} =255				
	C_1	475.80	2231.70	78.49	3 days of 19 hrs. sun drying	218.20	1093.60	53.10	54.11	59.90
	C_2	752.50				509.70		68.24		
	C_3	1003.40				365.70		40.98		

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