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Testing of Solar Grain Dryer

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Abstract: ***Solar grain dryer is designed to dry various seed. The purpose of dyer is to overcome the difficulties faced by conventional method of drying. Use of solar grain dryer is very effective and this method is fast as compare to other method of drying. Drying is dust free and Fast. This dryer can be used as roster also. This paper gives testing on solar dryer for drying various seed. Testing is carried out on solar grain dryer and result obtained s compared with result obtained in LPG testing and Electric Oven***.

Keywords: Solar dryer, roster, LPG, Electrical oven

1. Introduction

Solar grain dryer is designed to dry various seed. The purpose of dyer is to overcome the difficulties faced by conventional method of drying. Use of solar grain dryer is very effective and this method is fast as compare to other method of drying. Drying is dust free and Fast. This dryer can be used as roster also. This paper gives testing on solar dryer for drying various seed.

2. Literature Review

1) A. O. Adelaja and B. I. Babatope study , natural conventional dryer was designed and testing is carried out and thermal analysis is carried out. The system efficiency is 78.73% and moisture removal is 77.5 %. The cost of dyer was found to be $195.00. this is suitable for small- and medium-scale enterprises also domestic application.
2) Fudholi, M. Y. Othman, M. H. Ruslan, M. Yahya, A. Zaharim and K.Sopian, gives forced conventional drying . The main components of the system are doble pass solar collector with finned absorber, blower, heater and drying chamber. Testing is carried out on dyer and excel software is used for analysis of raw data. The initial moisture content of the seaweed are 94.6% (wet basis) and and final is 10% (product basis) respectively. Time of drying is about of 7 hours at average solar radiation of about 600 W/m2 and air flow rate 0.0613kg/s.
3) Performance evaluation of an enhanced fruit solar dryer using concentrating panels James Stiling a , Simon Li b , Pieter Stroeve b , Jim Thompson c , Bertha Mjawa d , Kurt Kornbluth e , Diane M. Barrett f, gives mixed – mode type of solar dryer. The temperature found is 10 °C higher than those of normal dryer. Use of concentrating solar panel increased drying rate with 27% decrease in total drying time as compare to initial drying system. The faster drying rate is achieved in both sunny and cloudy conditions.
4) Shobhana Singh, Subodh Kumar, gives laboratory model of mixed –mode solar dryer. This dryer is designed to carried out the drying experiments with cylindrical potato samples. By changing various parameter like thermal energy, air flow rate, food sample thickness and loading density different 16 curves were obseverd. The graph of moisture content- drying time gives new method of performance on solar dryer. Testing is carried out with potato, banana and wheat.
5) Design, construction and performance testing of a solar dryer for agro industrial by-products, I. Montero[a,*], J. Blanco[b], T. Miranda[a], S. Rojas[a], A.R. Celma[a,] This paper gives the prototype of dryer. Prototype is designed, constructed, and testing is carried out. Testing is carried out with various parameter like temperature , relative humidity, air mass flow rate, and effiency for indirect, mixed, passive, active, and hybrid operation modes. The most effective mode found is forced hybrid mode followed by passive, active mode. The analysis of the drying kinetics of the olive pomace shows the better performance of the hybrid and mixed modes, obtaining reductions of the drying time of a 50% in both cases.

3. Testing with Different Method

Moisture removal testing is carried out in three different modes.

1) LPG gas
2) Electric oven
3) Solar grain dryer

Results obtained in all cases are compared.

Table 1: Testing with LPG

Sr No	Grain	Temp °c	Time min	Cylinder weight kg		Grain Weight Kg		Power consumed W	Kw/kg	% Moisture removal
1	Green Gram	90	2.55	17.65	17.64	250	238	3013.04	12.052	5.04
2	Harbara	88	2.55	17.63	17.62	250	238	3188.11	12.752	5.04
3	Groundnut	74	2.5	17.60	17.55	250	238	3107.33	12.429	5.04
4	Peas	85	2.32	17.535	17.530	200	182	3348.42	13.394	9.9

3.1 Testing with LPG Gas

At initial stage to obtain rough information about the temperature requirement for moisture removal we did small experiment on LPG gas**.**

Procedure
1) Take the initial weight of the cylinder on the digital weight
2) Take the initial weight of the grain
3) Dry the grain with help of LPG
4) Note down the time of drying with the help of stopwatch
5) With the help of thermometer take the drying temperature of each grain
6) Take final weight of the cylinder after drying each grain
7) Take final weight of dry grain using digital weight

3.2 Testing with Electric Oven

At obtain rough information about the temperature requirement for moisture removal we did small experiment on electric Oven**.** While performing experiment we take weight of grain after 5 min interval

Table 2: Testing with Electric Oven

Grain	Weight of the grain after 5 min interval					% Moisture Content
	5	10	15	20	25	
Ground Nut	50	48.53	47.44	45.45	44.81	12
Harbara	50	48.9	47.7	45.932	44.932	10.13
Green Gram	50	48.734	47.350	45.330	44.110	1.78
Peas	50	46.136	45.132	44.130	44	11.99

3.3 Testing on Solar dryer

Procedure
1) Place dryer in sunlight in east- west direction
2) Adjust focal distance by turnbuckle
3) Check the aiming and adjust angle of parabola
4) Record temperature at the time of loading grains
5) Feed 250 gm grains in receiver and start the stopwatch
6) After 15 min remove grain from receiver
7) Kept grain in fixed volume box and take weight on digital weight
8) Find moisture content removed from grain

Table 3: Testing with Solar Dryer

Sr no	Grain	Initial Weight kg	Final Weight kg	% moisture removal
1	Ground Nut	119.543	106.07	11.27
2	Harbara	140.799	135.78	10.11
3	Green gram	164.722	139.35	10.40
4	Peas	157.70	141.69	10.14

Figure 2: Photo of Solar Grain Dryer Testing Result

4. Result and Discussion

With this solar dryer we achieved temperature upto 110°c. temperature will rise upto 200 to 250 °c. with some modification like hybridising and automatic tracking arregement.
1) Using renewable energy drying of grain is possible
2) 10% to 12% moisture removal is possible
3) Dust free drying

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