PERFORMANCE EVALUATION OF A SAWDUST BRIQUETTE POWERED DRYER FOR PEPPER PRESERVATION

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ABSTRACT

Agricultural sector is majorly faced with the problem of storage. Researches all over the world are geared towards reducing agricultural wastes encountered due to lack of proper storage of products. This study is targeted to improve the storage of pepper by designing and fabricating a sawdust briquette powered cabinet dryer capable to dry products at a regulated temperature and achieve efficient drying in lesser time, lesser contamination, and retaining of high quality of the products after drying. Briquette was produced by drying sawdust, carbonizing and moulding to serve as fuel for the dryer while a temperature regulator and a blower were incorporated in the design to aid the drying to reduce loss of nutrient. The dryer has a capacity of 1.576kg and results obtained from the performance evaluation carried out on the dryer showed that, it was able to dry pepper within a period of 4 hours 30minutes. The efficiency of the dryer was based on input and output of heat which was 70% and the dryer needed 0.22kg of sawdust briquette to dry the products thereby attaining a final moisture content of 10%. The study recommends that the combustion chamber should have an automated door to regulate the influx of oxygen which helps in combustion and study should be carried out on the effective disposal of ash from the combustion chamber when drying is in progress.

Keywords: Dryer, Sawdust, Briquette, Pepper, Heat Transfer, Drying Rate

1 INTRODUCTION

Drying is a process that involves the removal of moisture from a product using the application of heat. Drying permits long-time storage and continuous supply of product throughout the year and permits the farmer to have a better-quality product. The separation operation involved in drying includes the conversion of solid, semi-solid, or suspension into a solid product through the evaporation of the liquid into a vapor phase through the application of heat. This process is a complex heat and mass transfer process that is dependent on external variables such as humidity, temperature, and other natural variables [1]. During the design considerations, it is essential to consider the moisture content of the product to be dried [2]. The drying rate of products differs from one another that is, whether the material is hygroscopic or non-hygroscopic. While non-hygroscopic materials can be dried to zero moisture level, hygroscopic products will always have residual moisture content [1]. Red peppers are amongst a group of twenty plant species belonging to the *genus Capsicum* of the botanical family *Solanaceae*. Major species used in foods are *Capsicum frutescens* L and *Capsicum annuum* L. Other species include *capsicum chinense*, Capsicum baccatum L, and Capsicum pubescens [3]. Capsicum fruits may be considered as one of the earliest fruits used as a food additive. Plate I show a pictorial view of red pepper. Its usage spans traditional medicines which include treatments for sore throat, cough, toothache, stomach ailments, rheumatism, wound healing, and parasitic infections. Furthermore, the dried ripe fruit of the Capsicum species provides ingredients for skin-conditioning agents, external analgesics, flavouring agents, cosmetic fragrances, and repellant sprays [3].

Plate 1. Red Pepper [4]

Recently, there has been increasing interest in red pepper and capsaicin for dietary strategies to improve all-round health, particularly concerning energy balance and body weight maintenance. This can be seen in areas such as pain relief, effects on the digestive tract, obesity, diabetes, effects on cancer [4]. Dryers are considered very important in the food processing industries and have been improved over the years due to extensive research and innovations. Recently, the most common agricultural dryers are solar dryers but these are relatively expensive especially in rural areas of developing countries. Dryers are classified into two types namely adiabatic and non-adiabatic [5]. Adiabatic dryers expose the solids to a hot gas (usually air) while non-adiabatic dryers are those in which heat is transferred from an external medium. There are numerous types of dryers available and the choice of use of a particular drier depends on what is been dried. In some specific cases, the combination of two or more different types of dryers is required to carry out the drying process, depending on the material's conditions.

2 LITERATURE REVIEW

[6] designed two domestic solar dryers, one consisting of a mirror reflector used in concentrating the sun while the other without a glass reflector. Testing was done in Abraka Delta state of Nigeria and after testing, results showed that the solar dryer with the mirror reflector obtained a total power of 350.00 W during usage thereby allowing it to have a higher temperature and drying efficiency while that without the solar reflector obtained a total power of 330.56 W during usage while the open hair drying recorded 233.15 W. Although, these dryers are majorly meant for small batches of agricultural products, therefore, making it suitable for only domestic use. There was no temperature regulator to control the amount of heat during the drying operation. It was also verified to serve as a means of cooking. [7] designed, fabricated, and tested a charcoal-fired three shelf-dryer for drying agricultural products. The products tested with the dryer included tomatoes, rice, okra, and fish. The dryer consists of a combustion chamber, suction unit, heat exchanger, and drying chamber. The test carried out showed that the dryer performed satisfactorily as it was able to reduce the moisture content of the products to a safe level for storage. The average drying rate was 0.97 kg/h, 25.0 g/h and 15.4 g/h for rice, tomato, and okra respectively with the average drying rate for catfish being 2.40 - 9.0 g/h but the design of the dryer was found to be cumbersome as each unit stood alone and not integrated for simplicity. [8] designed and constructed a vegetable dryer using wood as the major material and the use of stove as the means of heat generation. The dryer was made up of the drying chamber and the heating chamber. The dryer worked efficiently by reducing heat loss which was made possible by the use of wood that is internally insulated. The drying of the vegetable took between 9 to 36 hours without smoke or moisture inside. The choice of material which was majorly plywood is not suitable for all weather and terrain. [9] designed and fabricated a solar dryer for bananas. The dryer has two different airflow configurations known as top flow and bottom flow, forced flow with variable flow rate from 0-3 m/s, and two different mounting schemes (conventional trays and wooded skewers). The drying rate increases when wooden skewers were used instead of conventional trays. [10] carried out a performance evaluation on a solar wind-ventilated cabinet dryer. Heat generation into the system is achieved through the solar air heater which consists of an absorber back plate and also through the solar radiation coming through the transparent walls. A rotary wind ventilator located at the top of the dryer helps in the effective circulation of heated air in the cabinet dryer which is essential in the efficient drying of agricultural products. The products tested

were yam chips and fresh pepper and at the end of the test, it took the pepper three days to achieve 80% weight loss and in the open hair eight days. Also, there was 55% weight loss for yam chips in the dryer compared to six days in the open air. It was also ascertained that the average air velocity when the wind ventilator is used is 1.62 ms^{-1} thereby giving a daylight efficiency of 46.7% as against 31.2% when the wind ventilator was not used. [11] were able to develop and carry out a performance evaluation for a multipurpose dryer that was electrically operated to give a maximum temperature of 110°c with an efficiency of 75%. It was also efficient in distributing hot air at a velocity of 18.7m/s yet there is concern that these good results might not be achievable if the design is to be increased to accommodate more produce. [12] designed and developed an industrial fruit and vegetable dryer to improve the storage of vegetables and reduce vegetable waste. It consists of three unit namely a drying chamber, heat exchanger, and a blower. The thermal efficiency was 84% with a drying capacity of 258.64kg and a drying rate of 40g/hr. Although the dryer performed satisfactorily yet, there is a question of longevity of the designed dryer due to the quality of choice of material used. [13] carried out the design and development of a domestic biscuit cabinet tray dryer solely to be used at home. A comparison was carried out with a similar imported biscuit dryer and it was found out that although the locally designed dryer was relatively cheaper compared to the imported one yet, it also performed satisfactorily like the imported dryer. A t-test analysis was done which resulted in a 95% confidence level, and the result showed that there is no significant difference between the locally fabricated and the imported dryers. The dryer is made up of three sections, the energy source (electricity), blower, and the drying cabinet sections. The energy source is located behind the dryer, which is used to connect the dryer to the electricity source. The blower is located in the middle of the drying chamber and has a power rating of 1.02 Watts. The blower helps in circulating heat for an effective and efficient heat flow rate within the drying cabinet and also helps in maintaining the temperature within the drying chamber. [14] made agricultural and bio-material dryer to be operated by local farmers which was designed and developed to minimize agricultural product waste and improve their storage conditions. The dryer has three units namely, drying chamber, blower, and heat exchanger. Analysis of variation (ANOVA) was used to carry out performance tests and evaluation using okra, pepper, and groundnut as the test materials at an average drying chamber temperature of 50°C for safe drying of the produce. The kilogram weight of the crops decreased with an increase in drying time as drying progressed, so there was no significant difference at a 5% level of significance in the drying rates of the three crops. The dryer has a mean drying capacity of 60.3kg per batch and thermal efficiency of 76.9%. The dryer operated at a drying rate of 0.041kg/hr and at a relative humidity of 35%.

3 METHODOLOGY

The method used is subdivided into three categories; the design of the dryer, fabrication of the dryer, and evaluation performance of the dryer. The design condition and assumption listed in Table 1 were followed to carry out the evaluation of the dryer.

Table 1. Design conditions and assumptions

Items	Conditions and assumptions
Products	Pepper
Density	1.004 2 g/cm^3
Slices	1.4 mm thick
Initial moisture content	80 %
Final moisture content	<10%
Drying time	4 hours
Loading technique	Batch process
Loading rate	300 g per tray of fresh products
Ambient temperature	30ºC
Ambient relative humidity	23%
Maximum allowable temperature	54ºC
Heat source	Briquette
Energy density of briquette	16.31 MJ
The vertical distance between two trays	120 mm

3.1 Design Analysis and Calculations

The amount of moisture to be removed is expressed equation 1 [12].

$$M_R = M\left(\frac{\text{M1-M2}}{\text{1-M2}}\right) \quad (1)$$

Where, M_R is the amount of moisture to be removed (kg), M is the dryer capacity per batch (kg), M_1 is the initial moisture content of pepper 80% relative humidity, M_2 is the maximum dried final moisture content (10%) [1]. Mass of pepper per batch.

$$\text{The volume of pepper per tray} = \text{L x B x H} \quad (2)$$

$$Mass = v \times \rho \quad (3)$$

The quantity of air required to effect drying [12] is expressed as:

$$Q_a = \frac{M_R}{H_{R2}\text{-}H_{R1}} \quad (4)$$

Where, Q_a is the quantity of air required to effect drying, [1] gave the safe drying temperature for pepper in which nutrient will be retained as between 50ºC to 54°. T_1 is the initial temperature at 50ºC (safe drying temperature for drying pepper), T_2 is the final temperature in the dryer at 54ºC, H_{r1} is the initial humidity ratio of air 0.065 dry air at 50ºC, H_{r2} is the final humidity ratio of air 0.087 dry air at 54ºC

The volume of air (m^3) to effect drying [1] is expressed as:

$$V_a = \frac{Q_a}{\rho_a} \quad (5)$$

Where, Qa is the quantity of air in kg, ρ_a is the average density of air at 50ºC is 1.109 kg/m^3.

The amount of heat required to effect drying (H_r) is expressed as: This is the amount of heat anticipated to be just sufficient to reduce the percentage of the moisture content of pepper from 80% to 10% or less which is safe for storage [15]. Therefore, Latent heat of vaporization of water at 50ºC is 2381.6 kJ/kg, Specific heat capacity of pepper = 3.81 kJ/kgºC. Let 1.576 kg of pepper = 100% (both dry and wet matter). 5% (dry matter) of 1.576 kg = 0.0788 kg. For 10% moisture content in the dried matter = $\frac{0.0788 \times 110}{100}$ = 0.08668 kg. 0.08668 – 0.0788 = 0.00788 kg. 0.00788 kg is the moisture content associated with 0.0788 kg of the dry matter. Hence, 1.2259 kg - 0.00788 kg = 1.218 kg. Therefore 1.2259 kg of wet matter must lose at least 1.218 kg of moisture to achieve a 10% dryness ratio. Therefore, the heat required for drying 1.576 kg of original material (H_r) = Heat energy to raise its temperature from 50ºC to 54ºC + Latent heat to remove water.

$$H_r = (M_a \times C_p \times \Delta T) + (M_m \times L) \quad (6)$$

The actual heat required to effect drying (H_D) is expressed as: This represents the energy/kg that will be required to remove 1.218 kg of moisture [1].

$$H_D = \frac{H_r}{1.218\text{ kg}} \quad (7)$$

The heat transfer rate (Q_{ht}) is expressed as: The heat transfer rate for a cylinder [16] is given by the expression.

$$Q_{ht} = \frac{(KA(T_1\text{-}T_2))}{D} \quad (8)$$

Where, Q_{ht} is the heat transfer rate, K is the thermal conductivity of stainless steel = 16.3 w/mK [1], K is the thermal conductivity of mild steel = 43 w/mK, Assuming D is the diameter of heat exchanger = 0.2 m, A is the area of the heat exchanger = 0.25133 m^2, T_1 is the temperature of heated air at 70ºC (343K)

[1], T_2 is the temperature of air in cabinet at 50°C (323K) [1]. The quantity of heat that can be lost through the insulator is given as:

$$q_L = \frac{KAT_{be}}{\delta_x} \quad (9)$$

Where k is the thermal conductivity of fibre glass = 0.04 w/mK, A is surface area = 16.11 m^2, T_{be} is the temperature difference between the hot air in the dryer and the environment, δ_x is the distance $0.02\ m$. Hence net heat transfer. Fan design and capacity: The fan is triggered to suck the heated air and moisture from the drying chamber when the temperature exceeds the required temperature of drying. The heat exchanger then circulates the heated air within the drying chamber. The mass transfer of the moisture away from the drying chamber is aided through the suction fan. Mass of water to be removed from a batch processed. Quantity of heat required to remove moisture content.

$$Q = M_a \times C_p \times \Delta T \quad (10)$$

Where, C_p is the specific heat capacity of water at 4.182 Jkg/K^{-1}, ΔT is the temperature difference between the initial temperature and final temperature (54°C – 50°C). Taking a drying time of 4 hours.

$$\text{Power required for drying} = \frac{\text{quantity of heat}}{\text{drying time}} \quad (11)$$

$$\text{Mass flow rate} = \frac{\text{power}}{C_{pa} \times \Delta T} \quad (12)$$

$$\text{Suction} = \text{mass flow rate} \times \text{specific volume of air} \quad (13)$$

The average density of air at 50°C is 1.109 kg/m^3.

$$\text{Specific volume of air} = \frac{1}{\rho_a} \quad (14)$$

$$\text{The velocity of air through the drying chamber} = \frac{\text{suction}}{\text{area}} \quad (15)$$

The rate of mass transfer (Q_{mtr}) [12]is expressed as:

$$Q_{mtr} = M_c\ A_T(H_{r2}\text{-}H_{r1}) \times q_2 \quad (16)$$

Where, M_c is mass transfer coeffient of free water surface = 0.083 kg/m^{3}s, A_T is total surface area of the tray. The drying rate is expressed as:

$$Rc = \frac{M_d(M_1\text{-}M_2)}{A_S t} \quad (17)$$

Where, R_c is the drying rate, M_d is the total weight of the dried product (0.3502 kg), A_S is the surface area of the tray containing dried pepper (0.1702 m^2), M_1 and M_2 is the initial and final moisture contents, t is drying time. The insulation of the drying chamber [16] is expressed as:

$$\text{Heat power loss} = \frac{K \times A \times (T_2\text{-}T_1)}{d} \quad (18)$$

Where K is the thermal conductivity of fibre glass 0.04 w/mK, A is Area, $T_2 - T_1$ is temperature change, d is Thickness = 0.02 m.

Support frame

Mild steel was chosen as the material for building the support because of its cheaper cost and high weldability property. The crippling stress and the modulus of elasticity for mild steel are 320 N/mm^2 and 205,000 N/mm^2 respectively [1].

$$W = \frac{S_c A}{1+a(\frac{L}{K})^2} \quad (19)$$

But W = S A

Therefore $S = \frac{S_c}{1+a\left(\frac{L_m}{K}\right)^2}$ (20)

Where, L_m is length member, K is least radius of gyration, S_c is cripping stress (320 N/mm^2), S is working stress, A is Rankine –Gordon's constant for the material, W is weight, A is area.

$$W = mh - \rho At \quad (21)$$

Where t is thickness, g = 9.8 m/s^2, ρ is density, total weight for mild steel sheet.

Total area of member $A_t = \frac{\sum W}{S}$ (22)

Therefore, the area of a single member $A_t = \frac{\sum W}{4S}$ (23)

The thermal efficiency of the dryer is expressed as:

Efficiency based on latent heat of vapourisation = $\frac{\text{Heat to evapourate moisture only}}{\text{heat in hot air being supplied}}$ (24)

The dryer efficiency based on the heat input and output in drying air:

$$\eta = \frac{T_1 - T_2}{T_1 - T_a}$$

Where T_1 is inlet temperature to the dryer (ºC), T_2 is the outlet temperature from the dryer (ºC), T_a is the ambient temperature (ºC), 1 kg of briquette will generate 21.1 MJ of energy. Therefore H_r (4.6 MJ) will require $\frac{4.6}{21.1}$ = 0.22 kg of briquette. This implies that 0.22 kg out of 1 kg of briquette was used for the drying operation. Efficiency in generating energy from briquette for the latent heat of vapourisation is therefore $\frac{0.22}{1} \times 100$ = 22 %. The fabricated dryer is seen in Plate 2.

Plate 2. Fabricated Dryer

3.2 Operation Principle of the Dryer

In operation, the solid fuel (briquette) is fired in the combustion chamber; the heated air then passes through the riser tube which is conserved and filtered with the aid of the suction unit, the heated air is conveyed to the drying chamber shown in Figure 1. In the drying chamber, as the heated air passes over the products on the drying trays, drying takes place by heat and mass transfer and the moisture is being sucked out by the fan to reduce moisture content for effective drying and exits through the chimney. The suction fan is powered by a battery which is charged by a solar panel. Connection is flexible and efficiently such as the solar panel itself can power the fan. A thermostat and a relay were incorporated to regulate the shutting down of the fan when dry air falls below the required temperature for drying the products and turn on when the temperature increase to circulate the dry air all through the dryer. The readings of the fresh air inlet and air exit of the drying chamber were recorded, while the atmospheric temperature and relative humidity values were measured and recorded using a digital thermometer/hygrometer. The ambient relative humidity was also measured. The weight of the dried products was weighed and recorded using an electronic weighing scale. Temperatures, relative humidity, and the mass of water evaporated were continuously analysed employing data logging.

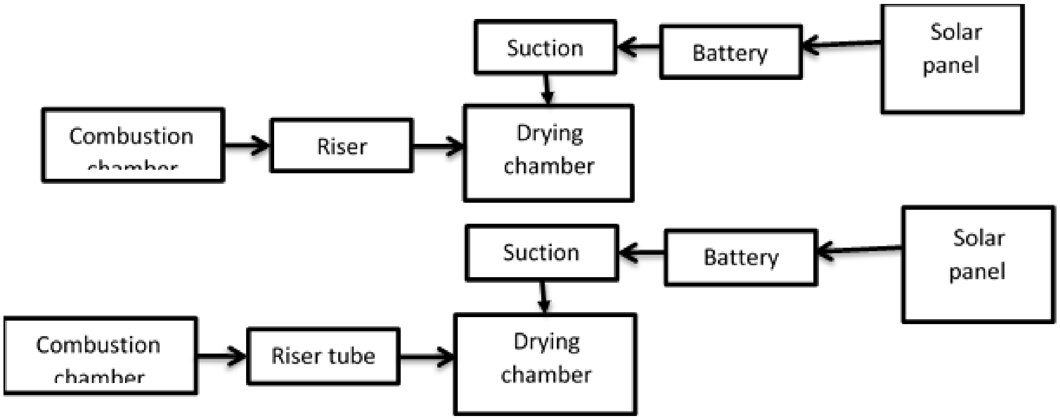

Figure 1. Schematic sketch of dryer operation principle

3.3 Briquetting Process

The sawdust was gotten from Maitunbi sawmill. The sawdust was carbonized in a heating device for hours and then quenched with water. After which the carbonized sawdust was mixed with starch shown in Plate 3.

Plate 3. Carbonized sawdust

3.4 Experimental Procedure

The dryer was heated up for the products (pepper and okra) to be inserted in for drying, the products were put one after the other. The products were all brought at Minna and pepper has an average moisture content of 80 % and okra 86.9 %. Fresh samples were washed, air-dried for 30 minutes and weighed. The weight was recorded as the initial (wet) weight. They were chopped into pieces and dried at a temperature of 54°C for 4 hours to attain a constant weight (the dry weight). The difference between the wet and dried samples was considered as the moisture content. Products (pepper and okra) were weighed and spread inside the tray before inserting into the dryer. The product in each tray was weighed at every interval of 30 minutes for 4 hours for the setup. This was done by rapidly removing the trays from the trolleys, weighing them on an electronic scale, and returning them to the dryer. The moisture content at each interval was calculated from the initial weight of the products in each tray. At the end of drying, when the moisture content of the product has reached 10 % or less the trays were removed from the trolley one at a time to determine the differences in drying rate. This was done repeatedly for each product and all weight was measured and recorded to determine the moisture content.

3.5 Bill of Engineering Measurement and Evaluation (BEME)

Listed in Table 2 are different materials used in the course of the manufacturing of the oven as well as their corresponding costs.

Table 2. Cost of the materials used

S/N	Items	Quantity	Unit Price (₦)	Amount (₦)
1	1’ x 1’ square pipes	3 Length	1500	4,500
2	$1\frac{1}{2}$ Inch Angle Iron	1 Length	2500	2,500
3	18 gauge mild steel plate	1 sheet	8000	8,000
4	24 gauge mild steel plate	1 sheet	6000	6,000
5	0.5mm stainless steel plate	1 sheet	15000	15,000
6	0.8mm stainless steel plate	$\frac{1}{2}$ sheet	22000	11, 000
7	Fibre glass insulation	5kg	8000	8, 000
8	Impeller fan	1	7000	7,000
9	12 v battery	1	7000	7,000
10	Solar panel	30 watts	10000	10,000
11	Thermostat	1	7000	7,000
12	Thermometer/Hygrometer	6	1500	9,000
13	Paint	2 litres	1000	2, 000
14	Rivet pins	$\frac{1}{2}$ pack	2000	1, 000
15	Screws	1 dozen	400	400
16	Thinner	2 litres	500	1, 000
	Labour	-	-	10,000
17	Labour cost			23, 000
	Total			**₦121,000**

4 RESULTS AND DISCUSSION

4.1 Briquette Production

The calorific value of the briquettes produced was 21.1 MJ/kg as obtained from the ultimate analysis of the same fuel as properties are shown in Table 4 and moulded briquettes shown in Plate 3. The results of the various tests carried out are as shown in Figures 2 to 5.

Table 3. Ultimate analysis of the briquettes produced.

Component composition	%
Carbon	62.20
Hydrogen	4.72
Nitrogen	2.01
Oxygen	18.91
Sulphur	0.35
Ash content	11.81

Plate 4. Briquette moulds

As the drying proceeded, from Figure 2, the weight of the samples continued to decrease gradually due to the evaporation or loss of moisture from the pepper samples. This result show dependency of the drying time on drying temperature and thickness. Samples dried at tray 4 and 5 had a shorter drying time because it was close to the combustion chamber. The temperatures increased the amount of water removed, thus decreasing the time required to draw out the moisture from the sample which is in agreement with the results of previous research conducted by [11].

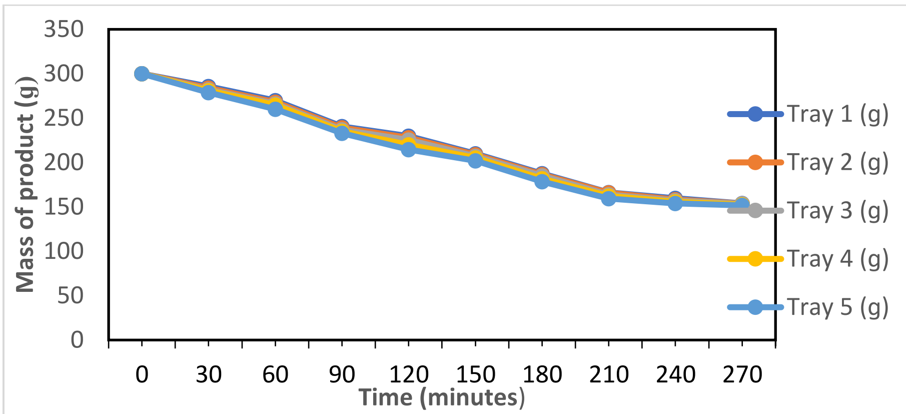

Figure 2. Variation of mass of product for pepper against time

In Figure 3 the water content of the wet samples decreases with drying time for all conditions of temperature and air velocity. However, the drying time varies with the drying conditions, the drying time being lower at increased temperature. The relationship between the moisture loss and the drying time is non-linear, with the initial moisture loss higher due to the release of free moisture, as compared to the latter part of drying. The internal moisture migration is increased by an increase in the heat and the effect of increased temperature on the activity of water, along with the influence on the moisture diffusion coefficient and the enthalpy of vapourisation of the product. Previous research has it that thick pepper slices took more time to dry than thinner ones, as moisture has to travel more distance to the surface by diffusion where the evaporation has to take place. Figure 3 shows a linear trend and afterward, it decreases in a non-linear fashion. This may be attributed to the availability and bonding of water molecules in the food sample. Initially, heat is taken from the source of heat by the sample and only a few portions of the free moisture are evaporated and as the drying advances, the moisture moves out by diffusion. The heat penetrates inside and knocks moisture out leaving a product with decreased water content. This result validates the result of [14].

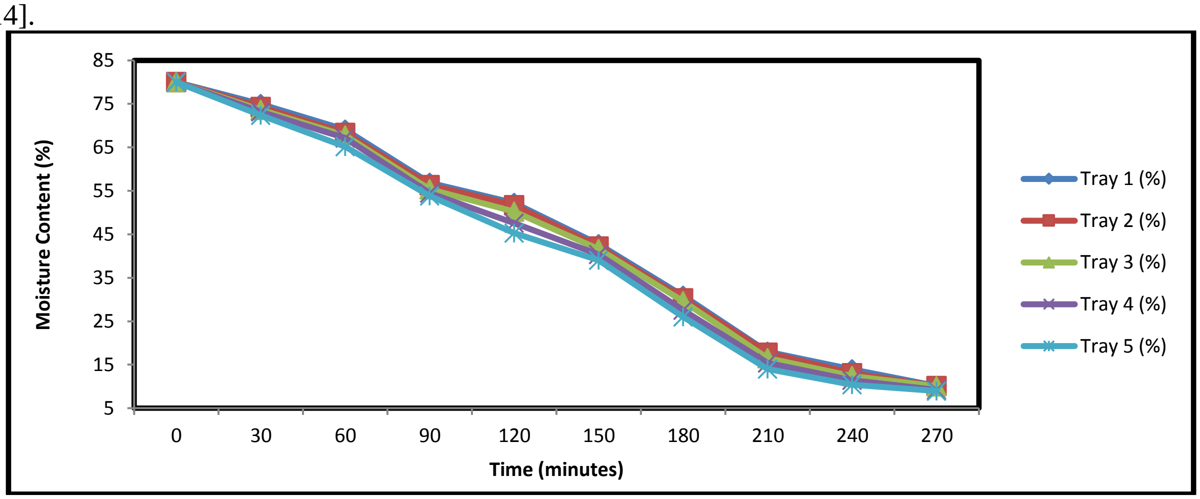

Figure 3. Variation of moisture content of pepper against time

In the beginning, the drying rate increases owing to the availability of free moisture shown in Figure 4. As the water content decreases, due to evaporation, more and more moisture moves out to the surface by diffusion, and thereby further decreasing the amount of water to be evaporated which leads to the decline in the drying rate. At last, the strongly bound water molecules are to be removed by the heat supplied. At this point, the kinetic energy of molecules increases due to which the temperature of air and the substance equals, which decreases the drying rate and finally brings it to an end. Similar findings have been reported by [17].

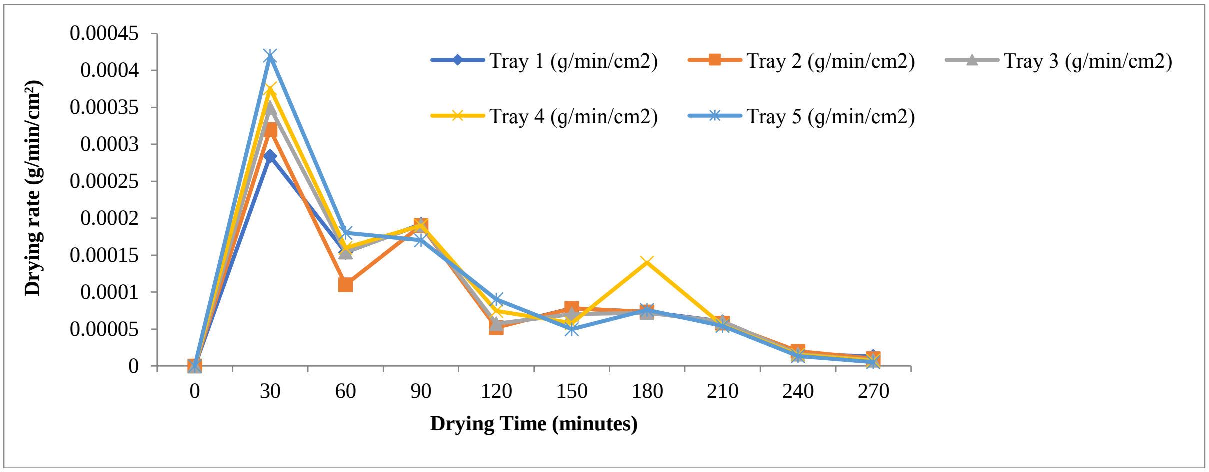

Figure 4. Drying rate of pepper with time

In Figure 5 half of the total moisture, present was removed during the first hour of the drying process. All the pepper samples had total moisture content in the range of 80%. As drying proceeds, a gradual decrease in the water content occurs due to the evaporation of water molecules from the sample. Initially, more than 15% of the moisture content was removed in all samples in the first one hour and more than 59% during the first three hours of drying. Thicker samples (1mm) took more time to dry than slices with a thickness of 0.34 mm. The effect of increasing temperature on the drying of samples is quite evident from the result, as it clearly shows an increase in temperature decreases the time duration of drying. Drying rate as a function of the water content also exhibits non-linear behaviour. In this study, the drying rate was observed to decrease with decreasing moisture content in Figure 5 which is in agreement with the results of previous research conducted by [18]. Overall, drying curves follow the general trends of drying curves, in agreement with the theory of the drying process. This results in a reduction of weight or moisture loss of the pepper. The moisture content of pepper was reduced from 80 % (w.b.) to 10.0 % (w.b.) or 0.3 kg H_2O/kg solids (d.b.) to 0.152 kg H_2O/kg solids (d.b) within almost four hours.

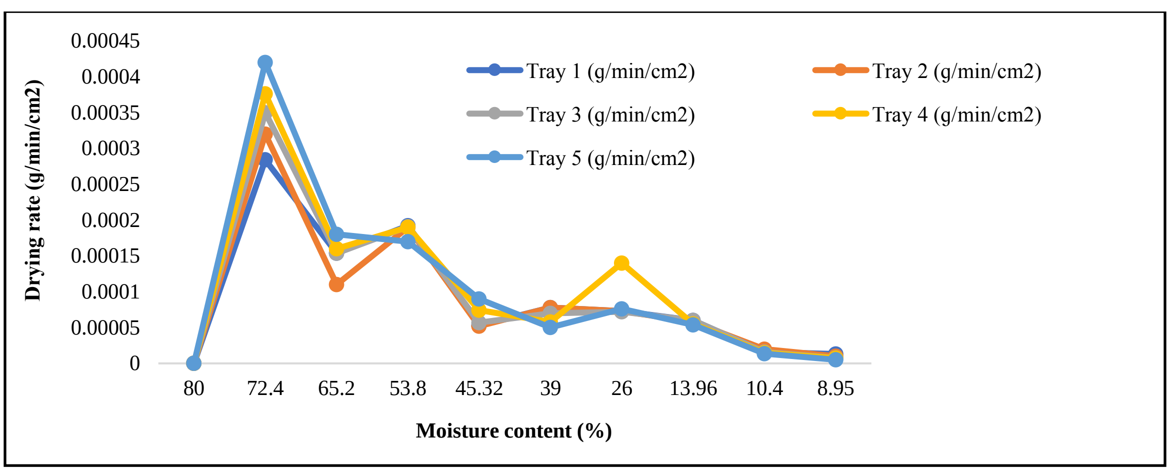

Figure 5. Drying rate of pepper with moisture content

5 CONCLUSIONS

After the completion of fabricating the dryer, the efficiency of the dryer based on input and output of heat was 70% and the dryer needed 22% out of 1kg of the briquette to dry the product. Pepper was dried during the test period with 0.3 kg on each tray. Pepper has a moisture content of 4 hours 30mins to dry. An equal weight of 0.3 kg of each sample was in the tray for drying and the weight differs for each of the product after drying, for pepper the final weight was 0.1517 kg. For the drying rate for pepper, the constant rate was at 240 to 270 minutes which was only for 30 minutes because of the drop in moisture drastically. The problem associated with the Storage of agricultural products has been addressed in this research which focused on the development and performance evaluation of a sawdust briquette powered cabinet dryer. The following conclusions were drawn from the research. The low-cost cabinet dryer was successfully designed and fabricated using locally sourced materials in accordance to specifications. Performance evaluation was carried out which showed that the dryer having a capacity of 1.576 kg/batch was able to dry pepper within a period of 4 hours 30 minutes. Test carried out showed steady progressive reduction in mass and moisture of the product which suggest a fairly even drying rate to attain 10% moisture content. The efficiency of the dryer based on input and output of heat was 70% and the dryer needed 0.22 kg of the briquette to dry the product.

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