



## Studies on the performance of UC Davis Chimney drier on drying of jackfruit pulps

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**Abstract:** The performance of UC Davis chimney drier on drying of jackfruit pulps were carried out at BAU-GPC, Department of Horticulture, Bangladesh Agricultural University, Mymensingh, during January 2017-September 2017. Eight varieties of jackfruits pulp were trialed. The collected jackfruits were washed by running tap water. Peeling off the hard rind of the jackfruits, then were sliced at desirable thickness i.e. 1.0 cm, 0.5 cm. After that sliced pulps were placed on tray for drying. Some trays were placed under UC Davis chimney drier for study and some trays were placed on open with net condition as control. Temperature within UCD was recorded 45°C to 67°C and open with net 26°C to 36°C. Under UCD drier required 7.63 days where open required 10.81 days to dry jackfruits pulp. Under UCD was high in final TSS (37.04%Brix), solar dry matter content (21.19%) and storage time (243.79 days) than open with net (0.00% Brix, 12.92% and 28.06 days respectively). Moisture content (78.81%) and relative humidity (60.27%) was higher in open with net than UCD (87.08% and 43.67% respectively). Thickness of 0.50 cm pulp required less time to dry (8.23 days), higher TSS (18.54%Brix), higher solar dry matter content (18.54%), longer storage periods (137.31 days) than 1.0cm of pulp (10.21 days, 18.50% Brix, 15.57% and 134.54 days respectfully). Panel test under UCD aroma (%), color (%) and taste (%) was higher (77.25%, 56.71% and 51.67% respectfully) than open with net condition (20.33%, 20.54% and 20.25% respectively). Thickness of 0.5cm was higher (48.96% aroma, 39.25% color and 36.25% taste) than 1.0cm (48.62%, 38.00% and 35.67% respectively) pulp.

**Key words:** UC Davis Chimney Drier, Variety, Jackfruit pulps.

### Introduction

Jackfruit (*Artocarpus heterophyllus* L.) is the largest tree borne fruit in the world, reaching up to 50 kg in weight and 60-90 cm in length. Its ranks are third in area under cultivation and second in production among the fruits of Bangladesh. There are 23,174,000 ha of land under jackfruit having an annual production of 9, 28,962,000 MT (BBS, 2016). Jackfruit contains vitamin A, vitamin C, thiamin, iron, sodium, zinc, and niacin among many other nutrients. Jackfruit has a low caloric content where 100 g of jackfruit only contains 94 calories (Mukprasirt and Sajjaanantakul, 2004).

Drying is defined as a process of moisture removal due to simultaneous heat and mass transfer (Ertekin and Yaldiz, 2004). Sun drying is being the most common method in Bangladesh. Sun drying has been reported to affect micronutrients significantly due to direct sunlight exposure to the product, with a possibility of product contamination with dust, insects and animals and a great risk of microbial spoilage.

The passive solar model designed by UC Davis Professors James Thompson and Michael Reid utilizes the chimney effect to dry products with increased air flow. They have helped farmers build and test similar models in California, Thailand and Honduras. They were able to achieve excellent results with this incredibly low-cost and low-tech model for drying products like tomatoes and mangoes, jackfruits etc. The solar dryer is very simple and can be built for about \$100. Thompson is optimistic the dryer design offers promising new low-tech solutions for farmers. According to Thompson, "The UC Davis Chimney Dryer is a significant improvement in solar drying technology. A chimney provides the air movement and the drying chamber design squeezes air through a small area so it flows five times faster than a typical cabinet drier.

In every year, a considerable amount of jackfruit, specially obtained in the glut season (June-July) goes waste (30 to 34 %) due to lack of proper post-harvest knowledge during harvesting, transporting and storing. Processing is important technique for the preservation of jackfruit; it adds diversified and attractive food items in dietary menu

as well as contributes to income generation and employment (Zakari, 2012). Hence the present study was undertaken with the following objectives: to assess the quality of jackfruits pulp after drying; to determine how thickness and orientation to be sliced; to know what is happened in chimney drying process and to know the solar dry matter content (%) of dried jackfruits pulp.

### Materials and Methods

The chimney dryer was constructed by wooden frame. The basic materials needed for the drying section and chimney were; one sheet of 4 mil polyethylene film 10m×3m, a 7m×3m, sheet of black nonwoven fabric plus four 2.5m poles and about 4m of thin wood strips to stabilize the chimney poles. The clear plastic is held above the trays with a 6m pieces of wood positioned just above the trays. The experiment was conducted in a Randomized Complete Block Design (RCBD) with 3 replications. The experiment consisted of three factors: M: Drying condition (O<sub>1</sub>: Open with net, U<sub>1</sub>: Chimney drying); V: Variety (V<sub>1</sub> = AH001, V<sub>2</sub> = H002, V<sub>3</sub> = AH003, V<sub>4</sub> = AH004, V<sub>5</sub> = AH005, V<sub>6</sub> = AH006, V<sub>7</sub> = AH007 and V<sub>8</sub> = AH008) and T: sliced thickness (T<sub>1</sub> = 1.0 cm, T<sub>2</sub> = 0.50 cm).

Jackfruits were collected for physical parameter studied e.g., required time to dry (days), Temperature (°C), Moisture content (%), Solar dry matter content (%), Relative humidity (%), Total soluble solids (% Brix) (initial and final TSS) and storage time (days). After nine months of different varieties of jackfruits drying pulp from UCD and open with net conditions were tested by the post graduate students and under graduate students, respected teachers of BAU by considering the aroma (%), color (%) and taste (%). Panel test are considered by five categories. The analysis was performed by F-test and significance of the difference between pairs of lines means was evaluated by the Least Significance Difference (LSD) test at 5% and 1% level of probability (Gomez and Gomez, 1984).

### Results and Discussion

**Effect of variety on different parameters of jackfruits pulp:** Average temperature was higher (52.96°C) for V<sub>2</sub> than the average lowest temperatures were (44.79°C) for

V<sub>8</sub>. Required time to dry was maximum 10.67 days for V<sub>7</sub> whereas minimum required time to dry was 7.25 for V<sub>1</sub> varieties (Table 1). Moisture (%) was higher 92.06% for V<sub>2</sub> than the moisture (%) was 70.49 % of V<sub>6</sub> varieties. Solar dry matter content was higher 29.51% for V<sub>6</sub> whereas lower dry matter content (%) was 7.94% for V<sub>2</sub>. Initial TSS was higher 22.67% for V<sub>2</sub> and lowest

14.58% for V<sub>3</sub> variety. Final TSS was higher 21.33% for V<sub>2</sub> and lowest 17.58% for V<sub>6</sub> variety. Relative humidity (%) was higher (57.57%) for V<sub>8</sub> whereas lower relative humidity (%) was 48.62% for V<sub>3</sub>. Storage times were higher 158.17 days for V<sub>2</sub> whereas lower storage time was 12.67 days for V<sub>7</sub> varieties.

**Table 1.** Effect of variety on different parameters of jackfruits pulp

Varieties	Required time to dry (days)	Average temp. (°C)	Initial TSS (Brix%)	Final TSS (Brix%)	Initial wt. (g)	Final wt. (g)	SDM content (%)	Moisture content (%)	Storage time (days)	RH (%)
V <sub>1</sub>	7.25	51.79	21.42	20.17	478.75	49.92	10.68	89.32	148.50	50.17
V <sub>2</sub>	7.58	52.96	22.67	21.33	361.00	27.00	7.94	92.06	158.17	49.89
V <sub>3</sub>	8.67	47.92	14.58	16.25	209.25	21.83	11.56	88.44	143.25	48.62
V <sub>4</sub>	9.92	49.77	19.42	19.17	304.25	22.58	8.40	91.60	143.67	48.71
V <sub>5</sub>	10.08	49.01	20.08	17.83	394.25	68.67	15.03	84.97	122.75	53.36
V <sub>6</sub>	9.25	50.76	17.08	17.58	480.25	153.58	29.51	70.49	125.00	50.09
V <sub>7</sub>	10.67	47.34	17.75	18.17	252.50	73.33	25.54	74.46	122.67	57.37
V <sub>8</sub>	10.33	44.79	16.67	17.67	232.00	73.42	27.78	72.22	123.42	57.57
LSD(0.01)	0.137	0.188	0.034	0.049	1.92	4.08	0.468	0.343	1.113	0.255
Level of significance	**	**	**	**	**	**	**	**	**	**

\*\* = Significant at 1% level of probability, SDM=Solar dry matter

**Table 2.** Effect of condition on different parameters of jackfruits pulp

Conditions	Required time to dry (days)	Average temp. (°C)	Initial TSS (Brix%)	Final TSS (Brix%)	Initial wt. (g)	Final wt. (g)	SDM content (%)	Moisture content (%)	Storage time (days)	RH (%)
U <sub>1</sub>	7.63	66.45	18.69	37.04	451.25	94.02	21.19	78.81	243.79	43.67
O <sub>1</sub>	10.81	32.13	18.73	0.00	226.81	28.56	12.92	87.08	28.06	60.27
LSD <sub>0.01</sub>	0.069	0.094	0.017	0.024	0.96	2.04	0.234	0.172	0.556	0.127
Level of significance	**	**	**	**	**	**	**	**	**	**

\*\* = Significant at 1% level of probability, SDM=Solar dry matter, U<sub>1</sub>=UCD chimney drier and O<sub>1</sub>=Open with net

Effect of condition on different parameters of jackfruits pulp: The higher temperature was (66.45°C) for UCD than open condition (32.13°C). Required times to dry was higher (10.81 days) in open with net condition compare to UCD (7.63 days) (Table 2). Moisture content was higher in open condition (87.08%) compare to UCD (78.81%). Solar dry matter content was higher (21.19%) under UCD than the dry matter content (%) was lower (12.92%) in

open with net condition. Final TSS (%) was higher (37.04%) under UCD than the final TSS (% Brix) was lower (0.00%) in open with net condition. Relative humidity (%) was higher (60.27) under open with than was lower (43.67%) at UCD. Storage time was higher (243.79 days) under UCD than was lower (28.06 days) in open with net condition.

**Table 3.** Combined effects of variety and condition on different parameters of jackfruits pulp

variety × Condition	Required time to dry (days)	Average temp. (°C)	Initial TSS (Brix%)	Final TSS (Brix%)	Initial wt. (g)	Final wt. (g)	SDM content (%)	Moisture content (%)	Storage time (days)	RH (%)
V <sub>1</sub> U <sub>1</sub>	6.33	69.13	21.33	40.33	657.50	68.33	10.58	89.42	265.17	40.89
V <sub>1</sub> O <sub>1</sub>	8.17	34.45	21.50	0.00	300.00	31.50	10.79	89.21	31.83	59.44
V <sub>2</sub> U <sub>1</sub>	6.33	70.40	22.67	42.67	407.00	22.17	5.72	94.28	276.00	40.84
V <sub>2</sub> O <sub>1</sub>	8.83	35.52	22.67	0.00	315.00	31.83	10.16	89.84	40.33	58.94
V <sub>3</sub> U <sub>1</sub>	7.83	65.29	14.50	32.50	254.50	17.50	7.02	92.99	255.50	44.23
V <sub>3</sub> O <sub>1</sub>	9.50	30.54	14.67	0.00	164.00	26.17	16.10	83.90	31.00	53.00
V <sub>4</sub> U <sub>1</sub>	7.83	67.25	19.50	38.33	349.00	18.50	5.67	94.33	257.00	43.50
V <sub>4</sub> O <sub>1</sub>	12.00	32.28	19.33	0.00	259.50	26.67	11.14	88.86	30.33	53.92
V <sub>5</sub> U <sub>1</sub>	7.83	66.07	20.33	35.67	640.00	125.50	19.98	80.02	221.83	44.88
V <sub>5</sub> O <sub>1</sub>	12.33	31.95	19.83	0.00	148.50	11.83	5.2	94.80	23.67	61.83
V <sub>6</sub> U <sub>1</sub>	7.33	68.46	16.83	35.17	680.50	243.83	36.33	63.67	225.83	44.73
V <sub>6</sub> O <sub>1</sub>	11.17	33.06	17.33	0.00	280.00	63.33	22.69	77.31	24.17	55.45
V <sub>7</sub> U <sub>1</sub>	8.50	63.28	17.67	36.33	320.00	128.83	40.80	59.20	223.17	45.64
V <sub>7</sub> O <sub>1</sub>	12.83	31.41	17.83	0.00	185.00	17.83	10.28	89.72	22.17	69.10
V <sub>8</sub> U <sub>1</sub>	9.00	61.75	16.67	35.33	301.50	127.50	43.45	56.56	225.83	44.67
V <sub>8</sub> O <sub>1</sub>	11.67	27.83	16.67	0.00	162.50	19.33	12.11	87.89	21.00	70.47
LSD <sub>0.01</sub>	0.194	0.266	0.049	0.069	2.71	5.76	0.662	0.486	1.574	0.360
Level of significance	**	**	**	**	**	**	**	**	**	**

\*\* = Significant at 1% level of probability, SDM=Solar dry matter, U<sub>1</sub>=UCD chimney drier and O<sub>1</sub>=Open with net

**Combined effects of variety and condition on different parameters of jackfruits pulp:** Average temperature was higher (70.40°C) for V<sub>2</sub>U<sub>1</sub> under UCD than UCD condition (61.75°C) for V<sub>8</sub>U<sub>1</sub> whereas average temperature was higher (35.52°C) for V<sub>2</sub>O<sub>1</sub> under open with net condition and lower (27.83°C) for V<sub>8</sub>O<sub>1</sub> under open with net conditions (Table.3). Required times to dry was higher (12.83 days) in open with net condition (V<sub>7</sub>O<sub>1</sub>) compare to UCD (6.33 days) condition. Moisture content

(%) was maximum (94.80%) for open condition (V<sub>5</sub>O<sub>1</sub>) and minimum moisture (%) was in 56.56% (V<sub>8</sub>U<sub>1</sub>) under UCD. Dry matter content was higher (43.45%) under UCD (V<sub>8</sub>U<sub>1</sub>) than the dry matter content (%) was lower (5.20%) for open condition (V<sub>5</sub>O<sub>1</sub>). Relative humidity (%) was higher (70.47%) under open with condition in V<sub>8</sub>O<sub>1</sub> than was lower (40.48%) at UCD in V<sub>2</sub>U<sub>1</sub>. Storage time was higher (276.00 days) under UCD in V<sub>2</sub>U<sub>1</sub> than was lower (21.00 days) in open with net condition at V<sub>8</sub>O<sub>1</sub>.

**Effect of thickness on different parameters of jackfruits pulp:**

Average temperature was higher (49.42°C) for 1.00cm thickness of jackfruits pulp and lower (49.16°C) for 0.5cm thickness of jackfruits varieties. Thickness of 1.0cm pulp slices required higher days (10.21 days) to dry and 0.50 cm thickness of pulp slices required lower days (8.23 days) to dry properly (Table 4). Moisture content was high (84.43%) in 1.0 cm thickness of jackfruits pulp whereas 0.5 cm thickness of jackfruits pulp contained low moisture (81.46%). It was observed that dry matter content was high in 0.5 cm thickness of jackfruits

pulp (18.54%) whereas 15.57% of dry matter in 1.0 cm thickness of jackfruits pulp. TSS was high (18.54%) in 0.5 cm thickness of jackfruits pulp whereas 1.0 cm thickness of jackfruits pulp contained low (18.50%) moisture. Relative humidity was high (52.17%) in 1.0 cm thickness of jackfruits pulp whereas 0.5 cm thickness of jackfruits pulp contained low (51.77%) relative humidity. Storage time was high (137.31 days) in 0.5 cm thickness of jackfruits pulp whereas 1.0 cm thickness of jackfruits pulp contained low (134.54 days) storage time.

**Table 4.** Effect of thickness on different parameters of jackfruits pulp

Thickness	Required time to dry (days)	Average temp. (°C)	Initial TSS (Brix%)	Final TSS (Brix%)	Initial wt. (g)	Final wt. (g)	SDM content (%)	Moisture content (%)	Storage time (days)	RH (%)
T <sub>1</sub>	10.21	49.42	18.73	18.50	438.25	75.88	15.57	84.43	134.54	52.17
T <sub>2</sub>	8.23	49.16	18.69	18.54	239.81	46.71	18.54	81.46	137.31	51.77
LSD <sub>0.01</sub>	0.069	0.094	0.017	0.024	0.96	2.04	0.234	0.172	0.556	0.127
Level of significance	**	**	**	**	**	**	**	**	**	**

\*\* = Significant at 1% level of probability, SDM=Solar dry matter, T<sub>1</sub> = 1.0cm, T<sub>2</sub> = 0.50 cm thickness

**Combined effects of variety and thickness on different parameters of jackfruits pulp:**

Thickness of 1.0cm jackfruits pulp (V<sub>2</sub>T<sub>1</sub>) had higher average temperature (53.21°C) and lower average temperature (44.58°C) in jackfruits pulp of 0.50 cm thickness (V<sub>8</sub>T<sub>2</sub>) (Table 5). Thickness of 1.0 cm jackfruits pulp (V<sub>7</sub>T<sub>1</sub>) required higher days to dry (12.00 days) whereas 0.50 cm thickness of jackfruits pulp (V<sub>1</sub>T<sub>2</sub>) required lower days to dry (6.50 days). Thickness of 1.0 cm jackfruits pulp (V<sub>2</sub>T<sub>1</sub>) had higher percentage (%) of moisture (93.07%) than 0.5 cm thickness of jackfruits pulp (V<sub>6</sub>T<sub>2</sub>) had lower

moisture (69.51%). Thickness of 0.50 cm jackfruits varieties (V<sub>6</sub>T<sub>2</sub>) had higher dry matter content (%) (30.49%) whereas 1.0 cm thickness of jackfruits pulp (V<sub>2</sub>T<sub>1</sub>) had lower percentage of dry matter content (6.93%). Thickness of 1.0 cm jackfruits pulp (V<sub>8</sub>T<sub>1</sub>) had higher percentage of relative humidity (58.13%) than 0.5 cm thickness of jackfruits pulp (V<sub>3</sub>T<sub>2</sub>) had lower relative humidity (48.33%). Thickness of 1.0 cm jackfruits pulp (V<sub>2</sub>T<sub>2</sub>) had longer times storage periods (161.50 days) than 1.0 cm thickness of jackfruits pulp (V<sub>7</sub>T<sub>1</sub>) had lower storage periods (121.17 days).

**Table 5.** Combined effects of variety and thickness on different parameters of jackfruits pulp

Variety × thickness	Required time to dry (days)	Average temp. (°C)	Initial TSS (Brix%)	Final TSS (Brix%)	Initial wt. (g)	Final wt. (g)	SDM content (%)	Moisture content (%)	Storage time (days)	RH (%)
V <sub>1</sub> T <sub>1</sub>	8.00	51.95	21.33	20.17	607.50	59.83	9.87	90.13	147.67	50.33
V <sub>1</sub> T <sub>2</sub>	6.50	51.63	21.50	20.17	350.00	40.00	11.50	88.50	149.33	50.00
V <sub>2</sub> T <sub>1</sub>	8.33	53.21	22.67	21.33	427.00	27.50	6.93	93.07	154.83	49.94
V <sub>2</sub> T <sub>2</sub>	6.83	52.71	22.67	21.50	295.00	26.50	8.95	91.05	161.50	49.83
V <sub>3</sub> T <sub>1</sub>	9.83	48.00	14.67	16.17	243.50	22.67	10.39	89.61	142.67	48.90
V <sub>3</sub> T <sub>2</sub>	7.50	47.83	14.50	16.33	175.00	21.00	12.72	87.28	143.83	48.33
V <sub>4</sub> T <sub>1</sub>	11.00	49.83	19.33	19.17	436.00	29.83	7.07	92.93	142.67	48.92
V <sub>4</sub> T <sub>2</sub>	8.83	49.71	19.50	19.17	172.50	15.33	9.73	90.27	144.67	48.50
V <sub>5</sub> T <sub>1</sub>	11.17	49.02	20.17	17.83	520.00	82.50	12.42	87.58	121.83	53.55
V <sub>5</sub> T <sub>2</sub>	9.00	49.00	20.00	17.83	268.50	54.83	17.64	82.36	123.67	53.17
V <sub>6</sub> T <sub>1</sub>	10.00	50.86	17.17	17.50	623.00	198.00	28.53	71.48	123.67	50.02
V <sub>6</sub> T <sub>2</sub>	8.50	50.67	17.00	17.67	337.50	109.17	30.49	69.51	126.33	50.17
V <sub>7</sub> T <sub>1</sub>	12.00	47.52	17.83	18.17	360.00	100.83	24.19	75.81	121.17	57.57
V <sub>7</sub> T <sub>2</sub>	9.33	47.17	17.67	18.17	145.00	45.83	26.89	73.11	124.17	57.17
V <sub>8</sub> T <sub>1</sub>	11.33	45.00	16.67	17.67	289.00	85.83	25.14	74.87	121.83	58.13
V <sub>8</sub> T <sub>2</sub>	9.33	44.58	16.67	17.67	175.00	61.00	30.42	69.58	125.00	57.00
LSD <sub>0.01</sub>	0.194	0.266	0.049	0.069	2.71	5.76	0.662	0.486	1.574	0.360
Level of significance	**	**	**	**	**	**	**	**	**	**

\*\* = Significant at 1% level of probability, SDM=Solar dry matter, T<sub>1</sub> = 1.0cm, T<sub>2</sub> = 0.50 cm thickness

**Table 6.** Combined effects of condition and thickness on different parameters of jackfruits pulp

Condition × Thickness	Required time to dry (days)	Average temp. (°C)	Initial TSS (Brix%)	Final TSS (Brix%)	Initial wt. (g)	Final wt. (g)	SDM content (%)	Moisture content (%)	Storage time (days)	RH (%)
U <sub>1</sub> T <sub>1</sub>	9.00	66.55	18.71	37.00	588.13	119.13	19.74	80.27	242.04	44.01
U <sub>1</sub> T <sub>2</sub>	6.25	66.35	18.67	37.08	314.38	68.92	22.65	77.35	245.54	43.33
O <sub>1</sub> T <sub>1</sub>	11.42	32.30	18.75	0.00	288.38	32.63	11.40	88.60	27.04	60.33
O <sub>1</sub> T <sub>2</sub>	10.21	31.97	18.71	0.00	165.25	24.50	14.44	85.56	29.08	60.21
LSD <sub>0.05</sub>	0.073	0.100	0.018	0.026	1.02	2.17	0.249	0.183	0.592	0.135
LSD <sub>0.01</sub>	0.097	0.133	0.024	0.034	1.36	2.88	0.331	0.243	0.787	0.180
Level of significance	**	NS	NS	**	**	**	NS	NS	**	**

\*\* = Significant at 1% level of probability, NS = Not significant; SDM=Solar dry matter.

**Combined effects of condition and thickness on different parameters of jackfruits pulp:**

Thickness of 1.0cm fruit pulp under UCD (U<sub>1</sub>T<sub>1</sub>) had higher average temperature (66.55°C) whereas 0.5 cm thickness of fruit slices under open with net (O<sub>1</sub>T<sub>2</sub>) had lower average temperature (31.97°C) (Table 6). Thickness 0.1 cm of fruit slices under open condition (O<sub>1</sub>T<sub>1</sub>) had higher days to dry

(11.42 days) whereas 0.5 cm thickness of fruit slices under UCD (U<sub>1</sub>T<sub>2</sub>) had lower days to dry (6.25 days). Thickness of 1.0cm fruit slices under open with net condition (O<sub>1</sub>T<sub>1</sub>) had higher moisture (88.60%) whereas 0.5 cm thickness of fruit slices under UC (U<sub>1</sub>T<sub>2</sub>) had lower moisture (%) (77.35%). 0.5 cm thickness of fruit slices under UCD (U<sub>1</sub>T<sub>2</sub>) had higher dry matter content (%) (22.65%)

whereas 1.0 cm thickness of fruit slices under open with net ( $O_1T_1$ ) had lower percentage (%) of dry matter content (11.40%). Thickness of 1.0cm fruit slices under UCD ( $U_1T_1$ ) had lower relative humidity (%) (44.01%) whereas 0.50 cm thickness of fruit slices under open with net condition ( $O_1T_1$ ) had higher percentage (%) of relative humidity (60.33%). Thickness of 0.5cm fruit slices under UCD ( $U_1T_2$ ) had longer storage time (245.54 days) whereas 1.0 cm thickness of fruit slices under open with net condition ( $O_1T_1$ ) had lower storage periods (27.04 days).

**Combined effects of variety, condition and thickness on different parameters of jackfruits pulp:** Thickness of 1.0 cm jackfruits pulp under UCD ( $V_2U_1T_1$ ) had higher average temperature ( $70.63^{\circ}C$ ) whereas 0.5 cm thickness of Jackfruits pulp under open condition ( $V_1O_1T_2$ ) had lower average temperature ( $27.67^{\circ}C$ ) (Table 7). Thickness of 1.0cm jackfruits pulp under open condition ( $V_7O_1T_1$ ) required higher days to dry (13.67 days) whereas 0.5 cm

thickness of jackfruits pulp under UCD ( $V_1U_1T_2$ ) required lower days to dry (5.33 days). Thickness of 1.0cm jackfruits pulp under open with net condition ( $V_5O_1T_1$ ) had higher moisture (95.50%) whereas 0.5 cm thickness of jackfruits pulp under UCD ( $V_8U_1T_2$ ) had lower moisture (52.27%). Thickness of 0.5cm jackfruits pulp under open with net condition ( $V_8U_1T_2$ ) had higher dry matter content (47.73%) whereas 1.0 cm thickness of jackfruits pulp under UCD ( $V_5O_1T_2$ ) had lower percentage of dry matter content (4.50%). 0.5 cm thickness of jackfruits pulp under UCD ( $V_1U_1T_2$ ) had lower relative humidity (40.70%) whereas 1.0 cm thickness of jackfruits pulp under open with net condition ( $V_8O_1T_2$ ) had higher percentage of relative humidity (71.26%). Thickness of 0.5cm jackfruits pulp under UCD ( $V_2U_1T_2$ ) had longer storage times (281.33 days) whereas 1.0 cm thickness of jackfruits pulp under open with net drier condition ( $V_8O_1T_2$ ) had shorter storage times (20 days).

**Table 7.** Combined effects of variety, condition and thickness on different parameters of jackfruits pulp

Variety × Condition × thickness	Required time to dry (days)	Average temp. ( $^{\circ}C$ )	Initial TSS (Brix%)	Final TSS (Brix%)	Initial wt. (g)	Final wt. (g)	SDM content (%)	Moisture content (%)	Storage time (days)	RH (%)
$V_1U_1T_1$	7.33	69.25	21.33	40.33	815.00	80.00	9.82	90.18	264.00	41.12
$V_1U_1T_2$	5.33	69.00	21.33	40.33	500.00	56.67	11.33	88.67	266.33	40.67
$V_1O_1T_1$	8.67	34.65	21.33	0.00	400.00	39.67	9.92	90.08	31.33	59.55
$V_1O_1T_2$	7.67	34.25	21.67	0.00	200.00	23.33	11.67	88.33	32.33	59.33
$V_2U_1T_1$	7.33	70.63	22.67	42.67	524.00	25.00	4.77	95.23	270.67	41.01
$V_2U_1T_2$	5.33	70.17	22.67	42.67	290.00	19.33	6.67	93.33	281.33	40.70
$V_2O_1T_1$	9.33	35.79	22.67	0.00	330.00	30.00	9.10	90.91	39.00	58.88
$V_2O_1T_2$	8.33	35.25	22.67	0.00	300.00	33.67	11.22	88.78	41.67	59.00
$V_3U_1T_1$	9.33	65.33	14.67	32.33	309.00	19.67	6.36	93.64	255.00	44.47
$V_3U_1T_2$	6.33	65.25	14.33	32.67	200.00	15.33	7.67	92.33	256.00	44.00
$V_3O_1T_1$	10.33	30.67	14.67	0.00	178.00	25.67	14.42	85.58	30.33	53.33
$V_3O_1T_2$	8.67	30.42	14.67	0.00	150.00	26.67	17.78	82.22	31.67	52.67
$V_4U_1T_1$	9.33	67.25	19.33	38.33	478.00	22.33	4.67	95.33	256.33	44.00
$V_4U_1T_2$	6.33	67.25	19.67	38.33	220.00	14.67	6.67	93.33	257.67	43.00
$V_4O_1T_1$	12.67	32.40	19.33	0.00	394.00	37.33	9.47	90.53	29.00	53.83
$V_4O_1T_2$	11.33	32.17	19.33	0.00	125.00	16.00	12.80	87.20	31.67	54.00
$V_5U_1T_1$	9.33	65.97	20.33	35.67	810.00	150.67	18.60	81.40	220.67	45.10
$V_5U_1T_2$	6.33	66.17	20.33	35.67	470.00	100.33	21.35	78.65	223.00	44.67
$V_5O_1T_1$	13.00	32.07	20.00	0.00	230.00	14.33	4.50	95.50	23.00	62.00
$V_5O_1T_2$	11.67	31.83	19.67	0.00	67.00	9.33	13.93	86.07	24.33	61.67
$V_6U_1T_1$	8.33	68.67	17.00	35.00	936.00	327.67	35.01	64.99	224.33	44.80
$V_6U_1T_2$	6.33	68.25	16.67	35.33	425.00	160.00	37.65	62.35	227.33	44.67
$V_6O_1T_1$	11.67	33.04	17.33	0.00	310.00	68.33	22.04	77.96	23.00	55.24
$V_6O_1T_2$	10.67	33.08	17.33	0.00	250.00	58.33	23.33	76.67	25.33	55.67
$V_7U_1T_1$	10.33	63.30	17.67	36.33	450.00	177.67	39.48	60.52	221.67	46.61
$V_7U_1T_2$	6.67	63.25	17.67	36.33	190.00	80.00	42.11	57.89	224.67	44.67
$V_7O_1T_1$	13.67	31.74	18.00	0.00	270.00	24.00	8.89	91.11	20.67	68.53
$V_7O_1T_2$	12.00	31.08	17.67	0.00	100.00	11.67	11.67	88.33	23.67	69.67
$V_8U_1T_1$	10.67	62.00	16.67	35.33	383.00	150.00	39.16	60.84	223.67	45.00
$V_8U_1T_2$	7.33	61.50	16.67	35.33	220.00	105.00	47.73	52.27	228.00	44.33
$V_8O_1T_1$	12.00	28.00	16.67	0.00	195.00	21.67	11.11	88.89	20.00	71.26
$V_8O_1T_2$	11.33	27.67	16.67	0.00	130.00	17.00	13.11	86.89	22.00	69.67
LSD <sub>0.01</sub>	0.275	0.376	0.069	0.097	3.84	8.15	0.937	0.687	2.23	0.509
Level of significance	**	**	**	**	**	**	**	**	**	**

\*\* = Significant at 1% level of probability.

**Table 8.** Effect of variety on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp

Variety	Aroma (%)	Color (%)	Taste (%)
$V_1$	51.33	47.67	28.33
$V_2$	46.83	44.34	33.00
$V_3$	52.83	46.00	27.33
$V_4$	48.83	37.34	40.17
$V_7$	49.17	36.67	41.50
$V_8$	49.00	33.66	40.00
$V_9$	45.83	28.33	44.83
$V_{10}$	46.50	35.00	32.50
LSD <sub>0.01</sub>	0.64	1.35	1.07
Level of significance	**	**	**

\*\* = Significant at 1% level of probability.

**Panel test on jackfruits pulp after nine months storage of chimney and open with net condition**  
**Effect of variety on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp**

Aroma was higher (52.83%) of  $V_3$  and lower (45.83%) of  $V_7$  of jackfruits pulp drying products (Table 8). Color was

higher (47.67%) of  $V_1$  and lower (28.33%) of  $V_7$  of jackfruits pulp drying products. Taste was higher (44.83%) of  $V_7$  and lower (27.33%) of  $V_3$  of jackfruits pulp drying products.

**Table 9.** Effect of condition on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp

Condition	Aroma (%)	Color (%)	Taste (%)
$U_1$	77.25	56.71	51.67
$O_1$	20.33	20.54	20.25
LSD <sub>0.01</sub>	0.32	0.68	0.53
Level of significance	**	**	**

\*\* = Significant at 1% level of probability;

**Effect of condition on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp**

Aroma was higher (77.25%) in UCD than open with net condition (20.33%). Taste was higher (51.67%) of UCD and lower (20.25%) of open with net condition (Table 9).

UCD color was higher (56.71%) and open with net condition color was lower (20.54%) of the pulp drier product.

**Combined Effect of variety and condition on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp**

Aroma was higher (82%) under UCD in V<sub>1</sub>U<sub>1</sub> than was lower in open with net condition (Table 10). Color was higher (73.33%) under UCD in V<sub>1</sub>U<sub>1</sub> than was lower in open with net condition. Taste was higher (69.67) under UCD in V<sub>9</sub>U<sub>1</sub> than was lower in open with net condition.

**Table 10.** Combined effect of variety and condition on panel test of aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp

Variety x condition	Aroma (%)	Color (%)	Taste (%)
V <sub>1</sub> U <sub>1</sub>	82.00	73.33	36.67
V <sub>1</sub> O <sub>1</sub>	20.67	22.00	20.00
V <sub>2</sub> U <sub>1</sub>	73.33	68.34	45.00
V <sub>2</sub> O <sub>1</sub>	20.34	20.34	21.00
V <sub>3</sub> U <sub>1</sub>	85.67	71.34	34.67
V <sub>3</sub> O <sub>1</sub>	20.00	20.67	20.00
V <sub>4</sub> U <sub>1</sub>	76.34	54.67	59.33
V <sub>4</sub> O <sub>1</sub>	21.33	20.00	21.00
V <sub>7</sub> U <sub>1</sub>	78.00	53.34	63.00
V <sub>7</sub> O <sub>1</sub>	20.34	20.00	20.00
V <sub>8</sub> U <sub>1</sub>	78.00	46.00	60.00
V <sub>8</sub> O <sub>1</sub>	20.00	21.32	20.00
V <sub>9</sub> U <sub>1</sub>	71.67	36.67	69.67
V <sub>9</sub> O <sub>1</sub>	20.00	20.00	20.00
V <sub>10</sub> U <sub>1</sub>	73.00	50.00	45.00
V <sub>10</sub> O <sub>1</sub>	20.00	20.00	20.00
LSD <sub>0.01</sub>	0.91	1.91	1.51
Level of significance	**	**	**

\*\* = Significant at 1% level of probability. U<sub>1</sub>=UCD chimney drier and O<sub>1</sub>=open with net

**Effect of thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp**

Aroma was higher (48.96%) for 0.5cm thickness and lower (48.96%) for 1.0 cm thickness of jackfruits pulp drier products (Table 11). Color was higher (39.25%) for 0.5 cm thickness and lower (38.00%) for 1.0cm thickness of jackfruits pulp drier products. Taste was higher (36.25%) for 0.5cm thickness and lower (35.67%) for 1.0 cm thickness of jackfruits pulp drier products.

**Table 11.** Effect of thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp

Thickness	Aroma (%)	Color (%)	Taste (%)
T <sub>1</sub>	48.62	38.00	35.67
T <sub>2</sub>	48.96	39.25	36.25
LSD <sub>0.05</sub>	0.24	0.51	0.40
LSD <sub>0.01</sub>	0.32	0.68	0.53
Level of significance	**	**	**

\*\* = Significant at 1% level of probability; T<sub>1</sub> = 1.0 cm and T<sub>2</sub> = 0.50cm

**Combined effect of variety and thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp**

Thickness of 1.0cm jackfruits pulp (V<sub>3</sub>T<sub>2</sub>) drier products was higher (57.00%) aroma whereas 1.0 cm thickness of jackfruits pulp (V<sub>8</sub>T<sub>1</sub>) was lower (44.67%) aroma (Table 12). Thickness of 0.5cm jackfruits pulp (V<sub>2</sub>T<sub>2</sub>) drier products was higher (48.67%) color whereas 1.0 cm thickness of jackfruits pulp (V<sub>9</sub>T<sub>1</sub>) was lower (44.67%) color. Thickness of 0.5cm jackfruits pulp (V<sub>4</sub>T<sub>2</sub>) drier products was higher (33.67%) taste whereas 1.0 cm thickness of jackfruits pulp (V<sub>3</sub>T<sub>1</sub>) was lower (25.67%) taste.

**Combined effect of condition and thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp**

Thickness of 0.5cm jackfruits pulp under UCD was higher (77.42%) aroma whereas 1.0 cm thickness of products was lower (77.08%) aroma content (Table 13). Otherwise 0.5 cm thickness of jackfruits pulp drier products was higher (20.50%) aroma than 1.0cm products (20.17%).Thickness of 0.5cm jackfruits pulp under UCD was higher (58.17%) color whereas 1.0cm thickness of products was lower (55.25%) color content. Otherwise 0.5 cm thickness of jackfruits pulp drier products was higher (20.75%) color than 1.0cm products (20.33%).Thickness of 0.5cm jackfruits pulp under UCD was higher (52.33%) taste whereas 1.0cm thickness of products was lower (51.00%) color content. Otherwise 0.5 cm thickness of jackfruits pulp drier products was higher (20.33%) color than 1.0cm products (20.17%).

**Table 12.** Combined effect of variety and thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp

Variety x thickness	Aroma (%)	Color (%)	Taste (%)
V <sub>1</sub> T <sub>1</sub>	47.67	47.33	26.67
V <sub>1</sub> T <sub>2</sub>	55.00	48.00	30.00
V <sub>2</sub> T <sub>1</sub>	47.00	45.34	30.67
V <sub>2</sub> T <sub>2</sub>	46.67	48.67	35.34
V <sub>3</sub> T <sub>1</sub>	50.67	43.34	25.67
V <sub>3</sub> T <sub>2</sub>	57.00	43.34	29.00
V <sub>4</sub> T <sub>1</sub>	55.00	37.34	33.67
V <sub>4</sub> T <sub>2</sub>	40.67	37.34	46.67
V <sub>5</sub> T <sub>1</sub>	48.34	36.00	39.67
V <sub>5</sub> T <sub>2</sub>	50.00	37.34	43.34
V <sub>6</sub> T <sub>1</sub>	46.00	36.00	43.34
V <sub>6</sub> T <sub>2</sub>	52.00	31.32	36.67
V <sub>7</sub> T <sub>1</sub>	46.67	26.67	45.00
V <sub>7</sub> T <sub>2</sub>	45.00	30.00	44.67
V <sub>8</sub> T <sub>1</sub>	44.67	33.34	32.34
V <sub>8</sub> T <sub>2</sub>	48.37	36.67	32.67
LSD <sub>0.05</sub>	0.68	1.44	1.14
LSD <sub>0.01</sub>	0.91	1.91	1.51
Level of significance	**	**	**

\*\* = Significant at 1% level of probability. U<sub>1</sub>=UCD chimney drier and O<sub>1</sub>=open with net

**Table 13.** Combined effect of condition and thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp

Condition x thickness	Aroma (%)	Color (%)	Taste (%)
U <sub>1</sub> T <sub>1</sub>	77.08	55.25	51.00
U <sub>1</sub> T <sub>2</sub>	77.42	58.17	52.33
O <sub>1</sub> T <sub>1</sub>	20.17	20.33	20.17
O <sub>1</sub> T <sub>2</sub>	20.50	20.75	20.33
LSD <sub>0.05</sub>	0.34	0.72	0.57
LSD <sub>0.01</sub>	0.45	0.96	0.76
Level of significance	NS	**	**

\*\* = Significant at 1% level of probability

**Combined effect of variety, condition and thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits pulp**

Thickness of 0.5cm jackfruits pulp drier products (V<sub>4</sub>U<sub>1</sub>T<sub>2</sub>) was higher (92.67%) aroma and 1.0cm (V<sub>4</sub>U<sub>1</sub>T<sub>1</sub>) thickness was lower (60.00%) aroma level under UCD than open with net condition (both 1.0cm and 0.5cm) (Table 14). Thickness of 0.5cm jackfruits pulp drier products (V<sub>4</sub>U<sub>1</sub>T<sub>2</sub>) was higher (76.00%) color and 1.0cm (V<sub>7</sub>U<sub>1</sub>T<sub>1</sub>) thickness was lower (40.00%) color level under UCD than open with net condition (both 1.0cm and 0.5cm). Thickness of 0.5cm jackfruits pulp drier products (V<sub>4</sub>U<sub>1</sub>T<sub>2</sub>) was higher (73.33%) taste and 1.0cm (V<sub>3</sub>U<sub>1</sub>T<sub>1</sub>) thickness was lower (31.33%) taste level under UCD than open with net condition (both 1.0cm and 0.5cm).

**Table 14.** Combined effect of variety, condition and thickness on aroma (%), color (%) and taste (%) of different varieties of jackfruits

Variety x condition x thickness	Aroma (%)	Color (%)	Taste (%)
V <sub>1</sub> U <sub>1</sub> T <sub>1</sub>	74.00	73.33	33.33
V <sub>1</sub> U <sub>1</sub> T <sub>2</sub>	90.00	73.33	40.00
V <sub>1</sub> O <sub>1</sub> T <sub>1</sub>	21.33	21.33	20.00
V <sub>1</sub> O <sub>1</sub> T <sub>2</sub>	20.00	22.67	20.00
V <sub>2</sub> U <sub>1</sub> T <sub>1</sub>	73.33	70.67	40.00
V <sub>2</sub> U <sub>1</sub> T <sub>2</sub>	73.33	66.00	50.00
V <sub>2</sub> O <sub>1</sub> T <sub>1</sub>	20.67	20.00	21.33
V <sub>2</sub> O <sub>1</sub> T <sub>2</sub>	20.00	20.67	20.67
V <sub>3</sub> U <sub>1</sub> T <sub>1</sub>	81.33	66.67	45.33
V <sub>3</sub> U <sub>1</sub> T <sub>2</sub>	90.00	76.00	73.33
V <sub>3</sub> O <sub>1</sub> T <sub>1</sub>	20.00	21.33	20.00
V <sub>3</sub> O <sub>1</sub> T <sub>2</sub>	20.00	20.00	20.00
V <sub>4</sub> U <sub>1</sub> T <sub>1</sub>	60.00	54.67	73.33
V <sub>4</sub> U <sub>1</sub> T <sub>2</sub>	92.67	54.67	45.33
V <sub>4</sub> O <sub>1</sub> T <sub>1</sub>	21.33	20.00	20.00
V <sub>4</sub> O <sub>1</sub> T <sub>2</sub>	21.33	20.00	22.00
V <sub>5</sub> U <sub>1</sub> T <sub>1</sub>	76.00	52.00	59.33
V <sub>5</sub> U <sub>1</sub> T <sub>2</sub>	80.00	54.67	66.67
V <sub>5</sub> O <sub>1</sub> T <sub>1</sub>	20.67	20.00	20.00
V <sub>5</sub> O <sub>1</sub> T <sub>2</sub>	20.00	20.00	20.00
V <sub>6</sub> U <sub>1</sub> T <sub>1</sub>	72.00	52.00	66.67
V <sub>6</sub> U <sub>1</sub> T <sub>2</sub>	84.00	40.00	53.33
V <sub>6</sub> O <sub>1</sub> T <sub>1</sub>	20.00	20.00	20.00
V <sub>6</sub> O <sub>1</sub> T <sub>2</sub>	20.00	22.64	20.00
V <sub>7</sub> U <sub>1</sub> T <sub>1</sub>	73.33	40.00	70.00
V <sub>7</sub> U <sub>1</sub> T <sub>2</sub>	70.00	33.33	69.33
V <sub>7</sub> O <sub>1</sub> T <sub>1</sub>	20.00	20.00	20.00
V <sub>7</sub> O <sub>1</sub> T <sub>2</sub>	20.00	20.00	20.00
V <sub>8</sub> U <sub>1</sub> T <sub>1</sub>	76.67	46.67	44.67
V <sub>8</sub> U <sub>1</sub> T <sub>2</sub>	69.33	53.33	45.33
V <sub>8</sub> O <sub>1</sub> T <sub>1</sub>	20.00	20.00	20.00
V <sub>8</sub> O <sub>1</sub> T <sub>2</sub>	20.00	20.00	20.00
LSD <sub>0.05</sub>	0.97	2.03	1.61
LSD <sub>0.01</sub>	1.29	2.70	2.14
Level of significance	**	**	**

\*\* = Significant at 1% level of probability.

**Conclusion:** In case of condition UCD chimney drier was very helpful to dry in advance than open with net condition. UCD Davis chimney condition average temperature (°C), final TSS (% Brix), solar dry matter (%), storage times (days) was higher than open with net condition. Moisture content (%) and relative humidity (%) was very high in open condition than UCD Chimney drier.

It may be concluded that thickness of 0.50 cm required less times to dry (days), better dry matter content (%), higher final TSS (% Brix) and longer storage time (days) compare to 1.0 cm thickness of jackfruits pulps. Moisture content (%) and relative humidity (%) was higher in 1.0cm thickness than 0.5cm thickness of jackfruit pulps. Panel test of jackfruit pulps under UCD Chimney drier had higher acceptability as aroma (%), color (%) and taste (%) compared to open with net condition. 0.5 cm thickness of jackfruits pulp was higher aroma (%), color (%) and taste (%) quality than 0.1cm thickness of the drier product. So, it may be recommended that UCD chimney drier would be helpful to dry jackfruits pulp compared to open with net condition drying method.

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