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Kerone Research & Development Centre (KRDC),
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HEAT TREATMENT FOR DRYING OF MANGO AND SAPOTA

ISO 9001-2008 | ISO 9001-2015 | EMS 14001 | OHSAS 18001
In Association with SVCH-Technologii, Moscow (Russia)

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Customer :	**M/s Sachin Nale**
Process :	**Heat Treatment for Drying of Mango and Sapota**

TEST REPORT No: 61/KRDC/LAB/17 Mum 04/04/2022

Date Sample reception : 09/04/2022
ID : 61/LAB/04

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Sampling date : 09/04/2022
Product : Mango and Sapota
Requirement : Removal of moisture content till the desired crispiness is achieved
Start Date test : 09/04/2022
End Date test : 10/04/2022

LABORATORY EXPERIMENTAL SET UP:

LAB BATCH CONVECTION + DEHUMIDIFIER HEATING SYSTEM

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LAB BATCH CONVECTION + DEHUMIDIFIER HEATING SYSTEM SPECIFICATIONS:

Heating Zone (width*height*depth)	550*650*550 mm
No. of Heaters	4
Total Heater Power	3 kW
Motor	0.5 HP
No. of trays	7
Tray size (width*height*depth)	600500 X 35
Nominal Capacity of Dehumidifier	1 tr each
Humidity Range of Dehumidifier	20-90%
Max. Ambient Temperature of Dehumidifier	40^{o}C
Water Removal Rate of Dehumidifier	80 lt per day at NTP

LAB BATCH MICROWAVE+CONVECTION HEATING SYSTEM

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LAB BATCH MICROWAVE+CONVECTION SYSTEM SPECIFICATIONS:

Microwave Power	2 KW (CW)
Frequency	2450 MHz ± 50
Convective Power	3.5 KW (airflow 350 I/min at 20°C)
Microwave Exposure Zone (Cavity)	1 Cubic meter
Mode Stirrer	One
Thermal Monitoring System	Single Channel Fiber Optic: Range -40 to 250°C
Exhaust Power	1 HP
Tray size (width*height*depth)	450*950*50 mm

ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (^{o}C)	30^{o}C (±5^{o}C)
Humidity (%)	≤74% RH
Pressure (kN/m2 or kPa)	Not recorded

Note for recommendation: Environmental conditions have a direct impact on test results. Accuracy and consistency of test data are affected by the laboratory conditions.

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EQUIPMENTS USED:

Name of Equipment	Picture of Equipment	Specifications
Compact Thermal Imaging Camera		Model: FLIR E-30 Resolution: 160 x 120 IR Thermal sensitivity of 0.10°C
Moisture Analyzer		Make: Axis Balance Description: Moisture range: 1%(sample 0.02/0.05g), 0.1% (Sample 0.5/5g), 0.01%(Sample>5g)
Thermo Hygrometer		Model No: HTC-2 Temperature accuracy: ±°C (1.8°F) Temperature resolution: 0.1°C (0.2°F) Humidity range: 10%~99% RH Humidity accuracy: ±5% RH Humidity resolution: 1% RH

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on Mango and Sapota to speed up the drying rate. For this experimental run, given sample has been placed on different heating system with suitable parameters. Observations are made after decided time period on the basis of weight of the product, moisture content and appearance.

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ANALYTICAL RESULTS: BATCH CONVECTION + DEHUMIDIFIER HEATING SYSTEM

Trail 1:

Product: Mango
Initial moisture: 78.8%
Initial weight: 125g

Sr. No.	Cycle time (hr/min)	Heater temp. (˚C)	Relative Humidity (%)	Remark, if any
1	1 hr	60	25	Started drying
2	1hr	60	25	Drying
3	1hr	60	25	Drying
4	1 hr 30 min.	60	25	Dried as desired moisture content but crispness not achieved

Total cycle time: 4 hr 30 min.
Final moisture:5.2%
Final weight:23g

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Trail 2:

Product: Sapota
Initial moisture: 73.6%
Initial weight: 125g

Sr. No.	Cycle time (hr.)	Heater temp. (˚C)	Relative Humidity (%)	Remark, if any
1	1 hr	60	25	Started drying
2	1hr	60	25	Drying
3	1hr	60	25	Drying
4	1 hr	60	25	Dried as desired moisture content but crispness not achieved

Total cycle time: 4 hr
Final moisture: 6.7%
Final weight:54g

BEFORE AND AFTER PICTURES OF TREATED SPCIMEN SAMPLE:

Trial 1

a) Untreated

b) Treated

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Trial 2

a) Untreated

b) Treated

ANALYTICAL RESULTS: BATCH CONVECTION + DEHUMIDIFIER HEATING SYSTEM AND BATCH MICROWAVE HYBRID SYSTEM

Trail 3:

Product: Mango
Initial moisture: 78.8%
Initial weight: 125g

Sr. No.	Cycle time (hr/min)	Heater temp. (˚C)	Relative Humidity (%)	Remark, if any
1	2 hr	70	25	Drying
2	2 hr	70	25	Dried and crispness achieved

Total cycle time: 4 hr.
Final moisture:4.2%

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After 2 hr half of the sample of moisture 7.9% treated in batch microwave hybrid heating system:

Product: Mango
Initial moisture: 7.9%

No. of cycle	Cycle time (min)	Microwave Power (kW)	Microwave Temp (˚C)	Heater Temp (˚C)	Remark, if any
1	After 20 min.	0.8	55	60	Dried

Total cycle time:20 min.
No. of cycle: 2
Final moisture:3.6%

Trail 4:

Product: Sapota
Initial weight: 125g

Sr. No.	Cycle time (hr/min)	Heater temp. (˚C)	Relative Humidity (%)	Remark, if any
1	2 hr	70	25	Drying
2	2 hr	70	25	Dried and crispness achieved

Total cycle time: 4 hr
Final moisture:4%

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After 2 hr half of the sample of moisture 10% treated in batch microwave hybrid heating system:

Product: Sapota
Initial moisture: 10%

No. of cycle	Cycle time (min)	Microwave Power (kW)	Microwave Temp (˚C)	Heater Temp (˚C)	Remark, if any
1	After 20 min.	0.8	55	60	Dried

Total cycle time:20 min.
No. of cycle: 2
Final moisture:6%

BEFORE AND AFTER PICTURES OF TREATED SPCIMEN SAMPLE:

Trial 3

a) Untreated

b) Treated

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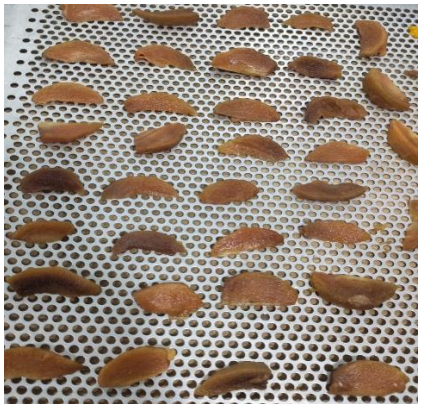
a) Untreated (7.9%)

b) Treated(MW)

Trial 4



a) Untreated

b) Treated

a) Untreated (10%)

b) Treated(MW)

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MOISTURE ANALYSIS REPORT: BATCH CONVECTION + DEHUMIDIFIER HEATING SYSTEM

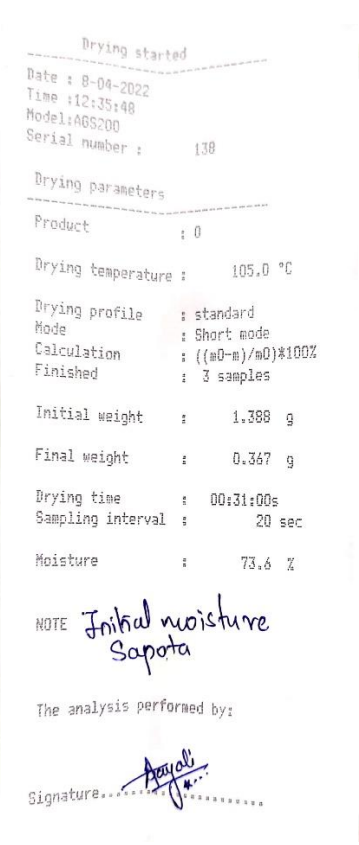
Drying started
Date : 8-04-2022
Time :12:00:08
Model:AGS200
Serial number : 138

Drying parameters
Product : 0
Drying temperature : 105.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 2.590 g
Final weight : 0.549 g
Drying time : 00:53:00s
Sampling interval : 20 sec
Moisture : 78.8 %

NOTE Initial moisture Mango

The analysis performed by:

Signature.....



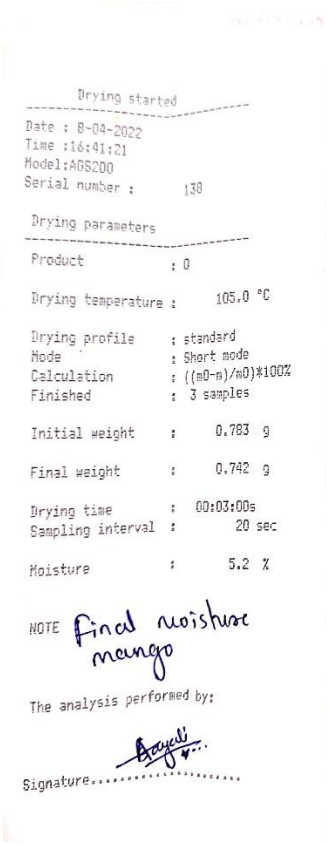
Drying started
Date : 8-04-2022
Time :12:35:48
Model:AGS200
Serial number : 138

Drying parameters
Product : 0
Drying temperature : 105.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 1.388 g
Final weight : 0.367 g
Drying time : 00:31:00s
Sampling interval : 20 sec
Moisture : 73.6 %

NOTE Initial moisture Sapota

The analysis performed by:

Signature.....



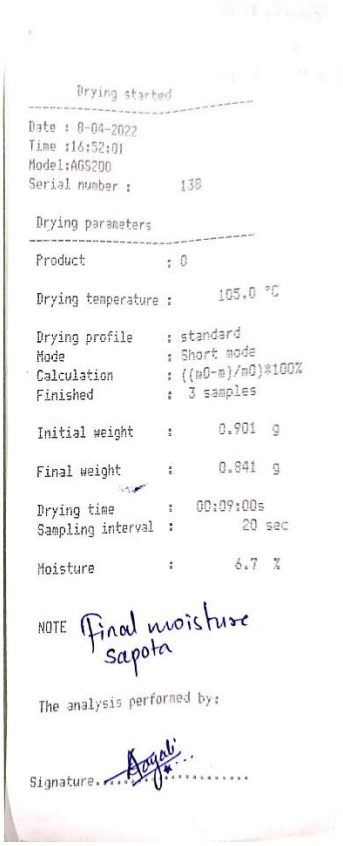
Drying started
Date : 8-04-2022
Time :16:41:21
Model:AGS200
Serial number : 138

Drying parameters
Product : 0
Drying temperature : 105.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 0.783 g
Final weight : 0.742 g
Drying time : 00:03:00s
Sampling interval : 20 sec
Moisture : 5.2 %

NOTE Final moisture mango

The analysis performed by:

Signature.....



Drying started
Date : 8-04-2022
Time :16:52:01
Model:AGS200
Serial number : 138

Drying parameters
Product : 0
Drying temperature : 105.0 °C
Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples
Initial weight : 0.901 g
Final weight : 0.841 g
Drying time : 00:09:00s
Sampling interval : 20 sec
Moisture : 6.7 %

NOTE Final moisture sapota

The analysis performed by:

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MOISTURE ANALYSIS REPORT: BATCH CONVECTION + DEHUMIDIFIER HEATING SYSTEM AND BATCH MICROWAVE HYBRID SYSTEM

Drying started

Date : 8-04-2022
Time :12:00:08
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples

Initial weight : 2.590 g

Final weight : 0.549 g

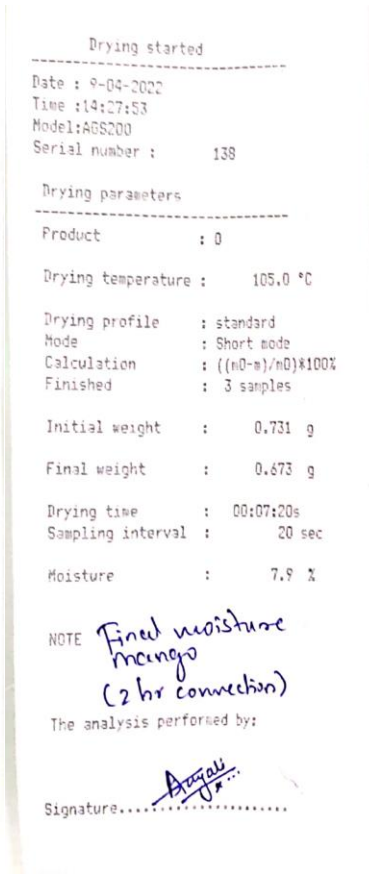
Drying time : 00:53:00s
Sampling interval : 20 sec

Moisture : 78.8 %

NOTE Initial moisture Mango

The analysis performed by:

Signature.....



Drying started

Date : 9-04-2022
Time :14:27:53
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples

Initial weight : 0.731 g

Final weight : 0.673 g

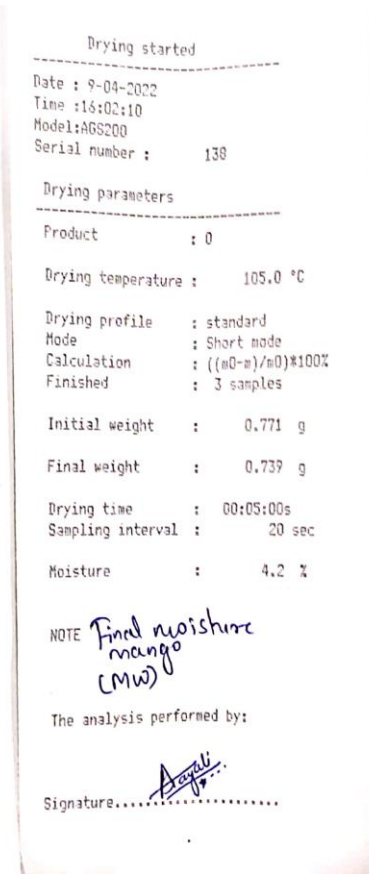
Drying time : 00:07:20s
Sampling interval : 20 sec

Moisture : 7.9 %

NOTE Final moisture mango (2 hr convection)

The analysis performed by:

Signature.....



Drying started

Date : 9-04-2022
Time :16:02:10
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples

Initial weight : 0.771 g

Final weight : 0.739 g

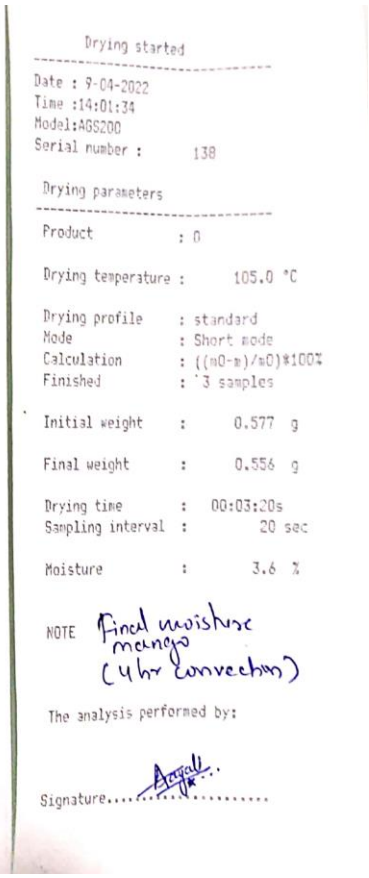
Drying time : 00:05:00s
Sampling interval : 20 sec

Moisture : 4.2 %

NOTE Final moisture mango (MW)

The analysis performed by:

Signature.....



Drying started

Date : 9-04-2022
Time :14:01:34
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples

Initial weight : 0.577 g

Final weight : 0.556 g

Drying time : 00:03:20s
Sampling interval : 20 sec

Moisture : 3.6 %

NOTE Final moisture mango (4 hr convection)

The analysis performed by:

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Drying started

Date : 8-04-2022
Time :12:35:48
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples

Initial weight : 1.388 g

Final weight : 0.367 g

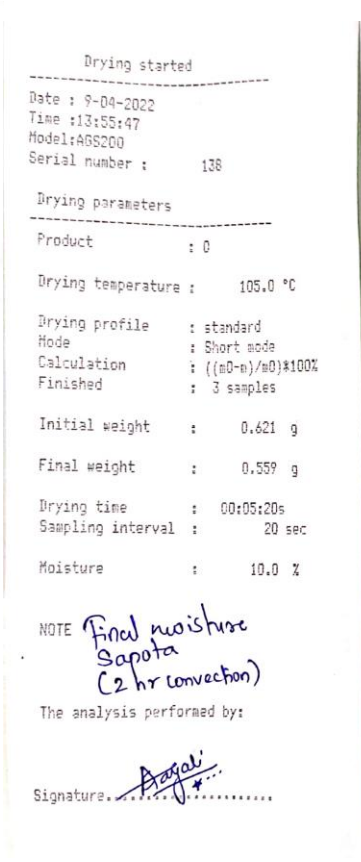
Drying time : 00:31:00s
Sampling interval : 20 sec

Moisture : 73.6 %

NOTE Initial moisture Sapota

The analysis performed by:

Signature.....



Drying started

Date : 9-04-2022
Time :13:55:47
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples

Initial weight : 0.621 g

Final weight : 0.559 g

Drying time : 00:05:20s
Sampling interval : 20 sec

Moisture : 10.0 %

NOTE Final moisture Sapota (2 hr convection)

The analysis performed by:

Signature.....

Drying started

Date : 9-04-2022
Time :16:09:48
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : time over

Initial weight : 0.782 g

Final weight : 0.735 g

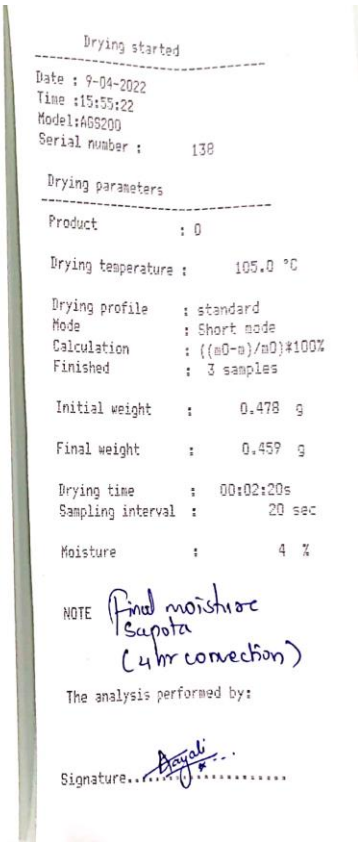
Drying time : 00:05:45s
Sampling interval : 20 sec

Moisture : 6.0 %

NOTE Final moisture Sapota (m/w)

The analysis performed by:

Signature.....



Drying started

Date : 9-04-2022
Time :15:55:22
Model:AGS200
Serial number : 138

Drying parameters

Product : 0

Drying temperature : 105.0 °C

Drying profile : standard
Mode : Short mode
Calculation : ((m0-m)/m0)*100%
Finished : 3 samples

Initial weight : 0.478 g

Final weight : 0.459 g

Drying time : 00:02:20s
Sampling interval : 20 sec

Moisture : 4 %

NOTE Final moisture Sapota (4 hr convection)

The analysis performed by:

Signature.....

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OBSERVATION:

The drying behavior of Mango and Sapota has been investigated under the Microwave + Convection heating system, Vacuum heating system, batch convection + dehumidifier heating system. The drying rate is found to be Increasing with respect to increase in time. It has been found that the product's weight is affected after drying. As per physical investigation, it has been observed that there is no degradation of product except in Microwave system and vacuum system. Also the crispiness and desired moisture was only observed in batch convection + Dehumidifier heating system.

Ms. Sayali Asole
(Tested By)