Kerone Research & Development Centre (KRDC), B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India
Tel- +91-251-2620542/13/44/45/46, Email-info@kerone.com, www.kerone.com

Customer :	**M/s Amalgamated Plantations Private Limited, Kolkata**
Process :	**Continuous Infra-red Heat Treatment for Drying of Turmeric Slices**

TEST REPORT No: 47/KRDC/LAB/17 Mum 02/02/2018

Date Sample reception : 02/02/2018
ID : 47/LAB/17

SAMPLE DESCRIPTION:

Sampling : As requested
Sample Condition : Acceptable
Quantity : 3 kilograms
Sampling date : 03/02/2018
Product : Turmeric Rhizome
Requirement : Final product must be with lowest moisture content.
Start Date test : 03/02/2018
End Date test : 03/02/2018

LABORATORY EXPERIMENTAL SET UP:

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LAB INFRA-RED HEATING SYSTEM SPECIFICATIONS:

IR Medium Wave Emitters	6 Nos (-each having 0.5 kW, 445 mm heating length)
Short Wave IR Emitter with special reflectors	6 Nos (-each having 1 kW, 406 mm heating length)
IR Emitter to Object Distance	120 mm (- in medium wave zone)
IR Emitter to Object Distance	100 mm (- in short wave zone)
Overall IR Heating Zone length	1400 mm
Web width	400 mm
IR wavelength range	0.7 to 10 microns
Direct Exposure of MW IR	500 mm
Direct Exposure of SW IR	750 mm
Temperature Range	0-400^{o}C

Environment-laboratory Ambient Conditions:

Temperature (degree C)	29 degrees C (±5 degrees C)
Humidity (%)	≤ 22 % 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)**

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on green turmeric slices without adding any additive to speed up the drying rate. The turmeric slices blanched in boiling water for 5-7 minutes and blanched slices on a perforated tray has placed in such a manner that there is some space around each slice for air to circulate for achieving even drying characteristics.

For this experimental run, some amount of sample was taken and chopped into slices of thickness about 2-3 mm and placed it on perforated tray and passed through continuous infra-red heating system with low conveyor speed. Observations are made after every pass of 10 minutes on the basis of LOD method by checking weight loss. Also, initial weight before drying and final weight after drying was taken.

ANALYTICAL RESULTS:

Initial sample weight: 1000 grams
Initial Moisture Content: 87.4%
Setting Temperature: 70^{o}C

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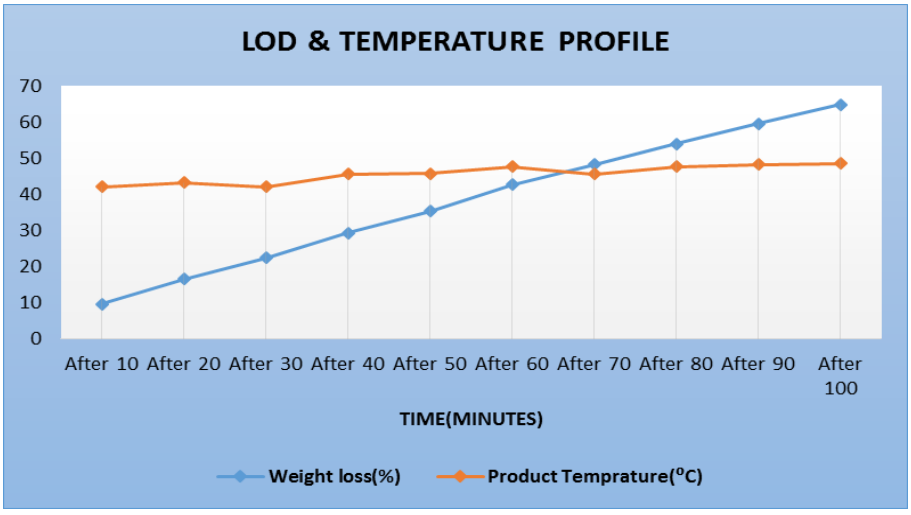
Sr. No.	Time (minutes)	Product Temperature(°C)	Weight noted (grams)	Weight loss (grams)	Remarks, if any
1.	After 10	42.1	904	96	Drying rate started
2.	After 20	43.3	835	165	Drying phase continue
3.	After 30	42	776	224	Variant of Drying rate
4.	After 40	45.6	707	293	Variant of Drying rate
5.	After 50	45.8	647	353	Variant of Drying rate
6.	After 60	47.6	574	426	Variant of Drying rate
7.	After 70	45.6	517	483	Variant of Drying rate
8.	After 80	47.6	461	539	Variant of Drying rate
9.	After 90	48.2	404	596	Variant of Drying rate
10.	After 100	48.6	352	648	Required Drying rate

Sample weight after drying: 352 grams
Total weight loss on drying: 648 grams
Final Moisture Content: 23.4%

GRAPHICAL REPRESENTATION OF DRYING PARAMETERS:



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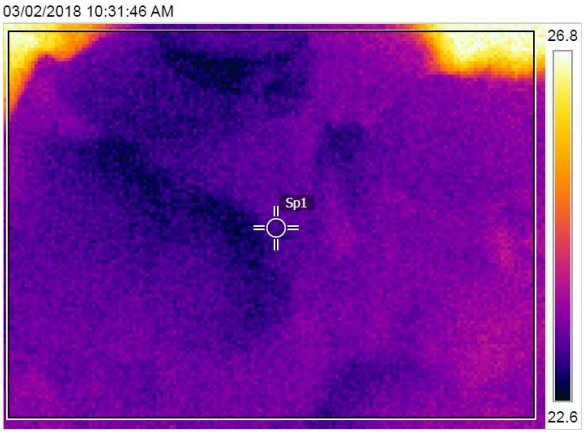
THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:

1. Before Heat Treatment

Measurements		°C
Ar1	Max	27.0
	Min	22.5
	Average	23.5
Sp1		23.2

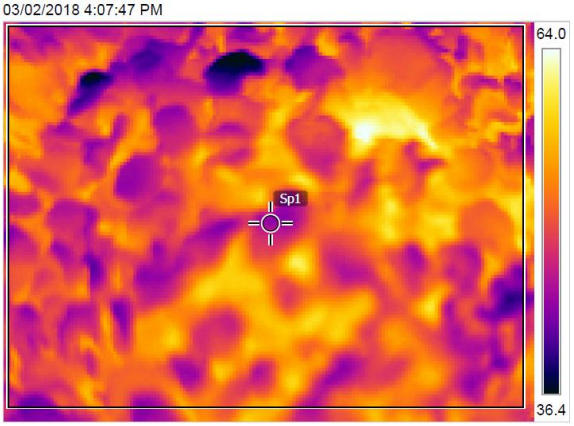
Parameters	
Emissivity	0.95
Refl. temp.	20 °C
Distance	2 m
Relative humidity	50 %
Atm. temp.	33 °C
IR window temp.	20 °C
IR window transmission	1



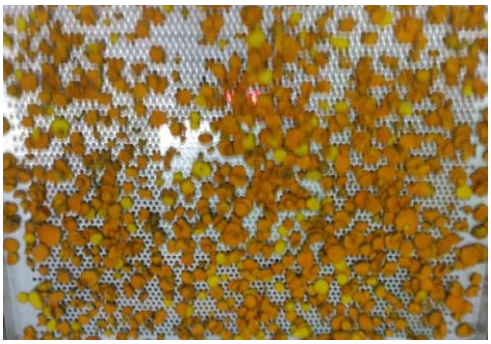
2. After Heat Treatment:

Measurements		°C
Ar1	Max	64.5
	Min	35.9
	Average	50.5
Sp1		43.7

Parameters	
Emissivity	0.95
Refl. temp.	20 °C
Distance	2 m
Relative humidity	50 %
Atm. temp.	33 °C
IR window temp.	20 °C
IR window transmission	1



BEFORE AND AFTER PICTURES OF SPECIMEN SAMPLE:



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Observation:

The Drying behavior of turmeric slices has been investigated under the continuous infra-red heating system. The drying rate is found to be decreasing with respect to increasing drying time. It has been found that the moisture content on the dry basis (%) decreases with respect to increase drying time.

In the processed sample, the fat, fiber, textural and color content has to analyze. As per physical investigation, it has been observed that there is no enzymatic browning, also there is colour change and still some softness is there due to moisture.

Miss Komal Bhoite
Tested By

Dr. Uttam K. Goswami
Approved By