



A CRISIL-NSIC RATED COMPANY
ISO-9001-2008 COMPANY

Member Of



AIMCAL (USA)



A.M.P.E.R.E (EUROPE)

In Association With



ELECTRO MAGNETIC Innovative Technologies

Kerone Research & Development Centre (KRDC),
B/47, Addl. MIDC. Anand Nagar, Ambarnath (East), Thane - 421 506, India
Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com



**Continuous Microwave+Convection Heat
Treatment for Drying of leaves and vegetable**

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



RESEARCH & DEVELOPMENT ASSOCIATES



A CRISIL-NSIC RATED COMPANY

ISO-9001-2008 COMPANY

Kerone Research & Development Centre (KRDC)

B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India

Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Customer:	M/s. Inventicure Technologies Pvt Ltd
Process:	Continuous Microwave+Convection Heat Treatment for Drying of leaves and vegetable

TEST REPORT No: 47/KRDC/LAB/17 Mum 14/04/2021

Date Sample reception : 14/04/2021

ID : 47/LAB/191

SAMPLE DESCRIPTION:

Sampling : As Requested

Sample Condition : Acceptable

Quantity : 1 kg each

Sampling date : 14/04/2021

Product : Moringa leaves, Curry leaves and Beetroot slices

Requirement : Final moisture content should be less than 5%

Start Date test : 14/04/2021

End Date test : 14/04/2021

LABORATORY EXPERIMENTAL SET UP:



Format: F/R&D/01

The value obtained is already corrected for possible recover value stated, if applicable. This document may not be reproduced or disclosed wholly or partly in any part thereof without the written consent of the laboratory management or customer. This document relates only to the specimen samples processed. The processed sample will be kept in this laboratory for 7 days from the date of heat treatment.



Kerone Research & Development Centre (KRDC)

B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India

Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

CONTINUOUS MICROWAVE+CONVECTION HEATING SYSTEM SPECIFICATIONS:

Microwave Power	8.7kW
Frequency	2450 ± 50 MHz
Convective Power	2.5 kW
Microwave Exposure Zone (Cavity)	3000 mm length wise
Product surface temp. range	Max. 120 deg cells
Conveyor width	500mm
Conveyor Speed	Variable 0.2 to 4MPM
Conveyor Motor Drive	1 HP AC Induction with VFD
Entry Vestibule length	1100mm
Exit Vestibule Length	1100 mm
Exhaust Power	1.5 HP

ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	35°C (±5°C)
Humidity (%)	≤30% 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






Kerone Research & Development Centre (KRDC)

B/47, Addl. MIDC. Anand Nagar, Ambarnath (East), Thane- 421 506, India

Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

EQUIPMENTS USED:

Name of Equipment	Picture of Equipment	Specifications
Compact Thermal Imaging Camera		Model: FLIR E-30 Resolution: 160x 120IR 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: $\pm (1.8^{\circ}\text{F})$ Temperature resolution: 0.1°C (0.2°F) Humidity range: 10%~99% RH Humidity accuracy: $\pm 5\%$ RH Humidity resolution: 1% RH

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on given sample of Moringa leaves, Curry leaves and Beetroot slices to speed up the drying rate. For this experimental run, given sample has been placed on conveyor belt of heating system and microwave+convection heating treatment has been given according to requirement to achieve uniform drying. Then, the observations are made on the basis of moisture content, temperature on product, physical appearance and texture of product.

ANALYTICAL RESULTS:

	Trial No. 1	Trial No. 2	Trial No. 3
Sample Name	Moringa Leaves	Curry Leaves	Beetroot slices
Microwave Power (kW)	6	6	6

Format: F/R&D/01



RESEARCH & DEVELOPMENT



A CRISIL-NSIC RATED COMPANY

ISO-9001-2008 COMPANY

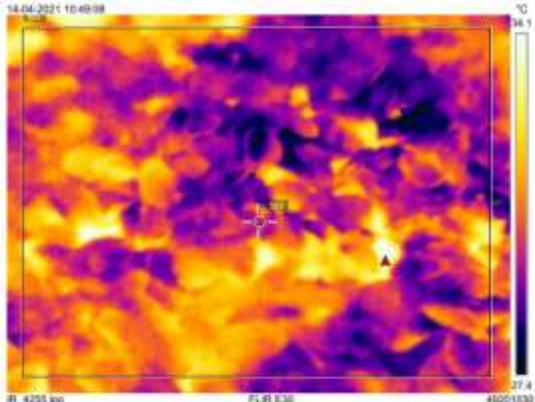
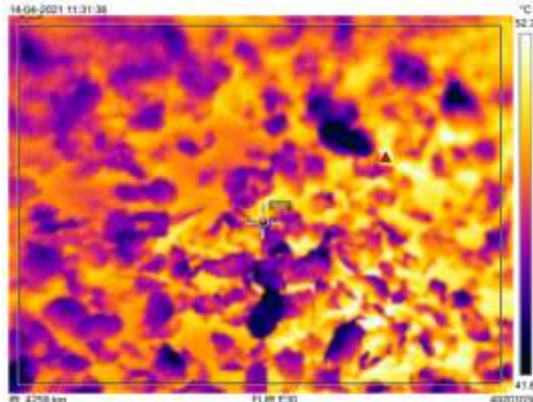
Kerone Research & Development Centre (KRDC)

B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India

Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Setting Temperature (°C)	120	120	120
Exposure Time (minutes)	18.5	18.5	21.5
Initial Weight (grams)	300	500	300
Final Weight (grams)	86	147	45
Temperature on Product (°C)	45-55	55-65	50-60
Initial moisture Content (%)	70.5	70	82.2
Final moisture Content (%)	6.5	5.7	2.6
Remarks, if any	Uniform drying with crunchy texture	Uniform drying with crunchy texture	Uniform drying with crunchy texture

THERMAL IMAGE BEFORE AND AFTER HEAT TRAETMENT:

Sample	Before Heat Treatment	After Heat Treatment																																
Moringa Leaves	<div><div><div>14-04-2021 10:49:08</div><div></div><div>IR_4255.jpgFLIR E3040001830</div></div><div><div>Measurements</div><table><tr><td>Bx1</td><td>Max</td><td>34.2 °C</td></tr><tr><td></td><td>Min</td><td>27.2 °C</td></tr><tr><td></td><td>Average</td><td>30.2 °C</td></tr><tr><td>Sp1</td><td></td><td>29.8 °C</td></tr></table><div>Parameters</div><table><tr><td>Emissivity</td><td>0.95</td></tr><tr><td>Refl. temp.</td><td>20 °C</td></tr></table></div></div>	Bx1	Max	34.2 °C		Min	27.2 °C		Average	30.2 °C	Sp1		29.8 °C	Emissivity	0.95	Refl. temp.	20 °C	<div><div><div>14-04-2021 11:31:38</div><div></div><div>IR_4258.jpgFLIR E3040001036</div></div><div><div>Measurements</div><table><tr><td>Bx1</td><td>Max</td><td>53.0 °C</td></tr><tr><td></td><td>Min</td><td>41.0 °C</td></tr><tr><td></td><td>Average</td><td>47.5 °C</td></tr><tr><td>Sp1</td><td></td><td>45.0 °C</td></tr></table><div>Parameters</div><table><tr><td>Emissivity</td><td>0.95</td></tr><tr><td>Refl. temp.</td><td>20 °C</td></tr></table></div></div>	Bx1	Max	53.0 °C		Min	41.0 °C		Average	47.5 °C	Sp1		45.0 °C	Emissivity	0.95	Refl. temp.	20 °C
Bx1	Max	34.2 °C																																
	Min	27.2 °C																																
	Average	30.2 °C																																
Sp1		29.8 °C																																
Emissivity	0.95																																	
Refl. temp.	20 °C																																	
Bx1	Max	53.0 °C																																
	Min	41.0 °C																																
	Average	47.5 °C																																
Sp1		45.0 °C																																
Emissivity	0.95																																	
Refl. temp.	20 °C																																	

Format: F/R&D/01

The value obtained is already corrected for possible recover value stated, if applicable. This document may not be reproduced or disclosed wholly or partly in any part thereof without the written consent of the laboratory management or customer. This document relates only to the specimen samples processed. The processed sample will be kept in this laboratory for 7 days from the date of heat treatment.

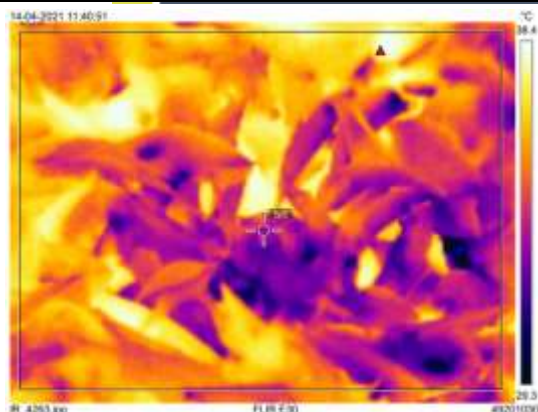


STRUCTURA E RACCOMANDO Assistenza Tecnica/Progettazione

Kerone Research & Development Centre (KRDC)

B/47,Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India

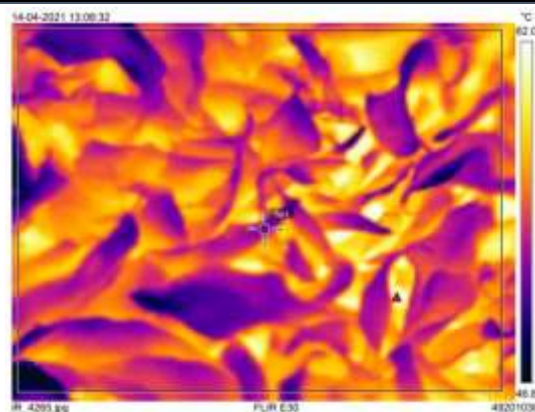
Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

Curry Leaves**Measurements**

Bx1	Max	38.5 °C
	Min	28.7 °C
	Average	34.8 °C
Sp1		33.1 °C

Parameters

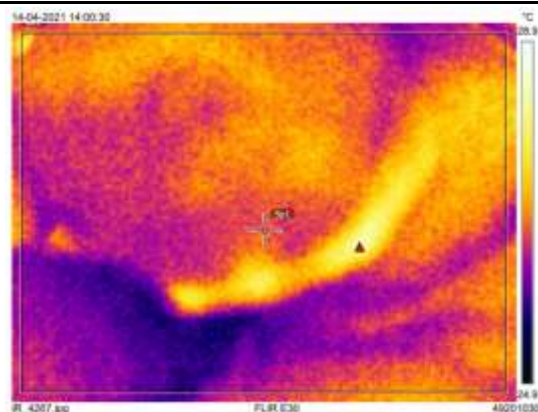
Emissivity	0.95
Refl. temp.	20 °C

**Measurements**

Bx1	Max	62.3 °C
	Min	46.2 °C
	Average	54.8 °C
Sp1		52.0 °C

Parameters

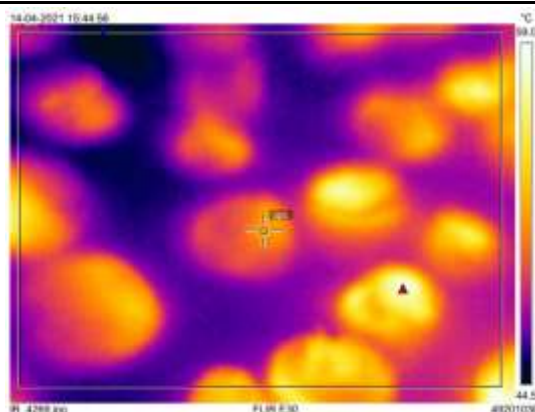
Emissivity	0.95
Refl. temp.	20 °C

Beetroot Slices**Measurements**

Bx1	Max	28.5 °C
	Min	25.4 °C
	Average	26.6 °C
Sp1		26.7 °C

Parameters

Emissivity	0.95
Refl. temp.	20 °C

**Measurements**

Bx1	Max	58.5 °C
	Min	44.5 °C
	Average	48.8 °C
Sp1		51.9 °C

Parameters

Emissivity	0.95
Refl. temp.	20 °C

Format: F/R&D/01

The value obtained is already corrected for possible recover value stated, if applicable. This document may not be reproduced or disclosed wholly or partly in any part thereof without the written consent of the laboratory management or customer. This document relates only to the specimen samples processed. The processed sample will be kept in this laboratory for 7 days from the date of heat treatment.



RESEARCH & DEVELOPMENT ASSOCIATES


KERONE

A CRISIL-NSIC RATED COMPANY







ISO-9001-2008 COMPANY

Kerone Research & Development Centre (KRDC)

B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India

Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

BEFORE AND AFTER PICTURES OF TREATED SPCIMEN SAMPLE:

Sample	Before	After
Moringa Leaves		
Curry Leaves		
Beetroot Slices		

Format: F/R&D/01

The value obtained is already corrected for possible recover value stated, if applicable. This document may not be reproduced or disclosed wholly or partly in any part thereof without the written consent of the laboratory management or customer. This document relates only to the specimen samples processed. The processed sample will be kept in this laboratory for 7 days from the date of heat treatment.



Kerone Research & Development Centre (KRDC)

B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India

Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com

MOISTURE ANALYSIS REPORTS:

Sample	Initial Moisture (%)	Final Moisture (%)	Signature
Moringa leaves	~75	~65	K Komal
Moringa leaves	~75	~65	K Komal
Curry leaves	~75	~65	K Komal
Curry leaves	~75	~65	K Komal
Beetroot slices	~75	~65	K Komal
Beetroot slices	~75	~65	K Komal

OBSERVATIONS:

The heating behavior of Moringa leaves, Curry leaves and Beetroot slices has been investigated under the microwave irradiation mode dryer for drying treatment. It has been found that the moisture content on the dry basis (%) decreases with respect to increase in drying time. As per physical investigation, it has been observed that there is crunchiness in texture without burning and with little color change.

Miss. Komal Bhoite

Tested By