

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

Customer :	M/s Foodiverse, Cairo, Egypt
Process :	Batch Microwave+Convection Heat Treatment for Cooking and Drying of Rice

### TEST REPORT No: 47/KRDC/LAB/17 Mum 25/04/2018

Date Sample reception : 25/04/2018  
ID : 47/LAB/28

#### SAMPLE DESCRIPTION:

Sampling : As Requested  
Sample Condition : Acceptable  
Quantity : 1 kg  
Sampling date : 26/04/2018  
Product : Sushi Rice  
Requirement : Final product must be cooked and dried upto 4-5% moisture content  
Start Date test : 26/04/2018  
End Date test : 26/04/2018

#### LABORATORY EXPERIMENTAL SET UP:



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#### LAB BATCH MICROWAVE HEATING SYSTEM SPECIFICATIONS:


Microwave Power	2 kW(CW)
Frequency	2450 MHz $\pm$ 50
Convective Power	3.5 kW (air flow 350 l/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	1HP
Tray Size	450x950x50 mm

#### ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	29.5°C ( $\pm$ 5°C)
Humidity (%)	$\leq$ 45% RH
Pressure (kN/m <sup>2</sup> 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

#### 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

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Moisture Analyzer		<b>Make:</b> Axis Balance <b>Description:</b> <b>Moisture range:</b> 1%(sample 0.02/0.05g), 0.1% (Sample 0.5/5g), 0.01%(Sample>5g)
Thermo Hygrometer		<b>Model No:</b> HTC-2 <b>Temperature accuracy:</b> $\pm^{\circ}\text{C}$ (1.8 $^{\circ}\text{F}$ ) <b>Temperature resolution:</b> 0.1 $^{\circ}\text{C}$ (0.2 $^{\circ}\text{F}$ ) <b>Humidity range:</b> 10%~99% RH <b>Humidity accuracy:</b> $\pm 5\%$ RH <b>Humidity resolution:</b> 1% RH
Vertical Autoclave		<b>Working Size:</b> 12" dia x 12"ht <b>Rating:</b> 3.0K.W. <b>Pressure Range:</b> upto 2 kg/cm <sup>2</sup>

### SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on sushi rice without adding any additive to speed up the drying rate. For this experimental run, after washing in tap water rice has been partly cooked by steam cooking in vertical autoclave. Then this partly cooked rice on a tray has placed in such a manner that it form uniform layer for air to circulate for achieving even drying characteristics and to achieve uniform microwave exposure within the product and then kept in batch microwave+convection heating system for treatment. The observations are made after every 10 minutes. Also, initial weight before drying, weight after washing, weight after steaming, final weight after drying, initial moisture content, moisture content after washing, moisture content after steaming, final moisture content after treatment, and moisture content after cooking test, i.e., rehydration has been taken.

### ANALYTICAL RESULTS:

**Setting Temperature:** 70 $^{\circ}\text{C}$

**Microwave Power:** 0.5 kW

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Heater: 50°C

Speed: 50%

Initial Sample Weight: 200 grams

Initial Moisture Content: 10.7%

Weight after Washing: 231 grams

Moisture Content after Washing: 16.9%

Weight after Steaming: 246 grams

Moisture content after Steaming: 27%

Sr. No.	Time (minutes)	Weight noted (grams)	Total weight loss(grams)	Temperature on sample(°C)	Remarks, if any
1.	After 10	226	20	63.4	Drying rate started
2.	After 20	209	37	73.2	Drying phase continue
3.	After 30	197	49	88.5	Variant of Drying rate
4.	After 40	189	57	93.2	Variant of Drying rate
5.	After 50	185	61	104.6	Required Drying rate

Sample weight after drying: 185grams

Total weight loss on drying: 61 grams

Final Moisture Content: 3.4%

## MOISTURE ANALYSIS REPORTS:

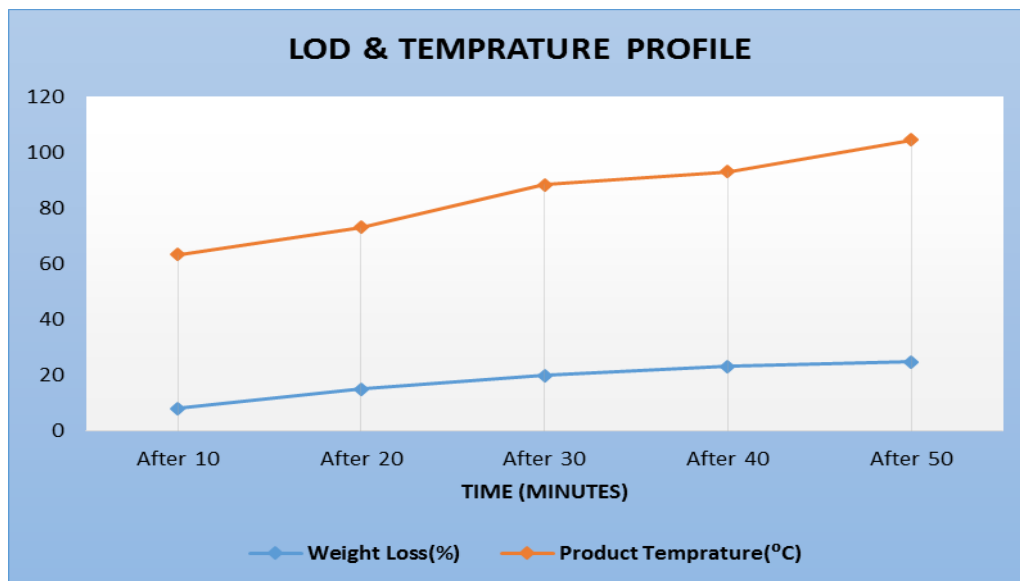
<p>Drying started</p> <p>Date :26-04-2018 Time :12:52:11 Model:405200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : Test</p> <p>Drying temperature : 105.0 °C</p> <p>Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*100% Finished : 3 samples</p> <p>Initial weight : 3.038 g Final weight : 2.713 g</p> <p>Drying time : 00:21:20s Sampling interval : 20 sec</p> <p>Moisture : 10.7 %</p> <p>NOTE Initial</p> <p>The analysis performed by: Signature: <i>K.Komal</i></p>	<p>Drying started</p> <p>Date :26-04-2018 Time :14:47:09 Model:405200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : Test</p> <p>Drying temperature : 105.0 °C</p> <p>Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*100% Finished : 3 samples</p> <p>Initial weight : 3.023 g Final weight : 2.512 g</p> <p>Drying time : 00:19:20s Sampling interval : 20 sec</p> <p>Moisture : 16.9 %</p> <p>NOTE After washing</p> <p>The analysis performed by: Signature: <i>K.Komal</i></p>	<p>Drying started</p> <p>Date :26-04-2018 Time :16:34:17 Model:405200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : Test</p> <p>Drying temperature : 105.0 °C</p> <p>Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*100% Finished : 3 samples</p> <p>Initial weight : 3.041 g Final weight : 2.219 g</p> <p>Drying time : 00:43:20s Sampling interval : 20 sec</p> <p>Moisture : 27.0 %</p> <p>NOTE After Steaming</p> <p>The analysis performed by: Signature: <i>K.Komal</i></p>	<p>Drying started</p> <p>Date :26-04-2018 Time :17:14:41 Model:405200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : Test</p> <p>Drying temperature : 105.0 °C</p> <p>Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*100% Finished : 3 samples</p> <p>Initial weight : 3.030 g Final weight : 2.933 g</p> <p>Drying time : 00:08:00s Sampling interval : 20 sec</p> <p>Moisture : 3.4 %</p> <p>NOTE After MW treatment</p> <p>The analysis performed by: Signature: <i>K.Komal</i></p>
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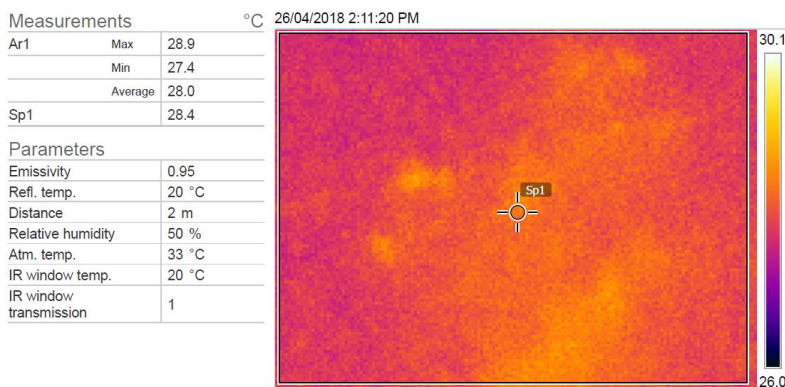
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## GRAPHICAL REPRESENTATION OF DRYING PARAMETERS:

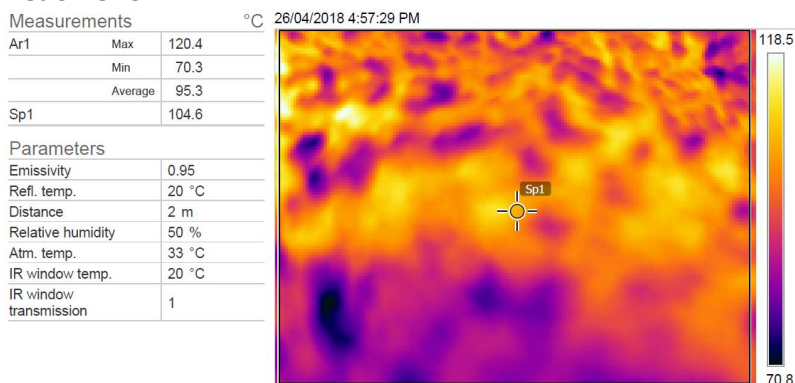


## THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:

### 1. Before Heat Treatment



### 2. After Heat Treatment:



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Tel- +91-251-2620542/13/44/45/46, Email-[info@kerone.com](mailto:info@kerone.com), [www.kerone.com](http://www.kerone.com)**BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE****PICTURES OF GRAIN SIZE AFTER EVERY TREATMENT:****INITIAL****AFTER  
STEAMING****FINAL****COOKING TEST:**

For cooking test, little amount of treated sample has been taken in a mug and then boiled water added to it and covered it for 2 minutes followed by stirring.

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## MOISTURE GAINED AFTER COOKING TEST:

Drying started

Date : 26-04-2018  
Time : 18:30:32  
Model : AGS200  
Serial number : 138

Drying parameters

Product : Test

Drying temperature : 105.0 °C

Drying profile : standard  
Mode : Short mode  
Calculation :  $((w_0 - w)/w_0) \times 100\%$   
Finished : 3 samples

Initial weight : 3.062 g  
Final weight : 1.790 g

Drying time : 00:39:40s  
Sampling interval : 20 sec

Moisture : 41.5 %

NOTE After cooking test

The analysis performed by:

*K Komal*  
Signature.....

## OBSERVATIONS:

The Drying behavior of steamed rice has been investigated under the microwave+convection irradiation mode dryer. The drying rate is found to be increasing 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. As per physical investigation, it has been observed that there is crunchiness in texture without burning and there is little colour change to yellowish.

*K Komal*

Miss Komal Bhoite  
Tested By

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