

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](mailto:info@kerone.com), [www.kerone.com](http://www.kerone.com)

Customer :	M/s. Rishikesh Exports
Process :	Batch Vacuum Microwave Dehydrator Treatment for Drying of Boiled Rice

### TEST REPORT No: 47/KRDC/LAB/17 Mum 12/07/2021

Date Sample reception : 12/07/2021  
ID : 47/LAB/02

#### SAMPLE DESCRIPTION:

Sampling : As Requested  
Sample Condition : Acceptable  
Quantity : 1 kg  
Sampling date : 12/07/2021  
Product : Rice (Heritage Super Dabur)  
Requirement : Final product must be cooked and dried fully  
Start Date test : 12/07/2021  
End Date test : 12/07/2021

#### LABORATORY EXPERIMENTAL SET UP:



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#### LAB BATCH MICROWAVE HEATING SYSTEM SPECIFICATIONS:

Magnetron Power Generator Rating	Air Cooled 1.45KW/2450+50 MHZ x 1 No.
Convection Power	1.5 KW
Total Heater Power	3KW (MW 1.45KW + Convection 1.5KW)
Supply Voltage required	230V 2Ph supply
Cavity Chamber (LxWxH) in mm	620X670X640
Cavity Chamber (INNER) in mm	L-300 & Ø220
Vacuum Pump Rating	560W, 220V/50Hz, 2880rpm
Free Air Displacement	10.7 CFM

#### ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	26°C (±5°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: $\pm^{\circ}\text{C}$ (1.8°F) Temperature resolution: 0.1°C (0.2°F)  Humidity range: 10%~99% RH Humidity accuracy: $\pm 5\%$ RH Humidity resolution: 1% RH
Vertical Autoclave		Working Size: 12" dia x 12"ht Rating: 3.0K.W. Pressure Range: upto 2 kg/cm <sup>2</sup>

### **SAMPLE PREPARATION AND METHOD/PROCEDURE:**

The experiment has been performed on Basmati Rice (Heritage) to speed up the drying rate. For this experimental run, after washing under tap water, rice has been partly cooked by steaming in vertical autoclave upto the pressure of 1 kg/cm<sup>2</sup> for 15-20 minutes. Later, this

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parboiled rice is placed on a tray in such a manner that it forms a uniform layer and kept in Batch Vacuum Microwave Dehydrator system. The observations are made after every 5 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:

Initial Wt. of rice- 250g  
Weight of rice after washing-249 g  
Weight of rice after steaming-576 g  
Initial moisture of untreated rice-3.7%  
Moisture of washed rice- 14.2%  
Initial moisture of rice- 56.2%

### CYCLE NO.1-

Microwave Power: 0.6 kW (40% Capacity)  
Heater: 55°C (switch 1)  
Cycle Time- 15 mins

Cycle Time	Weight noted (grams)	Total weight loss(grams)	Total weight loss( in % )	Remarks, if any
After 15min	429	138	24.3%	Drying rate started

### CYCLE NO.2-

Microwave Power: 0.6 kW (40% Capacity)  
Heater: 40°C (switch 1)  
Cycle Time- 5 mins

Total Time	Weight noted (grams)	Total weight loss(grams)	Total weight loss( in % )	Remarks, if any
After 20min	374	55	12.82%	Drying phase continue

### CYCLE NO.3-

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**Microwave Power: 0.6 kW (40% Capacity)**

**Heater: 20°C (switch 1)**

**Cycle Time- 5 mins**

Total Time	Weight noted (grams)	Total weight loss(grams)	Total weight loss( in % )	Remarks, if any
After 25min	330	44	11.76%	Drying phase continue

#### **CYCLE NO.4-**

**Microwave Power: 0.6 kW (40% Capacity)**

**Heater: 20°C (switch 1)**

**Cycle Time- 5 mins**

Total Time	Weight noted (grams)	Total weight loss(grams)	Total weight loss( in % )	Remarks, if any
After 30min	304	26	7.87%	Drying phase continue

#### **CYCLE NO.5-**

**Microwave Power: 0.6 kW (40% Capacity)**

**Heater: 20°C (switch 1)**

**Cycle Time- 5 mins**

Total Time	Weight noted (grams)	Total weight loss(grams)	Total weight loss( in % )	Remarks, if any
After 35min	270	34	11.18%	Drying phase continue

#### **CYCLE NO.6-**

**Microwave Power: 0.6 kW (40% Capacity)**

**Heater: 20°C (switch 1)**

**Cycle Time- 5 mins**

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Total Time	Weight noted (grams)	Total weight loss(grams)	Total weight loss( in % )	Remarks, if any
After 40min	250	20	7.4%	Drying phase continue

### CYCLE NO.7-

Microwave Power: 0.6 kW (40% Capacity)

Heater: 20°C (switch 1)

Cycle Time- 5 mins

Total Time	Weight noted (grams)	Total weight loss(grams)	Total weight loss( in % )	Remarks, if any
After 45min	238	12	4.8%	Drying complete

Final weight after drying: 238 grams

Final Moisture Content: 4.7%

### MOISTURE ANALYSIS REPORTS:

<p>Drying started</p> <p>Date :12-07-2021 Time :11:08:14 Model:AGS200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : 0</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 : 1.342 g Final weight : 1.311 g</p> <p>Drying time : 00:07:20s Sampling interval : 20 sec</p> <p>Moisture : 3.7 %</p> <p>NOTE Initial moisture of Untreated Rice</p> <p>The analysis performed by: D</p> <p>Signature: <i>Komal</i></p>	<p>Drying started</p> <p>Date :12-07-2021 Time :12:17:55 Model:AGS200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : 0</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 : 1.189 g Final weight : 1.020 g</p> <p>Drying time : 00:09:00s Sampling interval : 20 sec</p> <p>Moisture : 14.2 %</p> <p>NOTE Moisture after Washing of Rice</p> <p>The analysis performed by: D</p> <p>Signature: <i>Komal</i></p>	<p>Drying started</p> <p>Date :12-07-2021 Time :13:09:41 Model:AGS200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : 0</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 : 1.447 g Final weight : 0.634 g</p> <p>Drying time : 00:22:00s Sampling interval : 20 sec</p> <p>Moisture : 55.7 %</p> <p>NOTE Moisture of Boiled</p> <p>The analysis performed by: D</p> <p>Signature: <i>Komal</i></p>	<p>Drying started</p> <p>Date :12-07-2021 Time :14:25:37 Model:AGS200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : 0</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 : 2.020 g Final weight : 1.924 g</p> <p>Drying time : 00:08:00s Sampling interval : 20 sec</p> <p>Moisture : 4.7 %</p> <p>NOTE final moisture of Rice after treating in Vacuum MW + Convection Heater for 50mins.</p> <p>The analysis performed by: D</p> <p>Signature: <i>Komal</i></p>	<p>Drying started</p> <p>Date :12-07-2021 Time :15:41:49 Model:AGS200 Serial number : 138</p> <p>Drying parameters</p> <p>Product : 0</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 : 1.565 g Final weight : 1.393 g</p> <p>Drying time : 00:15:00s Sampling interval : 20 sec</p> <p>Moisture : 10.9 %</p> <p>NOTE Moisture of Rehydrated Rice (after cooking Test)</p> <p>The analysis performed by: D</p> <p>Signature: <i>Komal</i></p>
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### AFTER PICTURES OF TREATED SPECIMEN SAMPLE:

Untreated Rice



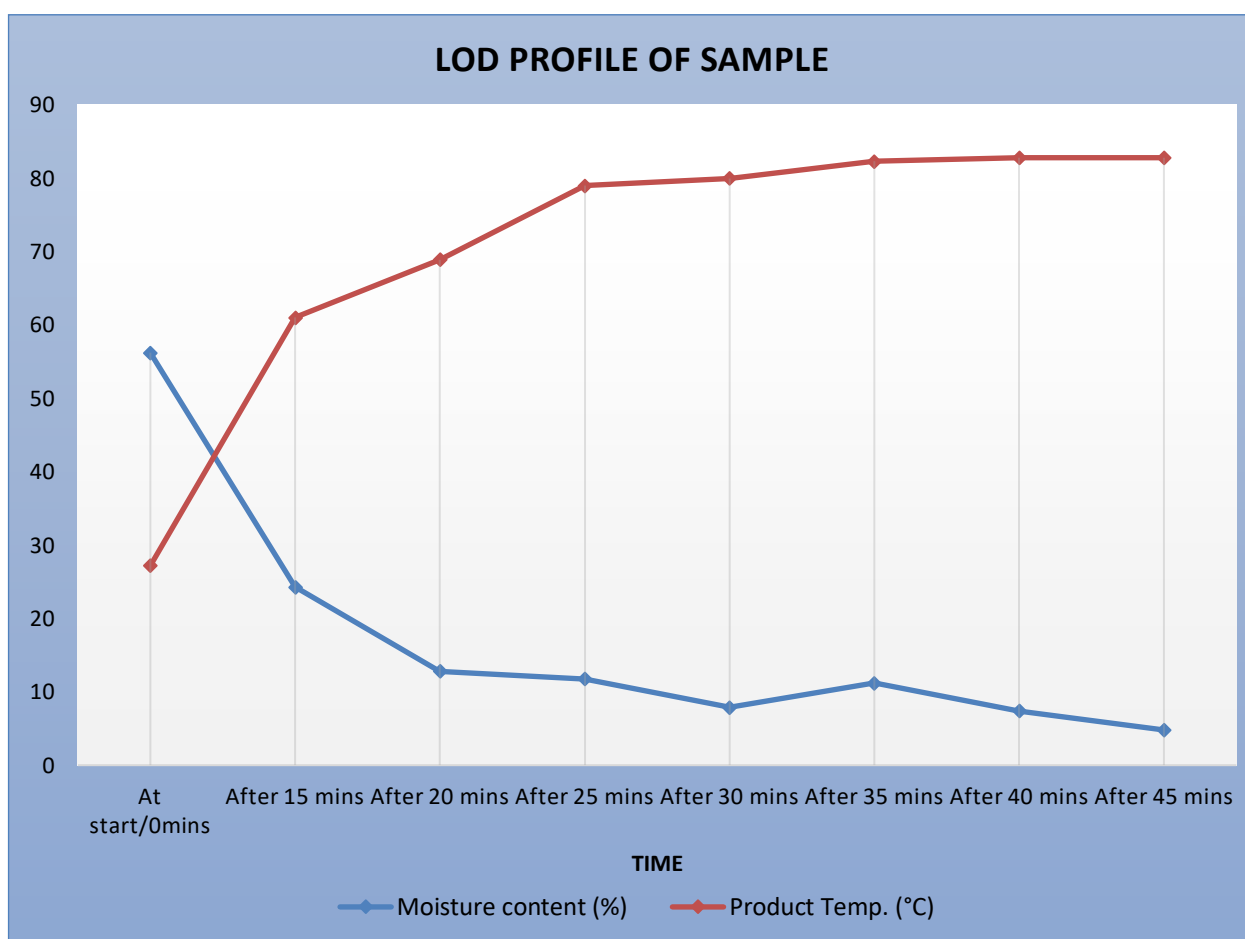
Steamed Rice



Dehydrated Rice



### GRAPHICAL REPRESENTATION OF DRYING PARAMETERS:



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## THERMAL ANALYSIS REPORTS:

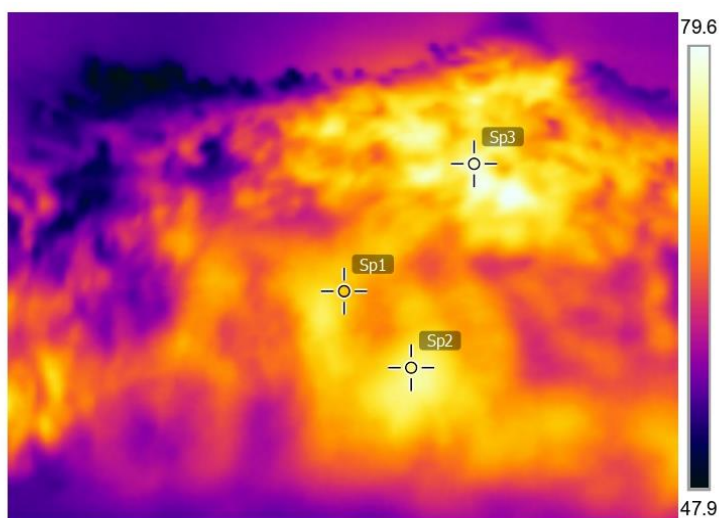
### During 4<sup>th</sup> Cycle:

#### Measurements

Sp1	70.3 °C
Sp2	75.2 °C
Sp3	77.9 °C

#### Parameters

Emissivity	0.95
Refl. temp.	20 °C



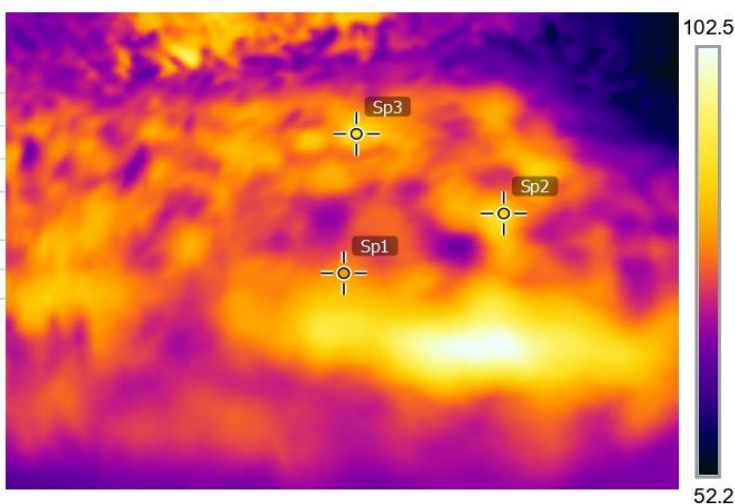
### During 7<sup>th</sup> Cycle:

#### Measurements

Sp1	82.8 °C
Sp2	89.8 °C
Sp3	91.1 °C

#### Parameters

Emissivity	0.95
Refl. temp.	20 °C



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### **BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE**

#### **COOKING TEST/ REHYDRATION TEST:**

For this test, 70g of treated sample has been taken in a beaker and then boiled water (around 200ml) is added to it and covered for 5 mins followed by stirring. Also, weight and moisture content of rehydrated rice is noted.



**Moisture Content of Rehydrated rice: 60.9%**

#### **OBSERVATIONS:**

The Drying behavior of steamed rice has been investigated under the convection heating system. 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.



**Ms. Komal Ingle**

**(Tested By)**

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