

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

Customer :	Laboratory Experimental Analysis
Process :	Continuous Microwave Heat Treatment for Cooking and Drying of Brown lentils

### TEST REPORT No: 47/KRDC/LAB/17 Mum 22/03/2018

Date Sample reception : 22/03/2018  
ID : 47/LAB/25

#### SAMPLE DESCRIPTION:

Sampling : As requested  
Sample Condition : Acceptable  
Quantity : 1.5 kg  
Sampling date : 22/03/2018  
Product : Brown lentils  
Requirement : Final product must be cooked and dried upto 4-5% moisture content  
Start Date test : 28/03/2018  
End Date test : 28/03/2018

#### LABORATORY EXPERIMENTAL SET UP:



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### LAB CONTINUOUS MICROWAVE HEATING SYSTEM SPECIFICATIONS:


Microwave Power	1.45 kW(CW)
Frequency	2450 MHz $\pm$ 50
Infra-red Power	6 kW
Microwave Exposure Zone (Cavity)	1000 mm length wise
Web width	380mm
Entry Vestibule length	1200mm
Exit Vestibule Length	1200 mm
Exhaust Power	0.5 HP

### ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (degree C)	38°C ( $\pm$ 5°C)
Humidity (%)	$\leq$ 36% 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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<b>Moisture Analyzer</b>		<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)
<b>Thermo Hygrometer</b>		<b>Model No:</b> HTC-2 <b>Temperature accuracy:</b> $\pm 1^{\circ}\text{C}$ ( $1.8^{\circ}\text{F}$ ) <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

#### SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on brown lentils without adding any additive to speed up the drying rate. For this experimental run, brown lentils has been soaked in water for 3 hours and then steamed to get 40-50% moisture and then those steamed lentils on microwave safe tray has placed in such a manner that it form uniform layer to get uniform exposure of microwaves and this tray passed through continuous microwave heating system with lower conveyor speed.

The observations are made after every pass of 10 minutes. Also, initial weight before drying, final weight after drying, initial moisture content, moisture content after soaking, moisture content after steaming and final moisture content after treatment has been taken.

#### ANALYTICAL RESULTS:

**Microwave Intensity:** 100%

**Initial Sample Weight:** 200 grams

**Initial Moisture Content:** 6.1%

**Moisture Content after soaking:** 49.2%

**Moisture Content after steaming:** 53.1%

Sr. No.	Time (minutes)	Weight noted (grams)	Total weight loss(grams)	Temperature on sample( $^{\circ}\text{C}$ )	Remarks, if any
1.	After 10	142	58	52.1	Drying rate started
2.	After 20	133	67	53.2	Drying phase continue

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3.	After 30	128	72	55.6	Variant of Drying rate
4.	After 40	122	78	57.2	Variant of Drying rate
5.	After 50	118	82	58.1	Variant of Drying rate
6.	After 60	103	97	60.3	Required Drying rate

Sample weight after drying: 103 grams

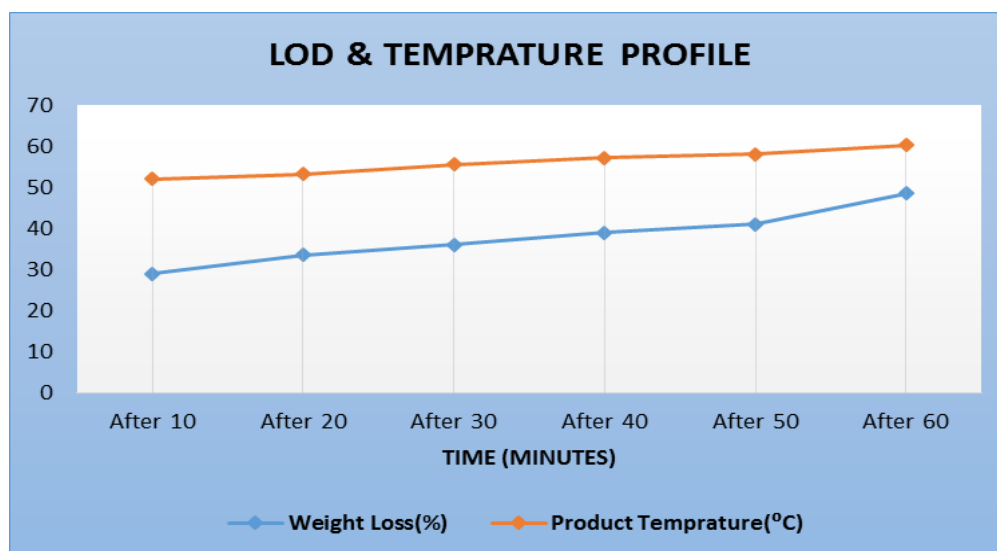
Total weight loss on drying: 97 grams

Final Moisture Content: 8.8%

### MOISTURE ANALYSIS REPORTS:

1 <sup>st</sup> Drying started	2 <sup>nd</sup> Drying started	3 <sup>rd</sup> Drying started	4 <sup>th</sup> Drying started
Date :24-03-2018 Time :10:15:18 Model:K0200 Serial number : 130	Date :28-03-2018 Time :12:55:34 Model:K0200 Serial number : 130	Date :28-03-2018 Time :14:49:26 Model:K0200 Serial number : 130	Date :28-03-2018 Time :17:52:23 Model:K0200 Serial number : 130
Drying parameters Product : Test Drying temperature : 105.0 °C Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*1000 Finished : 3 samples Initial weight : 3.003 g Final weight : 2.829 g Drying time : 00:16:20s Sampling interval : 20 sec Moisture : 4.1 %	Drying parameters Product : Test Drying temperature : 105.0 °C Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*1000 Finished : 3 samples Initial weight : 3.016 g Final weight : 1.571 g Drying time : 00:28:00s Sampling interval : 20 sec Moisture : 49.2 %	Drying parameters Product : Test Drying temperature : 105.0 °C Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*1000 Finished : 3 samples Initial weight : 3.014 g Final weight : 1.413 g Drying time : 00:29:40s Sampling interval : 20 sec Moisture : 53.1 %	Drying parameters Product : Test Drying temperature : 105.0 °C Drying profile : standard Mode : Short mode Calculation : ((w0-w)/w0)*1000 Finished : 3 samples Initial weight : 3.035 g Final weight : 2.747 g Drying time : 00:07:40s Sampling interval : 20 sec Moisture : 8.8 %
NOTE Initial	NOTE After soaking	NOTE After steaming	NOTE Final
The analysis performed by: Signature: <i>K Komal</i>	The analysis performed by: Signature: <i>K Komal</i>	The analysis performed by: Signature: <i>K Komal</i>	The analysis performed by: Signature: <i>K Komal</i>

### GRAPHICAL REPRESENTATION OF DRYING PARAMETERS:



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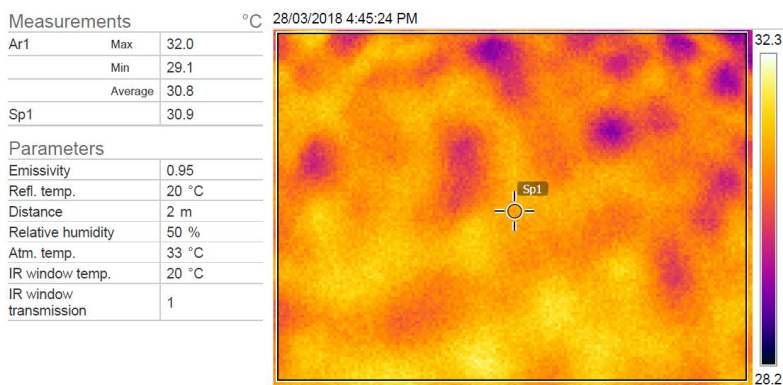
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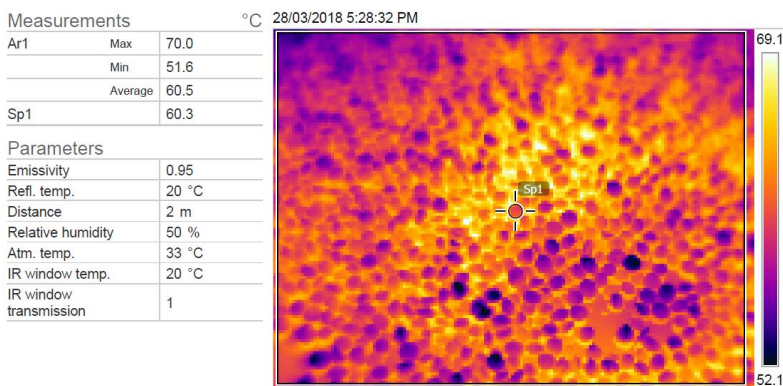
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## THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:

### 1. Before Heat Treatment



### 2. After Heat Treatment:



## BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



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### PICTURES OF LENTIL SIZE AFTER EVERY TREATMENT:



INITIAL



AFTER  
SOAKING



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.



### MOISTURE GAINED AFTER COOKING TEST:



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### OBSERVATIONS:

The Drying behavior of steamed brown lentils has been investigated under the microwave 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 was observed.



Miss. Komal Bhoite  
Tested By



Dr. Uttam K. Goswami  
Approved By

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