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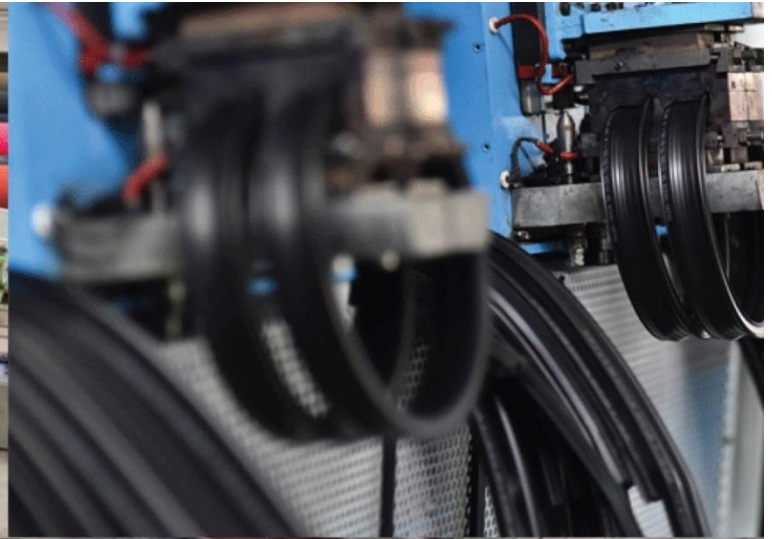
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In Association With



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



**Batch Microwave+Convection Heat  
Treatment for Drying of Protein Powder**



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Customer :	Laboratory Experimental Analysis
Process :	Batch Microwave+Convection Heat Treatment for Drying of Protein Powder

### TEST REPORT No: 47/KRDC/LAB/17 Mum 17/01/2019

Date Sample reception : 17/01/2019  
ID : 47/LAB/83

#### SAMPLE DESCRIPTION:

Sampling : As Requested  
Sample Condition : Acceptable  
Quantity : 1 kg  
Sampling date : 21/01/2019  
Product : Protein Powder  
Requirement : Final product must have moisture content less than 10%  
Start Date test : 21/01/2019  
End Date test : 21/01/2019

#### LABORATORY EXPERIMENTAL SET UP:



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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.



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### LAB BATCH MICROWAVE+CONVECTION HEATING SYSTEM SPECIFICATIONS:

<b>Microwave Power</b>	2 kW(CW)
<b>Frequency</b>	2450 MHz $\pm$ 50
<b>Convective Power</b>	3.5 kW (air flow 350 l/min at 20°C)
<b>Microwave Exposure Zone (cavity)</b>	1 cubic meter
<b>Mode Stirrer</b>	One
<b>Thermal Monitoring System</b>	Single Channel Fiber Optic: Range -40 to 250°C
<b>Exhaust Power</b>	1HP
<b>Tray Size</b>	450x950x50 mm



### ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

<b>Temperature (degree C)</b>	28.5°C ( $\pm$ 5°C)
<b>Humidity (%)</b>	$\leq$ 64% RH
<b>Pressure (kN/m<sup>2</sup> or kPa)</b>	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
Moisture Analyzer		<p><b>Make: Axis Balance</b>  <b>Description:</b>  <b>Moisture range: 1%(sample 0.02/0.05g), 0.1% (Sample 0.5/5g), 0.01%(Sample&gt;5g)</b></p>
Thermo Hygrometer		<p><b>Model No: HTC-2</b>  <b>Temperature accuracy: <math>\pm 0.1^{\circ}\text{C}</math> (<math>1.8^{\circ}\text{F}</math>)</b>  <b>Temperature resolution: <math>0.1^{\circ}\text{C}</math> (<math>0.2^{\circ}\text{F}</math>)</b>  <b>Humidity range: 10%~99% RH</b>  <b>Humidity accuracy: <math>\pm 5\%</math> RH</b>  <b>Humidity resolution: 1% RH</b></p>

### SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on protein powder with adding water to speed up the drying rate. For this experimental run, protein powder has been mixed with warm water (temperature around 35-40°C) and two samples, Sample A and sample B has been prepared. In sample A, 25 grams of protein powder and 15 ml of water is there and in sample B, 25 grams of protein powder and 20 ml of water. Then this both mixtures has been placed in microwave transparent tray with uniform thickness and placed in microwave heating system for drying treatment. Initial moisture content of protein powder, moisture content of samples A and B and final moisture content has been noted.

### ANALYTICAL RESULTS:

**Microwave Power: 0.2 kW**  
**Setting Temperature: 40°C**  
**Moisture Content of protein powder: 8.8%**  
**Initial Moisture Content of Sample A: 31.3%**



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**Initial Moisture Content of Sample B: 44.5%**

Sr. No.	Time (minutes)	Moisture Content of Sample A (%)	Moisture Content of Sample B (%)
1.	After 10	24.08	26.32
2.	After 20	18.48	21.97
3.	After 30	13.26	15.20
4.	After 35	9.4	9.8

Final Moisture content of Sample A: 9.4%

Final Moisture content of Sample B: 9.8%

**BEFORE AND AFTER PICTURES OF TREATED SPCIMEN SAMPLE:**

**1. Sample A:**



**2. Sample B:**



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## MOISTURE ANALYSIS REPORTS:

Drying started	Drying started	Drying started	Drying started	Drying started
Date : 01-01-2019 Time : 11:02:07 Model : A68200 Serial number : 130	Date : 01-01-2019 Time : 11:47:03 Model : A68200 Serial number : 130	Date : 01-01-2019 Time : 11:53:02 Model : A68200 Serial number : 130	Date : 01-01-2019 Time : 12:03:30 Model : A68200 Serial number : 130	Date : 01-01-2019 Time : 14:07:44 Model : A68200 Serial number : 130
Product : Test	Product : Test	Product : Test	Product : Test	Product : Test
Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C
Drying profile : standard Mode : Short mode Calculation : $\frac{(W-a)/W}{100}$ Finished : 3 samples	Drying profile : standard Mode : Short mode Calculation : $\frac{(W-a)/W}{100}$ Finished : 3 samples	Drying profile : standard Mode : Short mode Calculation : $\frac{(W-a)/W}{100}$ Finished : 3 samples	Drying profile : standard Mode : Short mode Calculation : $\frac{(W-a)/W}{100}$ Finished : 3 samples	Drying profile : standard Mode : Short mode Calculation : $\frac{(W-a)/W}{100}$ Finished : 3 samples
Initial weight : 0.603 g Final weight : 0.570 g	Initial weight : 0.671 g Final weight : 0.475 g	Initial weight : 0.721 g Final weight : 0.652 g	Initial weight : 0.670 g Final weight : 0.383 g	Initial weight : 0.552 g Final weight : 0.478 g
Drying time : 00:02:40s Sampling interval : 20 sec	Drying time : 00:04:00s Sampling interval : 20 sec	Drying time : 00:04:00s Sampling interval : 20 sec	Drying time : 00:13:00s Sampling interval : 20 sec	Drying time : 00:03:40s Sampling interval : 20 sec
Moisture : 0.8 %	Moisture : 31.3 %	Moisture : 7.4 %	Moisture : 44.5 %	Moisture : 5.8 %
NOTE Initial (Protein powder)	NOTE Initial (25 gm protein powder + 15 ml water) Sample A	NOTE Final (Sample A)	NOTE Initial (25 gm protein powder + 20 ml water) Sample B	NOTE Final (Sample B)
The analysis performed by: Signature: <u>KKomal</u>	The analysis performed by: Signature: <u>KKomal</u>	The analysis performed by: Signature: <u>KKomal</u>	The analysis performed by: Signature: <u>KKomal</u>	The analysis performed by: Signature: <u>KKomal</u>

## OBSRVATIONS:

The Drying behavior of protein powder and water mixture has been investigated under the microwave+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 drying with required moisture content without burning effect and there is little colour change.

Miss. Komal Bhoite  
Tested By

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