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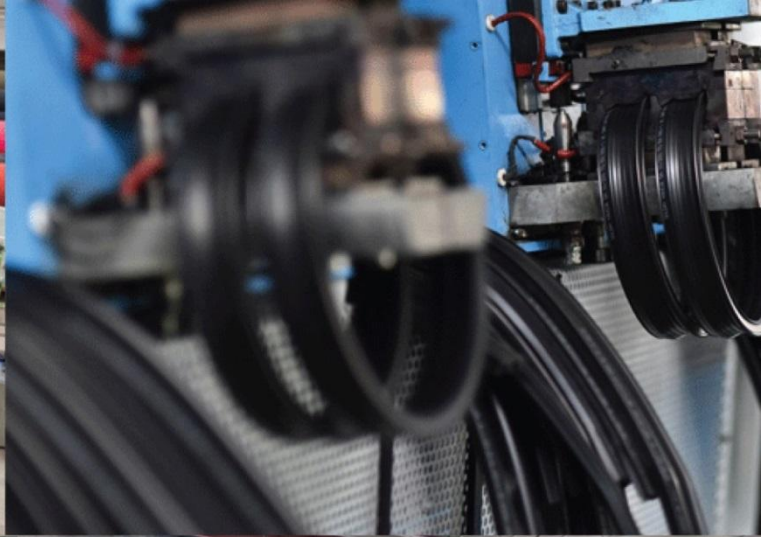
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In Association With



ELECTRO MAGNETIC innovative technologies

Kerone Research & Development Centre (KRDC),
B/47, Addl. MIDC, Anand Nagar, Ambernath (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 Sterilization of Spirulina Sticks**

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



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Customer :	M/s. Parry Nutraceuticals
Process :	Batch Microwave+Convection Heat Treatment for Sterilization of Spirulina Sticks

TEST REPORT No: 47/KRDC/LAB/17 Mum 25/09/2019

Date Sample reception : 25/09/2019
ID : 47/LAB/130

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 300 grams
Sampling date : 26/09/2019
Product : Spirulina sticks
Requirement : Sterilization upto 70°C product temperature
Start Date test : 26/09/2019
End Date test : 26/09/2019

LABORATORY EXPERIMENTAL SET UP:



Format: F/R&D/01



LAB BATCH MICROWAVE+CONVECTION 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)	30°C (\pm 5°C)
Humidity (%)	\leq 82% 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



EQUIPMENTS USED:

Name of Equipment	Picture of Equipment	Specifications
Compact Thermal Imaging Camera		Model: FLIR E-30 Resolution: 160x 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

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on given sample of spirulina sticks to speed up the heating rate for sterilization treatment. For this experimental run, given sample has been sealed packed in microwave transparent bags and placed in microwave heating system for different setting parameters to achieve sterilization treatment. The observations are made on the basis of temperature on product and any damage to sample.



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ANALYTICAL RESULTS:

Initial Moisture Content: 2%

Weight taken for every trial: 75 grams

Sr. No.	MW Power (kW)	Setting Temp (°C)	Time (minutes)	Temp. on product (°C)	Remarks, if any
1.	1.5	80	5	65-70	No change
2.	2	80	5	68-70	No change
3.	1.5	80	7	70-80	No change
4.	2	80	7	70-80	No change

THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:

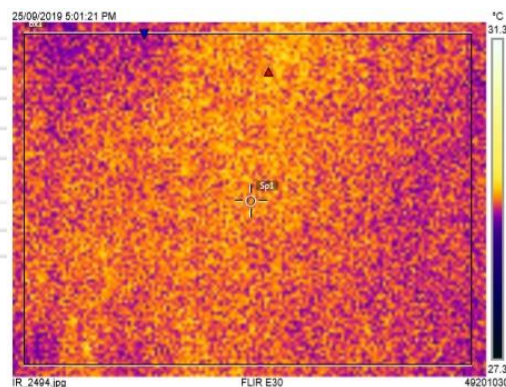
1. Before Heat Treatment:

Measurements

Bx1	Max	29.7 °C
	Min	28.8 °C
	Average	29.3 °C
Sp1		29.4 °C

Parameters

Emissivity	0.95
Refl. temp.	20 °C



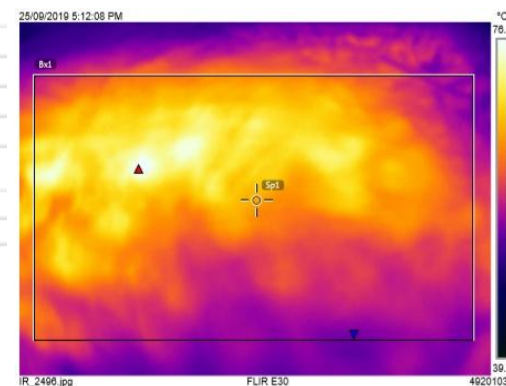
2. After Heat Treatment:

Measurements

Bx1	Max	76.6 °C
	Min	54.8 °C
	Average	64.1 °C
Sp1		66.6 °C

Parameters

Emissivity	0.95
Refl. temp.	20 °C



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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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BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



OBSERVATIONS:

The heating behavior of Spirulina sticks have been investigated under the microwave irradiation mode for sterilization treatment. As per physical investigation, it has been observed that there is no colour change in any of the sample with required temperature on product and no damage.

K Komal

Miss. Komal Bhoite
Tested By