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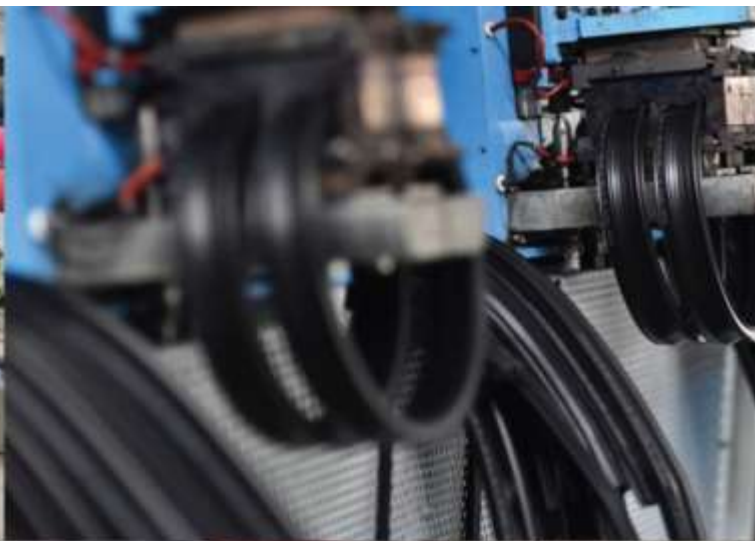
A.M.P.E.R.E (EUROPE)

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 Tea particles**

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



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Customer :	M/s. Unilever R&D Bangalore
Process :	Batch Microwave+Convection Heat Treatment for Drying of Tea particles

TEST REPORT No: 47/KRDC/LAB/17 Mum 18/02/2021

Date Sample reception : 18/02/2021

ID : 47/LAB/187

SAMPLE DESCRIPTION:

Sampling : As Requested

Sample Condition : Acceptable

Quantity : 2 kg

Sampling date : 18/02/2021

Product : Tea Powder (Red Label)

Requirement : Drying of Tea particles with enhance in porosity and rehydration test

Start Date test : 18/02/2021

End Date test : 18/02/2021

LABORATORY EXPERIMENTAL SET UP:**Format: F/R&D/01**

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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)	35°C (\pm 5°C)
Humidity (%)	\leq 45% 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: 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: $\pm 1^{\circ}\text{C}$ (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 sample of tea particles to speed up the drying rate for drying treatment. For this experimental run, tea particles and water has been mixed in 1:1 ration and placed in microwave transparent tray with layer of about 7-10 mm and microwave exposure has been given with different parameters. The observations are made on the basis of the temperature on product and moisture content of the product.

Also, rehydration test has been taken on treated and untreated sample by pouring same amount of boiling water in the same amount of sample and observations are made on the basis of change in particle size after rehydration test.

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ANALYTICAL RESULTS:

Quantity of Tea particles: 200 grams

Quantity of water: 200 grams

Initial Moisture Content of Tea Particles: 5.80%

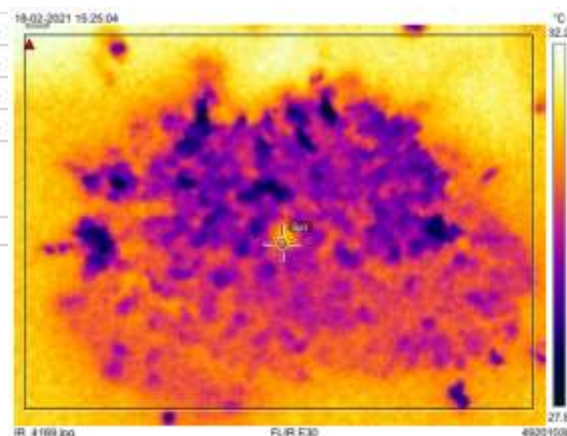
Moisture Content of Tea Particles after adding water: 44.01%

SR. No.	Microwave Power (kW)	Setting Temperature (°C)	Temperature on Product (°C)	Remarks, if any
1.	0.5	70	50-60	Drying rate started
2.	0.5	70	50-60	Drying phase continue
3.	0.5	70	50-60	Variant of Drying rate with moisture content 31.25%
4.	0.7	70	60-70	Variant of Drying rate
5.	0.7	70	70-75	Variant of Drying rate
6.	0.7	70	70-75	Required Drying rate with moisture content 5.14%

Final Moisture Content: 5.14%

THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:**1. Before Heat Treatment:****Measurements**

Bx1	Max	32.3 °C
	Min	27.4 °C
	Average	30.5 °C
Sp1		30.6 °C
Parameters		
Emissivity		0.95
Refl. temp.		20 °C

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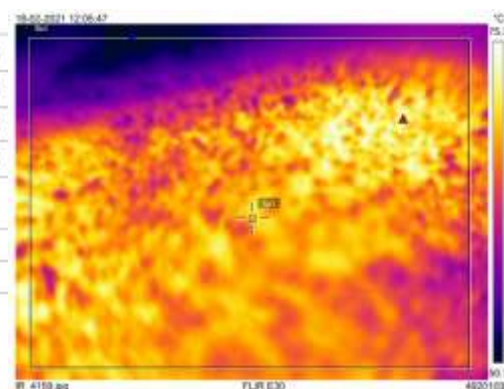
2. After Heat Treatment:

Measurements

Bx1	Max	76.2 °C
	Min	51.2 °C
	Average	66.1 °C
Sp1		68.9 °C

Parameters

Emissivity	0.95
Refl. temp.	20 °C



BEFORE AND AFTER PICTURES OF TREATED SPCIMEN SAMPLE:

1. Before Heat Treatment:



2. After Adding Water:



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3. After Heat Treatment:



4. Rehydration test with untreated sample:



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5. Rehydration test with treated sample:



6. Particle size:



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OBSERVATIONS:

The Drying behavior of tea particles has been investigated under the microwave+convection irradiation mode dryer for drying treatment. 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 in drying time. As per physical investigation, it has been observed that required moisture has been achieved without burning but with a color change. Also, it has been observed that after rehydration test, particle size of treated sample is not enhanced as compared to particle size of untreated sample.

Miss. Komal Bhoite

Tested By

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