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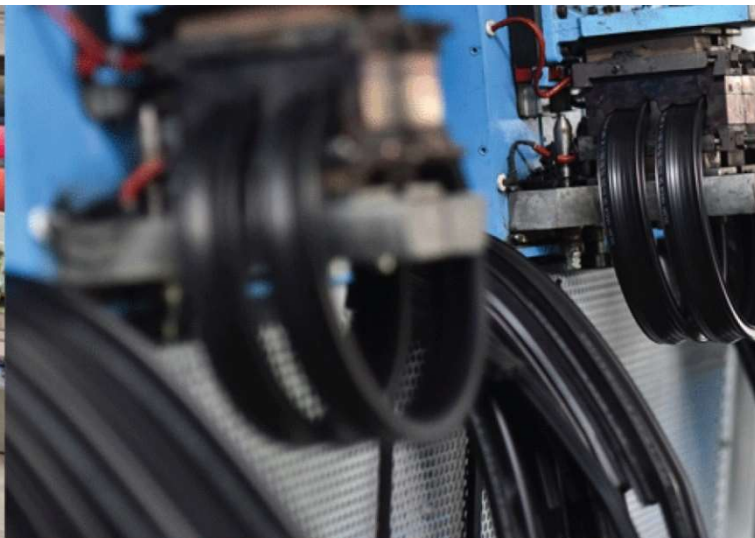
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In Association With



ELECTRO MAGNETIC Innovative Technologies

Kerone Research & Development Centre (KRDC),
B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India
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Batch Microwave+Convection Heat Treatment

for Drying of Fresh Leek, Turmeric Powder, Tomato flakes, Carrot slices,
Onion & Garlic



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



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Customer :	M/s. National Foods Pvt. Limited
Process :	Batch Microwave + Convection Heat Treatment for Drying of Fresh Leek, Turmeric Powder, Tomato flakes, Carrot slices, Onion & Garlic

TEST REPORT No: 47/KRDC/LAB/17 Mum 28/06/2021

Date Sample reception : 28/06/2021

ID : 47/LAB/168

SAMPLE DESCRIPTION:

Sampling : As Requested

Sample Condition : Acceptable

Sampling date : 28/06/2021

Product : Fresh Leek, Turmeric Powder, Tomato flakes, Carrot slices,
Onion & Garlic

Requirement : Final Product must be dried fully

Start Date test : 28/06/2021

End Date test : 02/07/2021

LABORATORY EXPERIMENTAL SET UP:



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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 (airflow 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	1 HP
Tray size (width*height*depth)	450*950*50 mm




ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

Temperature (°C)	30°C (\pm 5°C)
Humidity (%)	\leq 70% RH
Pressure (kN/m ² 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
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

EXPERIMENT ON – 1. FRESH LEEK

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on Fresh leek to speed up the drying rate. For this experimental run, given sample has been cut into pieces and then placed in MW+ Convection heating system with suitable parameters. Observations are made after decided time period on the basis of color change of product, Weight and temperature of the product.

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



Format: F/R&D/01



ANALYTICAL RESULTS:

Initial Wt. of Fresh leek: 160 g

Initial moisture of Fresh leek: 93%

Cycles	Specifications of Microwave	Cycle Time (Min.)
C1	Magnetron Power: 0.7 kW; Temperature Limit: 70°C; Fan speed: 100; Heater- 80%	20
C2	Magnetron Power: 0.7 kW; Temperature Limit: 70°C; Fan speed: 100; Heater- 80%	20
C3	Magnetron Power: 0.7 kW; Temperature Limit: 70°C; Fan speed: 100; Heater- 80%	30

Final Wt. of Fresh leek: 10 g

Final moisture of Fresh leek: 8.7 %

OBSERVATION:

The heating behavior of Fresh Leek has been investigated under the Microwave + Convection heating system. The heating rate is found to be increasing with respect to increase in time. It has been found that the product's weight decreases with respect to increase in setting temperature. As per physical investigation,

EXPERIMENT ON - 2. TOMATO FLAKES

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on Tomato flakes to speed up the drying rate. For this experimental run, given sample has been placed in MW+ Convection heating system with suitable parameters. Observations are made after decided time period on the basis of color change of product, Weight and temperature of the product.

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



BEFORE



AFTER

ANALYTICAL RESULTS:

Initial Wt. of Tomato flakes: 301 g

Initial moisture of Tomato flakes: 94.5%

Cycles	Specifications of Microwave	Cycle Time (Min.)
C1	Magnetron Power: 1.0 kW; Temperature Limit : 90°C; Fan speed: 100; Heater- 100%	20
C2	Magnetron Power: 0.8 kW; Temperature Limit : 80°C; Fan speed: 100; Heater- 100%	20
C3	Magnetron Power: 0.7 kW; Temperature Limit : 80°C; Fan speed: 100; Heater- 100%	10

Final Wt. of Tomato flakes: 18 g

Final moisture of Tomato flakes: 9.2 %



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OBSERVATION:

The heating behavior of Tomato flakes has been investigated under the Microwave + Convection heating system. The heating rate is found to be increasing with respect to increase in time. It has been found that the product's weight decreases with respect to increase in setting temperature. As per physical investigation,

EXPERIMENT ON - 3. CARROT SLICES

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on Carrot Slices to speed up the drying rate. For this experimental run, given sample has been placed in MW+ Convection heating system with suitable parameters. Observations are made after decided time period on the basis of color change of product, Weight and temperature of the product.

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



BEFORE



AFTER

ANALYTICAL RESULTS:

Initial Wt. of Carrot Slices: 320 g

Initial moisture of Carrot Slices: 71.4%

Cycles	Specifications of Microwave	Cycle Time (Min.)
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C1	Magnetron Power: 1.0 kW; Temperature Limit: 90°C; Fan speed: 100; Heater- 100%	20
C2	Magnetron Power: 0.8 kW; Temperature Limit: 90°C; Fan speed: 100; Heater- 100%	20

Final Wt. of Carrot slices: 34 g

Final moisture of Carrot slices: 6.12 %

OBSERVATION:

The heating behavior of Carrot slices has been investigated under the Microwave + Convection heating system. The heating rate is found to be increasing with respect to increase in time. It has been found that the product's weight decreases with respect to increase in setting temperature. As per physical investigation, there is a slight colour change and crunchiness in carrot.

EXPERIMENT ON – 4. TURMERIC POWDER

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on Turmeric Powder to speed up the drying rate. For this experimental run, given sample has been placed in MW+ Convection heating system with suitable parameters. Observations are made after decided time period on the basis of color change of product, Weight and temperature of the product.

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



ANALYTICAL RESULTS:

AFTER

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Initial Wt. of Turmeric Powder: 525 g

Initial moisture of Turmeric Powder: 16.1%

Cycles	Specifications of Microwave	Cycle Time (Min.)
C1	Magnetron Power: 0.8 kW; Temperature Limit: 80°C; Fan speed: 100; Heater- 80%	20
C2	Magnetron Power: 0.6 kW; Temperature Limit: 70°C; Fan speed: 100; Heater- 80%	10

Final Wt. of Turmeric Powder: 472 g

Final moisture of Turmeric Powder: 3.2 %

OBSERVATION:

The heating behavior of Turmeric Powder has been investigated under the Microwave + Convection heating system. The heating rate is found to be increasing with respect to increase in time. It has been found that the product's weight decreases with respect to increase in setting temperature. As per physical investigation, there is richness in colour of turmeric.

EXPERIMENT ON – 5. ONION

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on Onion slice to speed up the drying rate. For this experimental run, given sample has been placed in MW+ Convection heating system with suitable parameters. Observations are made after decided time period on the basis of color change of product, Weight and temperature of the product.

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:

Format: F/R&D/01



BEFORE



AFTER

ANALYTICAL RESULTS:

Initial Wt. of Onion: 575 g

Initial moisture of Onion: 83.8%

Cycles	Specifications of Microwave	Cycle Time (Min.)
C1	Magnetron Power: 1 kW; Temperature Limit: 90°C; Fan speed: 100; Heater- 100%	20
C2	Magnetron Power: 1 kW; Temperature Limit: 90°C; Fan speed: 100; Heater- 100%	20
C3	Magnetron Power: 1 kW; Temperature Limit: 100°C; Fan speed: 100; Heater- 100%	20

Final Wt. of Onion: 73 g

Final moisture of Onion: 1.47 %

OBSERVATION:

The heating behavior of Onion has been investigated under the Microwave + Convection heating system. The heating rate is found to be increasing with respect to increase in time.

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It has been found that the product's weight decreases with respect to increase in setting temperature.
As per physical investigation, colour of onion slice becomes brown and seems to be crunchy to eat.

EXPERIMENT ON - 6. GARLIC

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on garlic clove to speed up the drying rate. For this experimental run, given sample has been placed in MW + Convection heating system with suitable parameters. Observations are made after decided time period on the basis of color change of product, Weight and temperature of the product.

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



BEFORE



AFTER

ANALYTICAL RESULTS:

Initial Wt. of Garlic: 400 g

Initial moisture of Garlic: 70.4 %

Cycles	Specifications of Microwave	Cycle Time (Min.)
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C1	Magnetron Power: 1 kW; Temperature Limit: 100°C; Fan speed: 100; Heater- 100%	20
C2	Magnetron Power: 1 kW; Temperature Limit: 100°C; Fan speed: 100; Heater- 100%	20
C3	Magnetron Power: 1 kW; Temperature Limit: 90°C; Fan speed: 100; Heater- 100%	20

Final Wt. of Garlic: 151 g

Final moisture of Garlic: 1.3 %

OBSERVATION:

The heating behavior of garlic has been investigated under the Microwave + Convection heating system. The heating rate is found to be increasing with respect to increase in time. It has been found that the product's weight decreases with respect to increase in setting temperature. As per physical investigation, there is prominent change in the texture and colour of garlic and is crunchy to eat.

EXPERIMENT ON – 7. WHOLE TURMERIC

SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on turmeric slice one with skin and another without skin. For this experimental run, given sample has been placed in MW + Convection heating system with suitable parameters. Observations are made after decided time period on the basis of color change of product, Weight and temperature of the product.

BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:

With Skin-



Format: F/R&D/01



Without Skin-



BEFORE



AFTER

ANALYTICAL RESULTS:

Initial Wt. of turmeric with skin: 60 g

Initial Wt. of turmeric without skin: 80 g

Initial moisture of turmeric: 90.1%

Cycles	Specifications of Microwave	Cycle Time (Min.)
C1	Magnetron Power: 0.8 kW; Temperature Limit: 60°C; Fan speed: 100; Heater- 80%	20
C2	Magnetron Power: 0.8 kW; Temperature Limit: 60°C; Fan speed: 100; Heater- 80%	20
C3	Magnetron Power: 0.8 kW; Temperature Limit: 60°C; Fan speed: 80; Heater- 100%	20
C4	Magnetron Power: 0.8 kW; Temperature Limit: 60°C; Fan speed: 80; Heater- 100%	20

Final Wt. of turmeric with skin: 6 g

Final Wt. of turmeric without skin: 8 g

Final moisture of turmeric with skin: 10 %

Final moisture of turmeric without skin: 7.5 %

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OBSERVATION:

The heating behavior of turmeric has been investigated under the Microwave + Convection heating system. The heating rate is found to be increasing with respect to increase in time. It has been found that the product's weight decreases with respect to increase in setting temperature. As per physical investigation, there is prominent change in the texture and colour of turmeric.

A handwritten signature in blue ink that reads "Komal".

**Ms. Komal Ingle
(Tested By)**