







Kerone Research & Development Centre (KRDC)

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Customer:	M/s. Dollon's Food Product Ltd.
Process:	Vacuum Microwave + Convection Heat Treatment for Drying of Cottage Cheese

Test Report No: 188/KRDC/LAB/17 Mum 05/03/2023

Date Sample reception : 21/02/2023 ID : 188/LAB/05

Sample Description:

Sampling : As Requested
Sample Condition : Acceptable
Sampling date : 28/02/2023
Product : Cottage Cheese
Start Date test : 28/02/2023
End Date test : 04/02/2023

Laboratory Experimental System -





ISO-9001-2008 COMPANY



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System Specifications -

Magnetron Power Generator Rating	Air Cooled 1.45KW/2450+50 MHZ x 1 No.
Convection Power	1.5 KW
Total Heater Power	3 KW (MW 1.45KW + Convection 1.5KW)
Supply Voltage required	230V- 2Ph supply
MW Overall (LxWxH) in mm	620X670X640
Cavity Chamber (INNER) in mm	L-300 & Ф220
Vacuum Pump	1/2 hP; 1440rpm

Laboratory's Environmental Conditions -

Temperature (degree C)	29.4°C (±5°C)
Humidity (%)	≤50% 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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Equipment Used -

Name of Equipment	Picture of Equipment	Specifications
Compact Thermal Imaging Camera		Model: FLIR E-30 Resolution: 160x 120IR Thermal sensitivity of 0.10°C
Thermo Hygrometer	24 di 28 di	Model No: HTC-2 Temperature accuracy: ±°C (1.8°F) Temperature resolution: 0.1°C (0.2°F) Humidity range: 10%~99% RH Humidity accuracy: ±5% RH Humidity resolution: 1% RH
Moisture Analyzer		Make: Axis Balance Description: Moisture range: 1%(sample 0.02/0.05g), 0.1% (Sample 0.5/5g), 0.01%(Sample>5g)



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Procedure of the Experiment -

- The experiment was performed on Cottage Cheese to speed up the heating rate.
- For this experimental run, the sample was prepared using cow milk with Calcium lactate chemical in a ratio of 4:1
- The prepared same was taken and then passed in the Vacuum Microwave + Convection heating system with suitable parameters.
- After the heating treatment, the sample was analyzed.

Analytical Results:

VACUUM MICROWAVE HEATING SYSTEM

Trials 1 – TM1

Initial Weight – 100g

Initial Moisture – 64.8%

Cycle	Cycle time	System Specification	On Product temp	Remark
C1	After 5 min	Vacuum pressure: 300mmHg;	(70-71) °C	Drying started
		MW Power: 1.45Kw;		
		Heater: 0.5Kw		
C2	After 10 min	Vacuum pressure: 300mmHg;	(75-80) °C	Drying continuous
		MW Power: 1.45Kw;		
		Heater: 0.5Kw		
C3	After 20 min	Vacuum pressure: 300mmHg;	(90-100) °C	Some Charring
		MW Power: 1.45Kw;		
		Heater: 0.5Kw		
C4	After 25 min	Vacuum pressure: 300mmHg;	(75-80) °C	Drying continuous
		MW Power: 1.45Kw;		
		Heater: 0.5Kw		
C5	After 30 min	Vacuum pressure: 300mmHg;	(80-82) °C	Drying continuous
		MW Power: 1.45Kw;		
		Heater: 0.5Kw		
C6	After 35 min	Vacuum pressure: 300mmHg;	(82-85) °C	Dried below 5%
		MW Power: 1.45Kw;		moisture content
		Heater: 0.5Kw		

Final Weight – 28g

Final Moisture – 3.7%

Total cycle time - 35 mins.

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$Trials\ 2-TM2$

Initial Weight – 100g Initial Moisture - 64.8%

Cycle	Cycle time	System Specification	On Product temp	Remark
C1	After 5 min	Vacuum pressure: 100mmHg; MW Power: 1.45Kw; Heater: 0.5Kw	(70-71) °C	Drying started
C2	After 15 min	Vacuum pressure: 100mmHg; MW Power: 1.45Kw; Heater: 0.5Kw	(70-72) °C	Drying continuous
C3	After 25 min	Vacuum pressure: 100mmHg; MW Power: 1.45Kw; Heater: 0.5Kw	(70-74) °C	Drying continuous
C4	After 35 min	Vacuum pressure: 300mmHg; MW Power: 1.45Kw; Heater: 0.5Kw	(70-75) °C	Drying continuous
C5	After 45 min	Vacuum pressure: 300mmHg; MW Power: 1.45Kw; Heater: 0.5Kw	(70-80) °C	Dried below 4% moisture content

Final Weight – 32g Final Moisture – 3.3% Total Cycle time -45 mins.





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Trials 3 – TM3 Initial Weight – 100g Initial Moisture – 64.8%

Cycle	Cycle time	System Specification	On Product temp	Remark
C1	After 30 min	Vacuum pressure: 100mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Drying started
C2	After 60 min	Vacuum pressure: 100mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Drying continuous
C3	After 90 min	Vacuum pressure: 100mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Drying continuous
C4	After 120 min	Vacuum pressure: 300mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Drying continuous
C5	After 150 min	Vacuum pressure: 300mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Drying continuous
C6	After 180 min	Vacuum pressure: 300mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Drying continuous
C7	After 210 min	Vacuum pressure: 300mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Drying continuous
C8	After 240 min	Vacuum pressure: 300mmHg; MW Power: 0.3Kw; Heater: 0	(45-50) °C	Dried up to 3% moisture content

Final Weight – 27g Final Moisture – 2% Total Cycle time – 4 hours.





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VACUUM CONVECTION HEATING SYSTEM

Trials 1 – TC1 Initial Weight – 100g Initial Moisture – 63.4%

Cycle	Cycle time	System Specification	On Product temp	Remark
C1	After 30 min	Vacuum pressure: 300mmHg;	(70-71) °C	Drying started
		Set temp: 45°C;		
		Heater: 1.5Kw		
C2	After 60 min	Vacuum pressure: 300mmHg;	(71-73) °C	Drying continuous
		Set temp: 45°C;		
		Heater: 1.5Kw		
C3	After 90 min	Vacuum pressure: 300mmHg;	(70-75) °C	Some Charring
		Set temp: 45°C;		
		Heater: 1.5Kw		
C4	After 120 min	Vacuum pressure: 300mmHg;	(75-80) °C	Dried below 4%
		Set temp: 45°C;		moisture content
		Heater: 1.5Kw		

Final Weight – 37g Final Moisture – 3.5% Total cycle time – 2 hours.



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Trials 2 – TC2 Initial Weight – 100g Initial Moisture – 63.4%

Cycle	Cycle time	System Specification	On Product temp	Remark
C1	After 60 min	Vacuum pressure: 100mmHg;	(50-55) °C	Drying started
		Set temp: 35°C;		
		Heater: 0.5Kw		
C2	After 120 min	Vacuum pressure: 100mmHg;	(50-55) °C	Drying continuous
		Set temp: 35°C;		
		Heater: 0.5Kw		
C3	After 180 min	Vacuum pressure: 100mmHg;	(50-55) °C	Some Charring
		Set temp: 35°C;		
		Heater: 0.5Kw		
C4	After 240 min	Vacuum pressure: 100mmHg;	(50-55) °C	Dried below 4%
		Set temp: 35°C;		moisture content
		Heater: 0.5Kw		

Final Weight – 40g Final Moisture – 3.9% Total cycle time – 4 hours.





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Trials 3 – TC3 Initial Weight – 100g Initial Moisture – 63.4%

Cycle	Cycle time	System Specification	On Product temp	Remark
C1	After 60 min	Vacuum pressure: 100mmHg;	(50-55) °C	Drying started
		Set temp: 30°C;		
		Heater: 0.5Kw		
C2	After 120 min	Vacuum pressure: 100mmHg;	(50-55) °C	Drying continuous
		Set temp: 30°C;		
		Heater: 0.5Kw		
C3	After 180 min	Vacuum pressure: 100mmHg;	(50-55) °C	Drying continuous
		Set temp: 30°C;		
		Heater: 0.5Kw		
C4	After 240 min	Vacuum pressure: 100mmHg;	(50-55) °C	Drying continuous
		Set temp: 30°C;		
		Heater: 0.5Kw		
C5	After 300 min	Vacuum pressure: 100mmHg;	(50-55) °C	Drying continuous
		Set temp: 30°C;		
		Heater: 0.5Kw		
C6	After 360 min	Vacuum pressure: 100mmHg;	(50-55) °C	Dried below 2%
		Set temp: 30°C;		moisture content
		Heater: 0.5Kw		

Final Weight – 28g Final Moisture – 1.6% Total cycle time – 6 hours.





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Trials Images:



Untreated Sample



Treated Sample (Tm1, Tm2, Tm3)



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Treated Sample (Tc1, Tc2, Tc3)



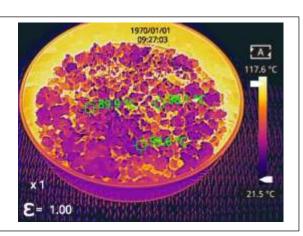


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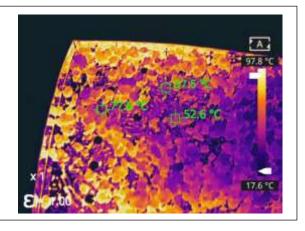
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Thermal Images:

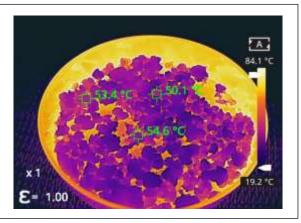
Measurements	S
Sp1	98.2°C
Sp2	99.6°C
Sp3	89.9°C
Parameters	
Emissivity	1.00
Temp.	117.6°C



Sp1	77.6°C
Sp2	57.5°C
Sp3	52.6°C
Parameters	
Parameters Emissivity	1.00



Sp1	53.4°C
Sp2	50.1°C
Sp3	54.6°C
D .	
Parameters	
Parameters Emissivity	1.00



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Moisture Analysis Report:

	-Lws	To
Brying atteted	Trying started	Bryang started
Date : 2-03-2023 Fine : 12:19:27 HodelinGSCOO Serial number : 138	Sate : 3-83-2023 Time :18:51:50 Model:4655203 Serial number : 138	Take : N-03-2002 Time :No:01-37 Todel:ABSTOD Serial rumber : 176
making basediala	Wrying paramaters	Brying paraseters
Product : 0	Freduct 1 0	Product + 0
Drying temperature : 105.0 70	Drying temperature : 105.0 °C	Drying temperature : 185.0 °C
Prying profile : standard Mode : Short code Calculation : ((00-x)/=0)=1003 Finished : 3 samples	Brains profile : standard Nade : Short mode Exiculation : ((e0-e)/r0)#1002 Finished : 3 seeples	Drying profile : standard Node : Short hode Calculation : ((=0-3/25) 01500 Finished : 3 respices
Initial weight : 0.727 g	Initial weaght : 0,764 g	Initial weight : 1,835 g
Final weight : 0.715 a	Final weight # 0.739 g	Final weight : 1,000 g
Drying time : 20:04:00s Suppling interval : 20 sec	Brying time 00:06:00s Sampling interval 20 was	Nying time : 00:07:25: Scopling interval : 20 sec
Moisture 1 3.7 I	Moisture i 3,3 %	Meisture 1 2,0 %
NOTE (Final mots he	MOTE Final neoistan	HITE Final woodhoe
The analysis parformed by:	The inilysis performed by:	The analysis performed by:
Signature	Signature Approal.	Elignature.
	Tame :12:19:27 RedelinDECOD Serial number: 138 Drying parameters Product: 9 Drying temperature: 105.0 °C Brying profile: standard Rode: s	Date : 2-03-2023 Fine : 12:19:27 Birch 10:200 Serial number : 138 Drying persectors Product : 9 Drying temperature : 105.0 °C Drying profile : standard Mode : Short code Calculation : ((00-9/+00)*1002 Finished : 3 samples Initial weight : 0.727 0 Final weight : 0.739 0 Final weight :



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	Tc1	Tez	Te3
200100 \$100000 Lete 020-7545512 Tora (05045512 Tora (05045513 Toral 050500 Hotal 050500 152	Drainy stacked Jake 13-23-2033 Line 133-22-62 Rodins65220 Serial maber 1 135 Drying purseters	Brying started Bate : 2-03-2020 Time :03052-23 Hocels4652-00 Berial mestyr : 128	Fried trained Sine of Collection Time Admittal Recoll Action Security success Dryang personness
Frederic () Drying temperature () (57.6 °C) Drying temperature () (57.6 °C) Drying temperature () standard foce () Short bods Temperature () (10-a)/a0/a1000 Fundable () 3 samples DritteG emight () 1/850 g Focal weight () 5,307 g	Froduct 0 0 Trying temporature 1 105.5 °C Prying profile 1 stendard Spoe 5 Short code Calculation 1 (100-0)/b0;21007 Finished 1 3 samplet Initial weight 0 0.778 9 Final weight 1 0.75% 9 Frank time 6 60:04:009	Product t D Orying temperature : 105.6 °C Prying profile : standard finds : Short code Calculation : ((m2-s)/+0 4100% Finished : 3 samples Ential seight : 0.924 g	Frederic (C Brying temperature : (55.0 %) Drying profile (stanford tide (50.0 times (50.0
testing time a contribute constitute of the cons	Haistone : 3.5 3	Brying time 1 85:521425 Smellog interval 1 80-505 Statemen 1 1.9 2 Myre Final maisha	supplied interval to 120 secondary that store to 120 secondary to 120 seco
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Observations:

The heating behavior of Cottage Cheese was investigated under the Convection heating system. The heating rate was found to be increasing with respect to increasing in time. As per the physical investigation, it was observed that the product was dried as desired without any charring effect at low temperature with prolonged time and was seal packed after treatment. Also, the desired moisture content was obtained.

- Feeta

Ms. Sayali Asole (Tested By)