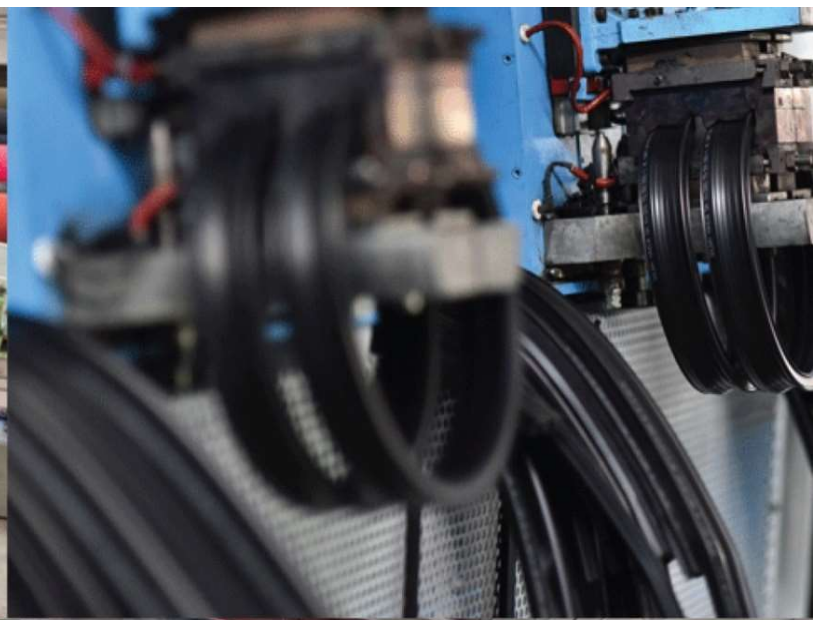


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Continuous IR Heat Treatment for Drying of Marigold Flowers



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Customer :	
Process :	Continuous IR Heat Treatment for Drying of Marigold Flowers

Test Report No: 243/KRDC/LAB/17 Mum 02/11/2023

Date Sample reception : 01/11/2023
ID : KRDC/R&D/23-24/02/11

Sample Description:

Sampling : As Requested,
Sample Condition : Acceptable
Sampling date : 01/11/2023
Product : Marigold Flower
Requirement : Drying of Marigold Flowers
Start Date test : 01/11/2023
End Date test : 01/11/2023

Laboratory Experimental System -



Format: F/R&D/01



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System Specification –

IR Medium Wave Emitters	6 Nos (-each having 0.5 kW, 445 mm heatinglength)
Short Wave IR Emitter withspecial reflectors	6 Nos (-each having 1 kW, 406 mm heatinglength)
IR Emitter to Object Distance	120 mm (- in medium wave zone)
IR Emitter to Object Distance	100 mm (- in short wave zone)
Overall IR Heating Zonelength	1400 mm
Web width	400 mm
IR wavelength range	0.7 to 10 microns
Direct Exposure of MW IR	500 mm
Direct Exposure of SW IR	750mm
Temperature Range	0-400°C

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		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)
Tachometer		Make: Lutron Model No.: DT-2236C Values: RPM contact; M/min contact Contact probes: 3 Cal.: 21/10/22 – 20/10/23



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Procedure of the Experiment -

- The experiment was performed to speed up the heating rate.
- For this experimental run, the given sample was taken in the tray and placed in a IR heating system with suitable parameters.
- After the heating treatment, the sample was analyzed.

Analytical Results:

TRIAL-1:

Initial Weight (grams) - 100 grams

Initial moisture – 81.7%

Cycle	Drying Time (min.)	System Parameters	Remark
C1	After 4 min (1 st pass)	Set temp.- 70°C; IR intensity – 100 %	Drying Started
C2	After 4 min (2 nd pass)	Set temp.- 70°C; IR intensity – 100 %	Dried as desired

Final Weight (grams) - 20 grams

Final moisture – 32.6%

Total cycle time- 8 minutes.

TRIAL-1:

Initial Weight (grams) - 100 grams

Initial moisture – 81.7%

Cycle	Drying Time (min.)	System Parameters	Remark
C1	After 4 min (1 st pass)	Set temp.- 200°C; IR intensity – 100 %	Drying Started
C2	After 4 min (2 nd pass)	Set temp.- 200°C; IR intensity – 100 %	Dried as desired

Final Weight (grams) - 14 grams

Final moisture – 13.1%

Total cycle time- 8 minutes.

Format: F/R&D/01



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Before and After images:

Trial:01



Untreated Sample



Treated Sample

Trial:02



Untreated Sample



Treated Sample



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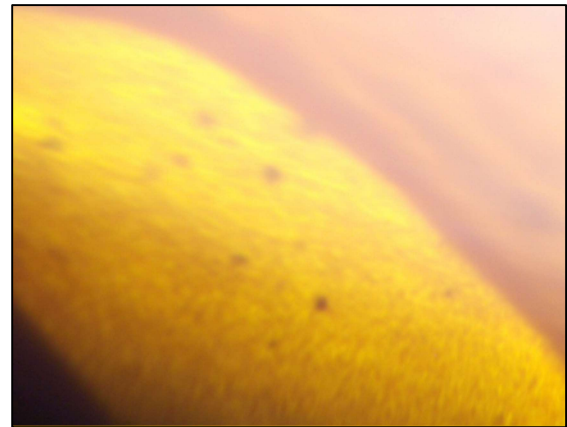
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Microscopic Images:

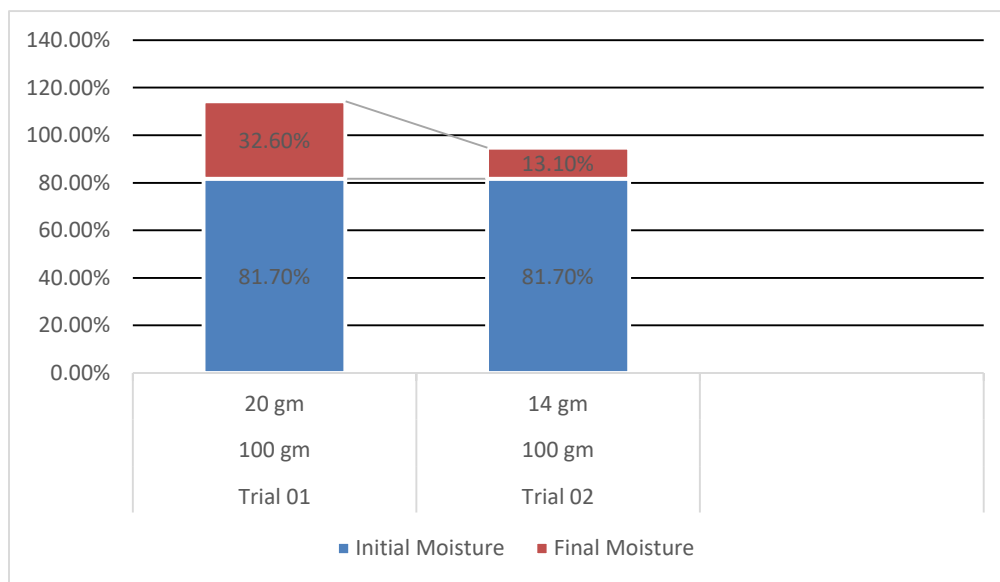


Before Drying



After Drying

LOD Profile Bar Diagram:





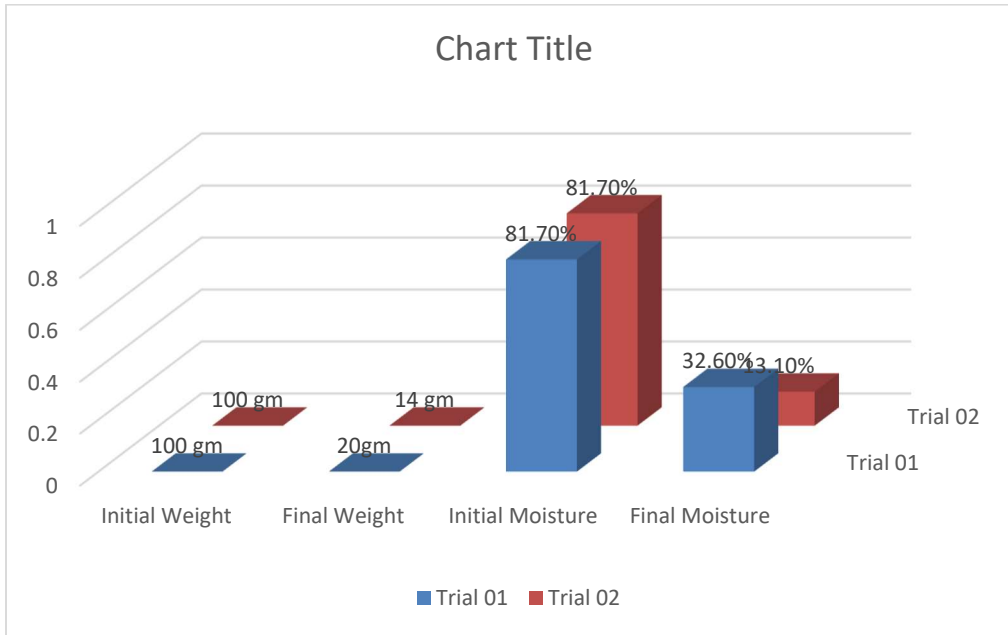
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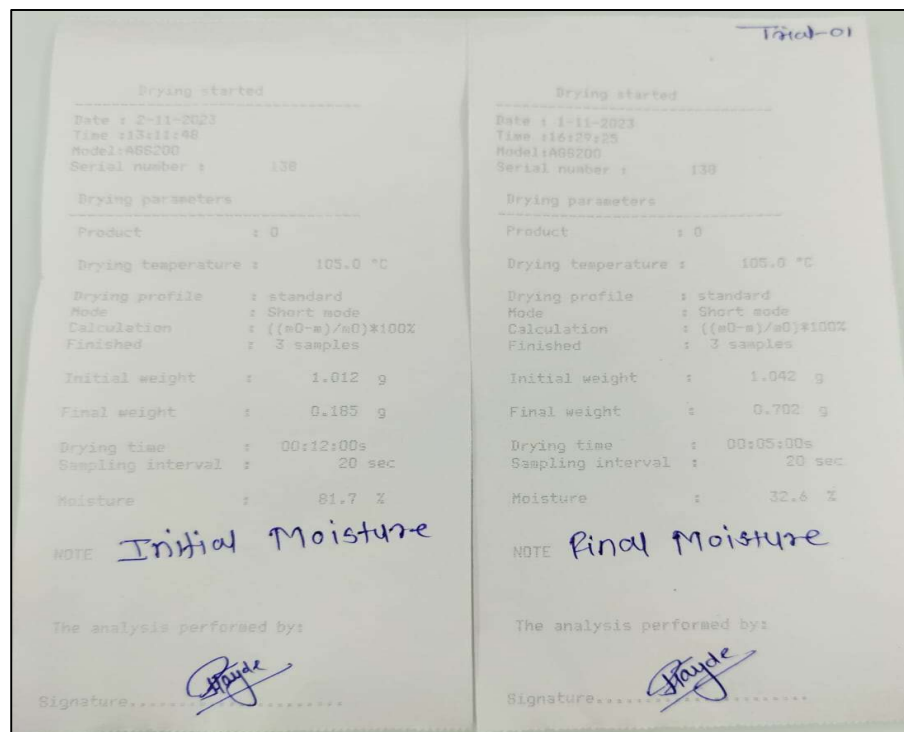
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Histogram



Moisture Analysis Report:

Trial 01:



Format: F/R&D/01

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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Trial 02:

Drying started		Drying started	
Date : 2-11-2023	Time : 13:11:48	Date : 1-11-2023	Time : 16:46:10
Model: ABS200	Serial number : 138	Model: ABS200	Serial number : 138
Drying parameters		Drying parameters	
Product : 0	Drying temperature : 105.0 °C	Product : 0	Drying temperature : 105.0 °C
Drying profile : standard	Mode : Short mode	Drying profile : standard	Mode : Short mode
Calculation : $((m_0 - m) / m_0) * 100\%$	Finished : 3 samples	Calculation : $((m_0 - m) / m_0) * 100\%$	Finished : 3 samples
Initial weight : 1.012 g	Final weight : 0.165 g	Initial weight : 1.207 g	Final weight : 1.049 g
Drying time : 00:12:00s	Sampling interval : 20 sec	Drying time : 00:05:00s	Sampling interval : 20 sec
Moisture : 81.7 %		Moisture : 13.1 %	
NOTE Initial Moisture		NOTE Final Moisture	
The analysis performed by:	Signature.....	The analysis performed by:	Signature.....
Signature.....		Signature.....	

Observations:

The heating behavior of the marigold flowers was investigated under the continuous IR heating system. The heating rate was found to be increasing with respect to the increase in time. As per the physical investigation, it was observed that the sample was dried as desired in 08 minutes without any charring effect.

Mrs. Priya Tayde**(Tested By)**