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A CRISIL-NSIC RATED COMPANY
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AIMCAL (USA)



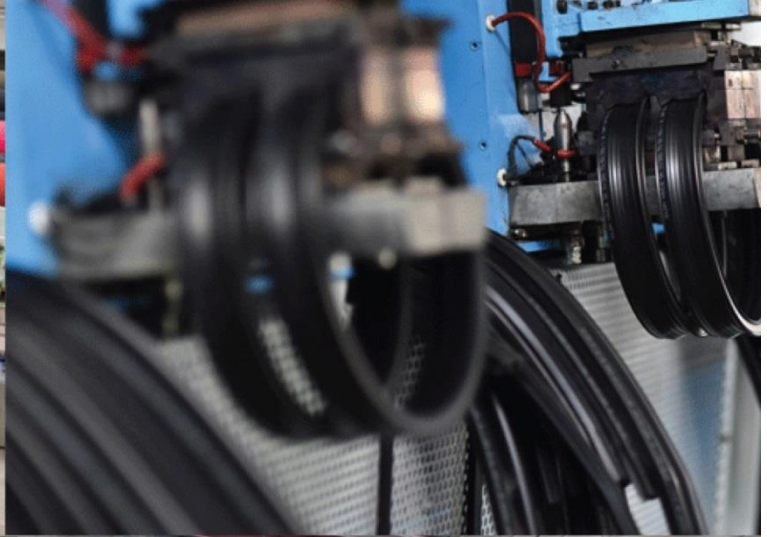
A.M.P.E.R.E (EUROPE)

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 Preheating of Palm Leaves and
Drying of Palm Plates**

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



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Customer :	Laboratory Experimental Analysis
Process :	Batch Microwave+Convection Heat Treatment for Preheating of Palm Leaves and Drying of Palm Plates

TEST REPORT No: 47/KRDC/LAB/17 Mum 17/01/2019

Date Sample reception : 17/01/2019
ID : 47/LAB/87

SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 5 leaves and 10 plates
Sampling date : 25/01/2019
Product : Palm Leaves and plates
Requirement : Preheating of Palm leaves and Drying of Palm Plates
Start Date test : 25/01/2019
End Date test : 02/02/2019

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 (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)	28.5°C (\pm 5°C)
Humidity (%)	\leq 64% 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



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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: $\pm^{\circ}\text{C}$ (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 palm leaves and palm plates to speed up the drying rate. For this experimental run, palm leaves have been dipped in water for about 2 minutes and then preheated in microwave exposure. Similarly, plates have been dipped in water for about 2 minutes and then drying has been done in stack in microwave exposure. Observations are made by physical appearance. Initial moisture content and final moisture content has been noted.

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ANALYTICAL RESULTS:

1. Preheating of Palm Leaves:

	Trial No. 1	Trial No. 2	Trial No. 3	Trial No. 4
Microwave Power (kW)	2	2	2	2
Setting Temp (°C)	90	120	120	150
Time (seconds)	30	30	60	60
Initial Moisture Content (%)	26.5	26.5	26.5	26.5
Final Moisture Content (%)	24.9	25.6	22.6	24.2
Temp. on Product(°C)	40-45	70-75	85-90	90-95

2. Drying of Palm Plates:

- a) Microwave Power: 1.5 kW
Setting Temperature: 100°C
Cycle Time: 9 minutes
Initial Moisture Content: 8.2%
Moisture Content after Dipping in water: 26.5%
Final Moisture Content: 6.1%
- b) This trial has been taken on same plates by recycling it by dipping it in water again.
Microwave Power: 1.5 kW
Cycle Time: 7 minutes
Moisture Content after Dipping in water: 22.3%
Final Moisture Content: 9.1%
- c) This trial has been taken on same plates after trial no. b)
Microwave Power: 1.5 kW
Cycle Time: 15 minutes
Final Moisture Content: 3.9%

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BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



Trial No. a)



Trial No. b)



Trial No. c)



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MOISTURE ANALYSIS REPORTS:

Drying started	Drying started	Drying started	Drying started	Drying started
Date :23-01-2019 Time :11:50:22 Model:AGS200 Serial number : 138	Date :23-01-2019 Time :15:58:23 Model:AGS200 Serial number : 138	Date :23-01-2019 Time :16:03:44 Model:AGS200 Serial number : 138	Date :23-01-2019 Time :16:33:30 Model:AGS200 Serial number : 138	Date :23-01-2019 Time :17:24:04 Model:AGS200 Serial number : 138
Drying parameters	Drying parameters	Drying parameters	Drying parameters	Drying parameters
Product : Test	Product : Test	Product : Test	Product : Test	Product : Test
Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C
Drying profile : standard	Drying profile : standard	Drying profile : standard	Drying profile : standard	Drying profile : standard
Mode : Short mode	Mode : Short mode	Mode : Short mode	Mode : Short mode	Mode : Short mode
Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$
Finished : 3 samples	Finished : time over	Finished : 3 samples	Finished : 3 samples	Finished : time over
Initial weight : 0.657 g	Initial weight : 0.923 g	Initial weight : 0.579 g	Initial weight : 0.767 g	Initial weight : 0.829 g
Final weight : 0.483 g	Final weight : 0.693 g	Final weight : 0.431 g	Final weight : 0.748 g	Final weight : 0.628 g
Drying time : 00:05:00s	Drying time : 00:03:55s	Drying time : 00:05:20s	Drying time : 00:11:20s	Drying time : 00:01:30s
Sampling interval : 20 sec	Sampling interval : 20 sec	Sampling interval : 20 sec	Sampling interval : 20 sec	Sampling interval : 20 sec
Moisture : 26.5 %	Moisture : 24.9 %	Moisture : 25.6 %	Moisture : 22.6 %	Moisture : 24.2 %
NOTE After soaking in water	NOTE After Preheat (2kW, 90°C, 30 seconds)	NOTE After Preheat (2kW, 120°C, 30 seconds)	NOTE After Preheat (2kW, 120°C, 60 seconds)	NOTE After Preheat (2kW, 150°C, 60 seconds)
The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>
Signature:	Signature:	Signature:	Signature:	Signature:

Drying started	Drying started	Drying started	Drying started	Drying started
Date :31-01-2019 Time :10:09:40 Model:AGS200 Serial number : 138	Date :2-02-2019 Time :11:04:27 Model:AGS200 Serial number : 138	Date :2-02-2019 Time :11:30:47 Model:AGS200 Serial number : 138	Date :2-02-2019 Time :12:44:58 Model:AGS200 Serial number : 138	Date :5-02-2019 Time :11:01:15 Model:AGS200 Serial number : 138
Drying parameters	Drying parameters	Drying parameters	Drying parameters	Drying parameters
Product : Test	Product : Test	Product : Test	Product : Test	Product : Test
Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C	Drying temperature : 105.0 °C
Drying profile : standard	Drying profile : standard	Drying profile : standard	Drying profile : standard	Drying profile : standard
Mode : Short mode	Mode : Short mode	Mode : Short mode	Mode : Short mode	Mode : Short mode
Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$	Calculation : $((w_0-w)/w_0)*100\%$
Finished : 3 samples	Finished : 3 samples	Finished : 3 samples	Finished : 3 samples	Finished : 3 samples
Initial weight : 0.637 g	Initial weight : 0.682 g	Initial weight : 0.689 g	Initial weight : 0.516 g	Initial weight : 0.691 g
Final weight : 0.585 g	Final weight : 0.501 g	Final weight : 0.647 g	Final weight : 0.449 g	Final weight : 0.664 g
Drying time : 00:03:00s	Drying time : 00:08:40s	Drying time : 00:04:00s	Drying time : 00:02:40s	Drying time : 00:02:00s
Sampling interval : 20 sec	Sampling interval : 20 sec	Sampling interval : 20 sec	Sampling interval : 20 sec	Sampling interval : 20 sec
Moisture : 8.2 %	Moisture : 26.5 %	Moisture : 6.1 %	Moisture : 7.1 %	Moisture : 3.9 %
NOTE Initial (plate)	NOTE After dipping in water	NOTE After Trial No.a)	NOTE After Trial No.b)	NOTE After trial No.6)
The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>	The analysis performed by: <u>KKomal</u>
Signature:	Signature:	Signature:	Signature:	Signature:

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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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OBSRVATIONS:

The Drying behavior of palm leaves and palm plates has been investigated under the microwave+convection heating system. 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 drying time. As per physical investigation, it has been observed that there is drying with required moisture content without burning effect and there is little colour change in palm leaves preheating trial, and there is deformation of shape of plates when used convective power with microwave. There is no deformation of shape in purely microwave exposure only. In trial No. c), burning effect has been observed for longer microwave exposure.

Miss. Komal Bhoite
Tested By