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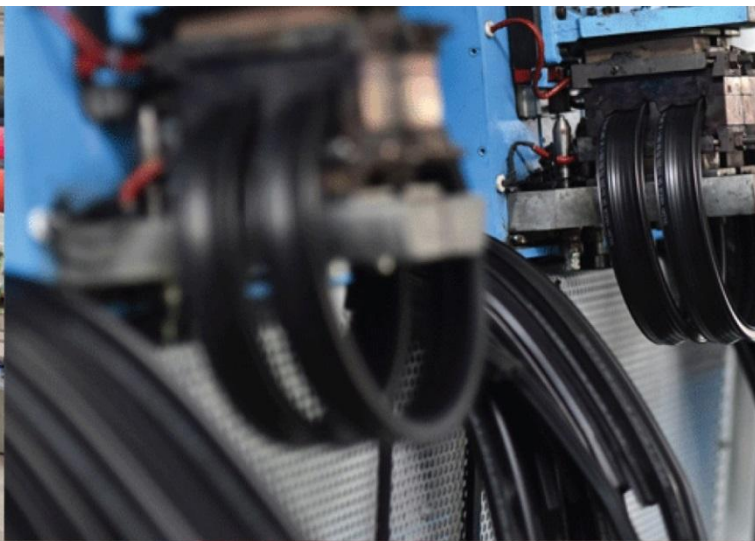
A.M.P.E.R.E (EUROPE)

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 Bamboo Sticks**

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



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Customer :	M/s. Machau Industries LLP
Process :	Batch Microwave+Convection Heat Treatment for Drying of Bamboo Sticks

**TEST REPORT No: 47/KRDC/LAB/17 Mum 29/09/2020**

Date Sample reception : 29/09/2020  
ID : 47/LAB/182

**SAMPLE DESCRIPTION:**

Sampling : As Requested  
Sample Condition : Acceptable  
Quantity : 3 Nos. of bunch  
Sampling date : 02/10/2020  
Product : Bamboo Sticks  
Requirement : Final Moisture Content should be 2%  
Start Date test : 02/10/2020  
End Date test : 02/10/2020

**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)	33°C ( $\pm$ 5°C)
Humidity (%)	$\leq$ 82% RH
Pressure (kN/m <sup>2</sup> 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: 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 Bamboo sticks in batch microwave+convection heating system for drying treatment. For this experimental run, given bamboo sticks have been soaked overnight in water and then after draining it has been placed in microwave+convection heating system with uniform layer to achieve even drying characteristics. Drying treatment has been continued till it gives completely dry texture. Observations are made after every 10 minutes by visible observations and by texture.

## ANALYTICAL RESULTS:

	Trial No. 1	Trial No. 2
Microwave Power (kW)	1.5	1.8
Hot Air Temperature (°C)	100	100
Cycle time (minutes)	30	40
Temperature on Product (°C)	80-90	90-100

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Initial Moisture Content (%)	28.5	33.9
Final Moisture Content (%)	4.2	4.5

## THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:

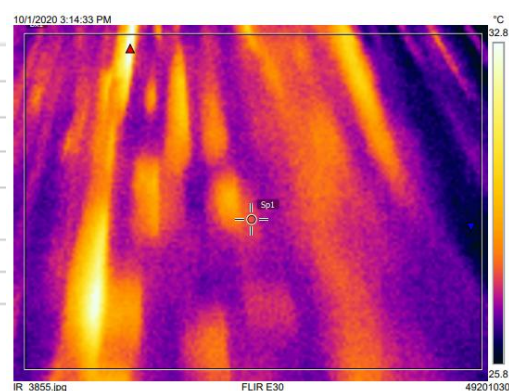
### 1. Before Heat Treatment:

#### Measurements

Bx1	Max	33.8 °C
	Min	25.6 °C
	Average	27.5 °C
Sp1		27.8 °C

#### Parameters

Emissivity	0.95
Ref. temp.	20 °C



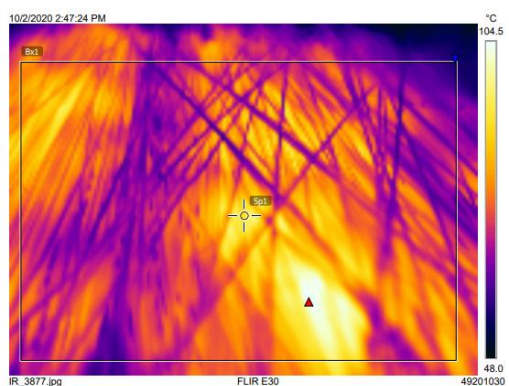
### 2. After Heat Treatment:

#### Measurements

Bx1	Max	105.0 °C
	Min	57.0 °C
	Average	77.2 °C
Sp1		94.1 °C

#### Parameters

Emissivity	0.95
Ref. temp.	20 °C



## BEFORE AND AFTER PICTURES OF TREATED SPCIMEN SAMPLE:



BEFORE



AFTER

Format: F/R&D/01



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**MOISTURE ANALYSIS REPORTS:**

Drying started		Drying started		Drying started		Drying started	
Date : 2-10-2020		Date : 2-10-2020		Date : 2-10-2020		Date : 2-10-2020	
Time : 12:16:43		Time : 13:30:13		Time : 14:06:07		Time : 15:40:33	
Model: AGS200		Model: AGS200		Model: AGS200		Model: AGS200	
Serial number : 138		Serial number : 138		Serial number : 138		Serial number : 138	
Drying parameters		Drying parameters		Drying parameters		Drying parameters	
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 profile : standard		Drying profile : standard		Drying profile : standard		Drying profile : standard	
Mode : Short mode		Mode : Short mode		Mode : Short mode		Mode : Short mode	
Calculation : $\frac{(w_0 - w)}{w_0} \times 100\%$		Calculation : $\frac{(w_0 - w)}{w_0} \times 100\%$		Calculation : $\frac{(w_0 - w)}{w_0} \times 100\%$		Calculation : $\frac{(w_0 - w)}{w_0} \times 100\%$	
Finished : 3 samples		Finished : 3 samples		Finished : 3 samples		Finished : 3 samples	
Initial weight : 0.592 g		Initial weight : 0.578 g		Initial weight : 0.911 g		Initial weight : 0.602 g	
Final weight : 0.423 g		Final weight : 0.546 g		Final weight : 0.602 g		Final weight : 0.575 g	
Drying time : 00:04:40s		Drying time : 00:02:00s		Drying time : 00:07:40s		Drying time : 00:02:00s	
Sampling interval : 20 sec		Sampling interval : 20 sec		Sampling interval : 20 sec		Sampling interval : 20 sec	
Moisture : 28.5 %		Moisture : 4.2 %		Moisture : 33.9 %		Moisture : 4.5 %	
NOTE Initial (Trial No.1)		NOTE Final (Trial No.1)		NOTE Initial (Trial No.2)		NOTE Final (Trial No.2)	
The analysis performed by:		The analysis performed by:		The analysis performed by:		The analysis performed by:	
Signature: <u>KKomal</u>		Signature: <u>KKomal</u>		Signature: <u>KKomal</u>		Signature: <u>KKomal</u>	

**OBSRVATIONS:**

The drying behavior of Bamboo sticks have 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 in drying time. As per physical investigation, it has been observed that there is little colour change without any damage to sample with final moisture content less 5%.

KKomal

Miss. Komal Bhoite  
Tested By