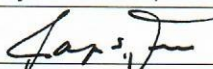


BERKELEY ANALYTICAL

815 Harbour Way South, Suite 6
Richmond, CA 94804-3614
Ph. 510-236-2325; Fax 510-236-2335
E-mail info@berkeleyanalytical.com

Product Formaldehyde Emissions**Customer & Building Product Sample Information**

Report Certification	
Report number	868-002-01A-Oct1016
Report date	Oct 10, 2016
Certified by (Name/Title)	Raja S. Tannous, Laboratory Director
Signature	
Date	October 10, 2016

Standard	
Test method	ASTM D 5116-10 (Small Chamber)

Customer Information	
Manufacturer or organization	Trinity Bamboo, LLC
City/State/Country	Bainbridge Island, WA USA
Contact name/Title	Tom Goodham
Phone number	206-488-1266

Product Sample Information*	
Manufacturer (if not customer)	Same as above
Product name / Number	Trinity Bamboo Engineered (HDF) Strand Bamboo Flooring /
Product CSI category	Wood Flooring (09 64 00)
Customer sample ID	2016
Manufacturing location	Zhejiang Yongyu Bamboo Joint-stock Company Ltd.
Date sample manufactured	Aug 30, 2016
Date sample collected	Sep 3, 2016
Date sample shipped	Sep 6, 2016
Date sample received by lab	Sep 8, 2016
Condition of received sample	No observed problems
Lab sample tracking number	868-002-01A
Conditioning start date & duration (if applicable)	Sep 28, 2016; 6 days
Chamber test start date & duration	Oct 4, 2016; 1 days (24 hours)
Total test start date & duration	Sep 28, 2016; 7 days (168 hours)

*Chain-of-custody (COC) form for product sample is attached to this report

Test Method for Building Product Samples

Test Specimen Preparation – Cut two 19.0cm long sections from bamboo flooring planks, assembled them with one seam, trimmed the tongue and groove to get a 19.0cm*19.0cm specimen, placed on a stainless steel plate and sealed all edges with foil tape. The exposed testing area is based on one surface of 17.6cm*17.7cm. Photographs of the tested specimen are given later in this report. The test results presented herein are specific to this item.

Test Protocol Summary* – This formaldehyde emission test was performed following the guidance of ASTM Standard Guide D 5116. Sampling and analysis for low molecular weight aldehydes were performed following ASTM Standard Method D 5197. The product specimen was prepared from the supplied product sample. If conditioning was required, the specimen was placed directly into the conditioning environment and maintained at controlled conditions of air flow rate, temperature and relative humidity for the specified period. At the end of this period, the specimen was transferred directly to a small-scale chamber. If conditioning was not required, the specimen was placed directly into the small-scale chamber. The chamber conditions for the test period are summarized in Table 1. Air samples were collected from the chamber at one or more specified elapsed times. Samples for the analysis of formaldehyde were collected on treated DNPH cartridges.

Formaldehyde was analyzed by HPLC and quantified using multi-point (4 or more points) calibration curves. The analytical instruments and their operating parameters used for these analyses are described in Appendix A.

Availability of Data – All data, including but not limited to raw instrument files, calibration files, and quality control checks used to generate the test results will be made available to the customer upon request.

Table 1. Chamber conditions for test period

Parameter	Symbol	Units	Value
Tested specimen exposed area	A_s	m^2	0.031
Chamber volume	V_c	m^3	0.067
Loading ratio	L	m^2/m^3	0.465
Avg. Inlet gas flow rate & Range	Q_c	m^3/h	0.067 (0.064-0.070)
Avg Temperature & Range		$^{\circ}C$	22.9 (22-24)
Avg Relative humidity & Range		%	50 (45-55)
Test period duration		h	24
Earlier air sampling time(s)		h	none

*All standards identified in this section are included in Berkeley Analytical's scope of ISO/IEC17025 accreditation, Testing Laboratory TL-383, International Accreditation Service, www.iasonline.org

VOC Emission Test Results

Target Chemical – The target chemical for this test is listed Table 2.

Table 2. Target chemical and applicable sampling and analytical method standards

Chemical	CAS No	Standard
Formaldehyde	50-00-0	ASTM D 5197

Chamber Background Concentrations – Background concentrations of formaldehyde measured at time zero is reported in Table 3. Reported chamber concentrations are background corrected.

Table 3. Chamber background formaldehyde concentrations at time zero

Chemical/Chemical Group	CAS No	Chamber Conc ($\mu\text{g}/\text{m}^3$)
Formaldehyde	50-00-0	LQ

VOC Emission Test Results, Continued

Formaldehyde Chamber Concentrations and Emission Factors – The chamber sample(s) was analyzed for formaldehyde. The emission factors for formaldehyde were calculated from the chamber parameters, the measured quantity of the test specimen and the chamber concentrations.

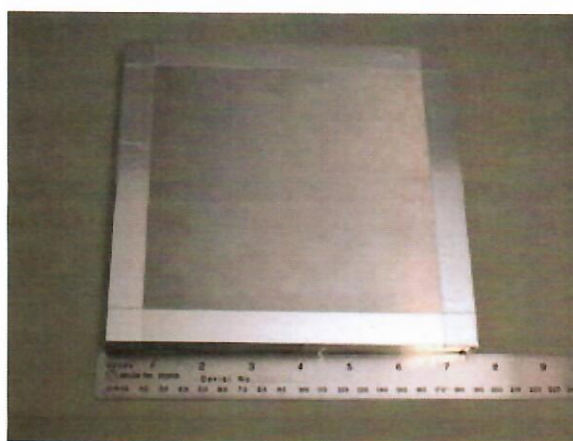
Table 4. Measured chamber concentrations and calculated emission factors for formaldehyde

Chemical/Chemical Group	Elapsed Time* (h)	Chamber Concentration ($\mu\text{g}/\text{m}^3$)	Emission Factor ($\mu\text{g}/\text{m}^2\text{-h}$)
No formaldehyde was detected	all sampling time points	LQ	LQ

*After 6 days of conditioning

Photographs of Tested Product Specimen

Photo Documentation – The product sample specimen is photographed immediately following specimen preparation and prior to initiating the test. Typically, the top and bottom faces of the specimen are photographed. Bottom faces may show a stainless steel plate or other substrate if required by the test.



Definitions**Table 5.** Definitions of parameters

Parameter/Value	Definition
CAS No.	Chemical Abstract Service registry number providing unique chemical ID
Chamber Conc.	Measured chamber VOC concentration at time point minus any analytical blank or background concentration for empty chamber measured prior to test. Lower limit of quantitation (LQ) or reporting limit for individual VOCs is $2 \mu\text{g}/\text{m}^3$ unless otherwise noted
Emission Factor	Mass of compound emitted per unit area per hour (calculation shown below). Reporting limits for emission factors are established by LQ or reporting limit for chamber concentration and specimen area tested
Formaldehyde	Volatile aldehyde quantified by HPLC following ASTM Standard Method D 5197. LQs for formaldehyde is $1.1 \mu\text{g}/\text{m}^3$
LQ	Indicates calculated value is below its lower limit of quantitation
"na"	Not applicable
"<"	Less than value established by LQ

Equations and Comments

Equations Used in Calculations – An emission factor (EF) in $\mu\text{g}/\text{m}^2\text{-h}$ for a chemical in a chamber test of a building product sample is calculated using Equation 1:

$$\text{EF} = (Q_c (C - C_o)) / A_s \quad (1)$$

where Q_c is the chamber inlet air flow rate (m^3/h), C is the VOC chamber concentration ($\mu\text{g}/\text{m}^3$), C_o is the corresponding chamber background VOC concentration ($\mu\text{g}/\text{m}^3$), and A_s is the tested specimen exposed area (m^2).

Comments: None

END OF REPORT

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Appendix A
Analytical Instruments & Operating Parameters

Table A1. Description of analytical instrument components

Component	Description
HPLC	1260 Infinity Quaternary LC, G1314F VW Detector, Agilent
Analytical column	Poroshell 120 EC-C18, Agilent
Column dimensions	2.1 mm x 100 mm
Thermal desorber	Unity / Ultra TD, Markes International, Ltd.
Gas chromatograph	Model 7890A, Agilent
Analytical column	DB-624, J&W Scientific
Column dimensions	1 µm film, 0.18 mm ID, 20 m
Mass spectrometer	Model 5975C MSD, Agilent

Table A2. HPLC operating parameters for analysis of formaldehyde and acetaldehyde

Parameter	Value
Solvent A	65/35% H ₂ O/Acetonitrile
Solvent B	100% Acetonitrile
Flow rate	0.3 mL/min
End time	11 min
Detector wavelength	360 nm