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NOTE: This is an English version report translated from the original test report.

TEST REPORT

No. 05A3535

Client

Address : Lot 414 9 1/4 Batu, Jalan Kelang Kapar, Mukim Kapar,
42200 Daerah Klang, Selangor Darul Ehasan, Malaysia

Firm Name : KOSSAN PAINT (M) SDN. BHD.

Representative: Mr. Lim Siew Kheong, Factory Manager

Designation of Test

MEASUREMENT OF FORMALDEHYDE EMISSION FACTOR OF ADHESIVE
AGENT

This is the test report on results of test requested on February 22, 2006 and issued
on April 19, 2006.

JAPAN TESTING CENTER FOR
CONSTRUCTION MATERIALS
CENTRAL LABORATORY


Tomoyuki Katsuno
Director

[Designation of Test]

Measurement of Formaldehyde Emission Factor of Adhesive Agent

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1. Description of Test

For the adhesive agent "KOSSAN VINYL URETHANE ADHESIVE KA-D4561" submitted by KOSSAN PAINT (M) SDN. BHD., measurement of the emission factor of formaldehyde was carried out.

2. Test Specimen

The name and material, etc. of the test specimens are shown in Table 1.

Table 1 Test Specimen

Test specimen	Name		Adhesive
	Trade name	Base resin	KOSSAN VINYL URETHANE ADHESIVE KA-D4561
		Hardener	KOSSAN VINYL URETHANE ADHESIVE KA-D400-H
	Material		Vinyl copolymer resin adhesive
Application conditions	Base plate		Glass plate (100 x 100 x 3mm)
	Application weight		300g/m ²
	Application area		80cm ² (80 x 100mm)
	Mixing ratio		Base resin : Hardener = 100 : 15
	Test specimen manufacturing date		March 27, 2006
	Remarks		The application work was carried out by the testing staff. The test specimen was prepared in accordance with 5.2. Formaldehyde emission testing in JIS A 5549 (Adhesives for fixture). The test sample applied on the base plate and after preconditioning it in a room with 23°C temperature and 50% relative humidity for 60 minutes, the base plate was installed in the small chamber.

3. Testing Method

The test was carried out in accordance with 5.2 Formaldehyde Emission Test specified in JIS A 5549 (Adhesives for fixture) and JIS A 1901 [Determination of the emission of volatile organic compounds and aldehydes for building products – Small chamber method]. Outline of the testing system is shown in Fig. 1.

3.1 Samplings and analysis

The small chamber was installed in a climate chamber of 28°C in temperature. Ventilation in small chamber was performed with the air that was adjusted to 50 % relative humidity after passed through air cleaning unit. The test specimen was installed in the middle of a cleaned small chamber.

The samples for analysis were collected by derivatizing the chemical substance emitted from the test specimen. For derivatization reaction, air in the small chamber including chemical substance emitted from the test specimen passed through sampler.

Samplings were 4 times in all: background sampling was collected before setting test specimen, and after test specimen installed, samplings of the 1st day, 3rd day and 7th day were collected.

Tables 2 and 3 show the small chamber operating conditions and the sampling conditions for analysis sample, respectively. The formaldehyde was analyzed using acetonitrile extraction – High Performance Liquid Chromatography (HPLC). The analysis conditions are shown in Table 4.

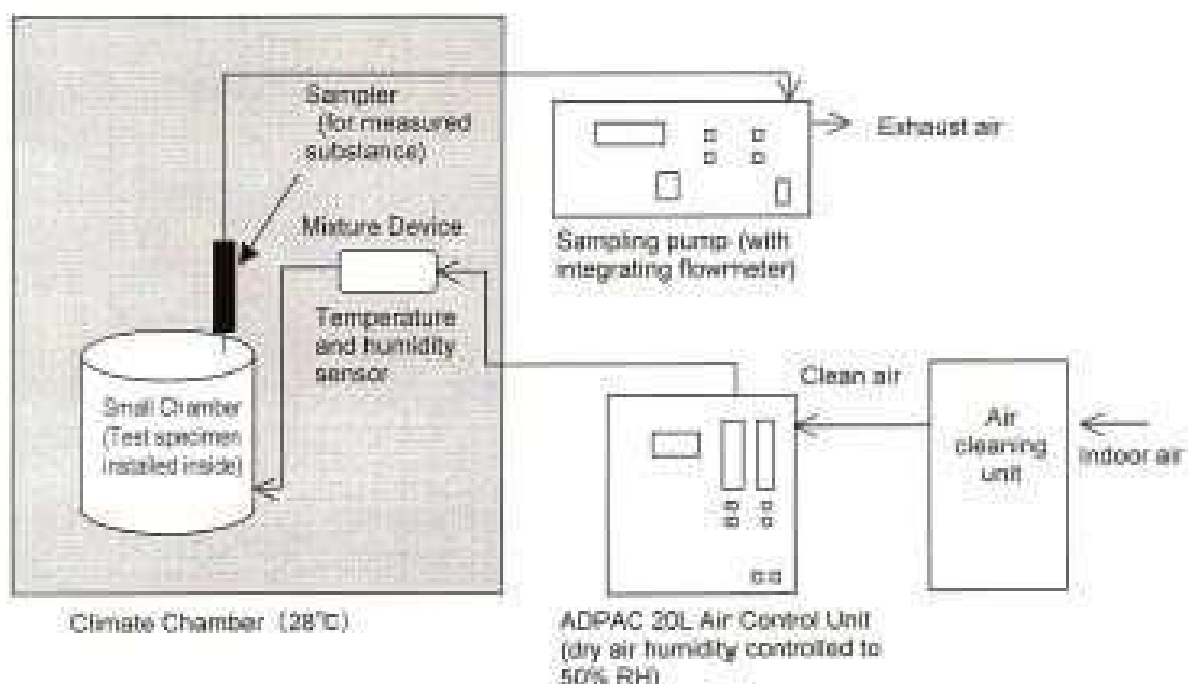


Fig. 1 Outline of Small Chamber System (20 liters)

Table 2 Small chamber operating conditions

Temperature	28±1°C
Humidity	50±5%
Air change rate	0.5 h ⁻¹
Loading factor	0.4 m ² /m ³
Internal volume	20 liters

Table 3 Sampling Conditions for analysis sample

Material to be measured	Formaldehyde
Sampler	GL-Pak mini AERO DNPH (GL Sciences, Inc.)
Flow rate	0.167 L/min
Sampling volume	20 L
Sampling frequency	Twice

Table 4 Analysis conditions

Name of apparatus	Shimadzu High-speed Liquid Chromatograph LC-VP System (Shimadzu Corporation made)
Detection wavelength	360nm
Column	ZORBAX Bonus-RP (φ4.6 x 150 mm)
Mobile phase	Water : Acetonitrile = 52 : 48
Column flow rate	1.5mL/min
Column temperature	40°C

3.2 Calculation of emission rate

From the measured values (concentration of chemical substance in the chamber) obtained in 3.1 above, the emission rate was calculated by using the following formula.

$$EF_u = \frac{(C_t - C_{t_0}) \times Q}{A} = (C_t - C_{t_0}) \times \frac{\pi}{L}$$

- where,
- EF_u: emission factor per unit area (μg/(m²·h))
 - C_t: small chamber concentration at elapsed time t (μg/m³)
 - C_{t₀}: travel blank concentration at elapsed time t (μg/m³)
 - Q: Ventilation rate in small chamber
 - A: Test specimen/test piece surface area (m²)
 - π: air change rate (h⁻¹)
 - L: Loading factor (m²/m³)