NARRATIVE REPORT

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Job Code: 209003

Report Date: May 6, 2004
Client: Samuel J. Goldberg, American Formulation & Manufacturing
Product I.D.: 50606-SR60 Safecoat Polyureseal BP Coating
Manufacturer's I.D.: DA94
Production Date: April 19, 2004
Product Received: April 22, 2004
Report Prepared By: R.S. Tannous, Laboratory Director

Report Approved By: _____ **Date:** 5/7/04
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OBJECTIVE

The objective of this test was to measure the emissions of formaldehyde from a clear coating sample at seven days. The test conformed to the guidance of the Japanese Industrial Standard, JIS A 1901 (2003), "Determination of the emission of volatile organic compounds and aldehydes for building products-Small chamber method."

SUMMARY

The coating was tested for emissions of formaldehyde. The test specimen was prepared by applying 1.73 grams of coating to a 178-mm x 178-mm (0.0316 m^2) stainless steel plate with a roller. The coating was let cure for one hour before transferring to testing chamber. The environmental parameters for the test were 28±1°C temperature, 50±5% relative humidity and 1.0±0.05 air change rate. Measurements of chamber VOC concentrations were made at 7 days. Area-specific emission rates (EF_a) were calculated by mass balance. The formaldehyde emission factor was below the lower limit of quantitation of <2.1 μg m^{-2} h^{-1}.

METHODS

Description of Product Specimen

On April 22, 2004, the laboratory received a product sample consisting of a container of a clear coating. The sample was identified as: manufacture's ID # DA94; product name Safecoat Polyureseal BP-SR60; sample ID 50606-SR60; manufacturing date 4/19/04. The sample was handled in accordance with BAA-SOP-2000.02, "Selection, Collection and Handling of Material Specimens for Testing to Determine the Emissions of Volatile Organic Compounds." On April 26, 2004, the container was opened. The coating was first thoroughly mixed in its container by stirring. Approximately 100 ml volume was transferred to an aluminum tray. A paint roller with a 10-cm cover was saturated with coating by running the roller back and forth in the tray. The coating was applied to one side of a 178-mm x 178-mm (0.0316 m^2) stainless steel plate using four strokes, two in the vertical direction and two in the horizontal direction, so that the entire area was uniformly

covered. 1.73 Grams of coating were applied in a single film. The coated surface area was 0.0316 m^2. Thus, the product loading was 55 g m^{-2}. The test specimen was allowed to dry for one hour before placing it on an open wire shelf in the test chamber.

Formaldehyde Analysis

The methods used for the sampling and analysis of formaldehyde and other carbonyl compounds are based on ASTM Method D-5197, "Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)."

Sep-Pak XPoSure Aldehyde Samplers (Part number WAT047205, Waters, Corp.) are used to collect air samples for formaldehyde and other low-molecular weight carbonyl compounds. Air is pulled through a sampler, and the acidified 2,4-dinitrophenylhydrazine (DNPH) reagent in the sampler reacts with carbonyl compounds to form the stable hydrazone derivatives that are retained by the sampler. The hydrazone derivatives are eluted from a sampler with acetonitrile. An aliquot of the sample is analyzed for the hydrazone derivatives of formaldehyde and acetaldehyde using reverse-phase high-performance liquid chromatography (HPLC) with UV detection. The absorbance of the derivatives is measured at 360 nm. The mass responses of the resulting peaks are determined using multi-point calibration curves prepared from standard solutions of the hydrazone derivatives.

Testing for Emissions of Formaldehyde from Materials Using Small-Volume Chambers

The methods used for the measurement of emissions of VOCs from this product specimen are based on the Japanese Industrial Standard, JIS A 1901 (2003), “Determination of the emission of volatile organic compounds and aldehydes for building products-Small chamber method,“ English edition.

The chamber consists of a 67-L, stainless steel cylindrical vessel with a stainless-steel lid equipped with three fittings. The chamber is held in an incubator that is maintained at 28±1^o C. Purified air from a clean air generator is introduced into the chamber through one fitting with a stainless-steel tubing extension. The inlet flow rate of 1.12±0.06 standard L min^{-1} is regulated with electronic mass-flow controllers (calibrated at 25^o C and 1 atm. pressure). The gas stream is split into two streams. One of these is passed through a bubbler containing distilled water. This saturated gas stream is mixed with the dry gas stream to produce a humidified gas stream with a relative humidity (RH) of 50±5% that is then introduced into the chamber. A humidity probe (Model HMD 30YB, Vaisala) is inserted into the chamber through a second fitting on the lid. Chamber temperature and humidity are measured and recorded throughout the test. Gas exits and is sampled for the analytes of interest at the other fitting on the lid. Atmospheric pressure at the laboratory is near 1 atm. Prior to use, the chamber and fittings are cleaned by washing them with hot water and a detergent.

A clean, empty chamber is operated at the same testing conditions for at least three hours prior to a test. Chamber background concentrations are measured. Then, the chamber is opened and the material specimen is positioned on a wire rack approximately near the center of the chamber. To initiate a test, the chamber is sealed and ventilated. At specified times, gas samples are collected at the chamber exhaust. The sample flow rates are regulated with electronic mass-flow controllers (calibrated at 25^o C and 1 atm. pressure). Aldehyde samples are collected on XPoSure Aldehyde Samplers at a flow rate of 0.5 standard L $min^{-1.}$ For this test, a 30-L gas sample for the analysis of formaldehyde was collected 7-days after initiating the test period. The parameters for the emissions test are summarized in Table 1.

Table 1. Parameters for a formaldehyde emission test conducted in a small-scale chamber.

Parameter	Value
Chamber volume, m^3	0.067
Coating substrate	Stainless steel
Substrate dimensions, mm	178 x 178
Coated surface area, m^2	0.0316
Loading ratio, $m^2\ m^{-3}$	0.472
Weight of coating applied, g	1.73
Inlet flow rate, $m^3\ h^{-1}$	0.067 ± 0.003
Average temp, ^oC	28 ± 1
Atmosphere	Humidified Air
Average humidity, %RH	50 ± 5
Test duration, day	7

Data Analysis and Reporting for Emission Tests

Steady-state emission rates (µg h^{-1}) are calculated for the quantified compounds using the following equation:

$$ER = Q\ (C - C_o) \quad (1)$$

where Q is the volumetric flow rate ($m^3\ h^{-1}$) through the chamber; C is the average chamber concentration for the sampling interval (µg m^{-3}); and C_o is the chamber blank or inlet gas concentration (µg m^{-3}). An area-specific emission rate or emission factor, EF_a (µg $m^{-2}\ h^{-1}$) is calculated by dividing the emission rate by A, the exposed planar surface area of the product (m^2).

$$EF_a = ER / A \quad (2)$$

RESULTS

Formaldehyde Emissions

The 7-day chamber sample was quantitatively analyzed for formaldehyde. The chamber concentrations and area-specific emission rate results are presented in Table 2. The chamber blank concentration was below the quantitation limit of 1 µg m^{-3}. The coating sample chamber concentration was also below the lower limit of quantitation of 1 µg m^{-3}.

Table 2. Chamber concentrations and emission factors of formaldehyde measured at 7 days for a test of 50606-SR60 Safecoat Polyureseal BP Coating.

Compound	Chamber Conc. (µg m^{-3})	Emission Factor (µg $m^{-2}\ h^{-1}$)
Formaldehyde	ND	ND