



Test Report
Glava AS
Emission test of
Ecophon Venus
according to M1 classification

October / November 2006

Client: **Glava AS**
Nybråtveien 2
1832 Askim
Norge

Date: 8th of November 2006

Testing Laboratory: Eurofins Miljø A/S
Smedeskovvej 38, DK-8464 Galten

Inge Bondgaard
Chemist

Thomas Neuhaus
Environmental Engineer



Table of Contents

1	Description of the Applied Testing Method	3
1.1	Test Specimen	3
1.2	Test Chamber	3
1.3	Testing Procedure.....	3
2	Results	6
2.1	Testing after 28 days.....	6
2.2	Sensory testing after 28 days	7
3	Interpretation of the Results	8

Appendices:

Appendix 1: Chromatogram VOC after 28 days	9
Appendix 2: Test Report for Delivery to RTS, Finland	10

Introduction

On 14th of September 2006 Eurofins Environment A/S received a sample named

Ecophon Venus, 6,5% binder

Date of production: 13th of September 2006.

The sample was clearly labelled, properly packaged and not damaged. Testing was carried out in the laboratories of Eurofins Miljø A/S. Before starting the testing procedure on 20th of September 2006 the sample had been stored unopened at room temperature.

1 Description of the Applied Testing Method

The applied method complies with the Protocol for Chemical and Sensory Testing of Building Materials as defined by the Finnish Emission Classification of Building Materials (version of 2002). The test method is based on the published methods: ENV 13419-1, ENV 13419-3, ISO 16000-3, ISO 16000-6, 16000-9, 16000-11. The internal method numbers are: 9810, 9811, 9812, 2808 and 8400.

1.1 Test Specimen

A sample was sent by the client to the laboratory of Eurofins Environment A/S in an airtight package. The package was opened and a test specimen was cut out. Edges and back were covered with aluminium foil. The sample was transferred into to a test chamber immediately (internal method no.: 9810).

1.2 Test Chamber

- **Chemical Testing:** The test chamber was consisting of stainless steel and had a volume of 119 litres. The air clean-up was realized in multiple steps. Before loading the chamber a blank check of the empty chamber was performed. The operation parameters were 23 °C, 50 % relative air humidity (in the supply air) with an air exchange rate of ½ per hour. The loading of the test chamber was 0.4 m² test specimen per m³ air volume, corresponding to an area specific flow rate of 1.25 m³/m²h (internal method 9811).
- **Sensory Testing:** The test chamber was a "BIG-PAC" chamber made of glass and had a volume of 200 litres. The air clean-up was realized in multiple steps. Before loading the chamber, a blind check of the empty chamber was performed. The operation parameters were 23 °C, 50 % relative air humidity (in the supply air). When assessing the odour, an area specific air flow rate of 4.76 m³/(h x m²) assured a flow rate of 0.9 litres per second (3,24 m³/h, air exchange 16 per hour) at the chamber outlet. The loading of the test chamber was 3,24 m² test specimen per m³ air volume (internal method 9811).

1.3 Testing Procedure

All emissions were calculated as area specific emission rate SER with the following formula:

$$SER = C \times n / L$$

With:

- C Concentration in test chamber, µg/m³
- n Air exchange rate, 1/h
- L Loading factor, m²/m³

1.3.1 Testing of VOC, SVOC, VVOC after 28 Days

The emissions of organic compounds after 28 days were tested by drawing air samples from the chamber outlet through Tenax TA tubes (main tube and backup tube). Analyses were done by thermal desorption and gas chromatography / mass spectroscopy (internal methods: 9812 / 2808).

Quantification was done with the Total Ion Chromatogram (TIC) signal, or in case of overlapping peaks by calculating with fragment ions. All identified and non-identified substances were quantified as toluene equivalent if giving more than 2.5 µg/m²xh. The uncertainty amounted to ± 20% (RSD).

The results of the individual substances were calculated in three groups depending on their appearance in a gas chromatogram when analysing with a non-polar column (HP-1):

- Very volatile organic compounds VVOC: All substances appearing before n-hexane (n-C₆).
- Semi-volatile organic compounds SVOC: All substances appearing after n-hexadecane (n-C₁₆).
- Volatile organic compounds VOC: All substances appearing between these limits.

Calculation of the Total Volatile Organic Compounds was done by addition of the results of all individual substances in the retention time interval C₆-C₁₆.

Calculation of the Total Semi-Volatile Organic Compounds was done by addition of the results of all substances between C₁₆ and C₂₂.

Calculation of the Total Very Volatile Organic Compounds was done by addition of the results of all substances appearing before C₆.

This test covered only substances that can be adsorbed on Tenax TA and that can be thermally desorbed. If other emissions occurred then these could not be monitored (or with limited reliability only).

1.3.2 Testing of Carcinogens after 28 Days

The presence of volatile organic carcinogens (IARC 1987 listing, category C1, 1 µg/m²xh and above), which means benzene and vinyl acetate, was tested. This test covered only substances that can be adsorbed on Tenax TA and that can be thermally desorbed. If other emissions occurred for example vinyl chloride then - these could not be monitored (or with limited reliability only).

The test was done by drawing air samples from the chamber outlet through Tenax TA tubes (main tube and backup tube) after 28 days. Analyses were done by thermal desorption and gas chromatography / mass spectroscopy (internal methods: 9812 / 2808). The uncertainty amounted to ± 20% (RSD).

The presence of a listed carcinogen was stated if the specific combination of fragment ions was lacking at the specific retention time in the chromatogram. Otherwise it was checked whether the required detection limit (1 µg/m²xh) was exceeded. In this case the identity was finally checked by comparing full scan sample mass spectra with full scan standard mass spectra.

This test covered only substances that can be adsorbed on Tenax TA and that can be thermally desorbed. If other emissions occurred then these could not be monitored (or with limited reliability only).

1.3.3 Testing of Aldehydes after 28 Days

The presence of formaldehyde was tested by drawing air samples from the chamber outlet through DNPH-coated silicagel tubes after 28 days. Analysis was done by solvent desorption, HPLC and UV-/diode array detection (ISO 16000-3, internal methods: 9812 / 8400). The uncertainty amounted to ± 20 % (RSD).

The absence of formaldehyde and acetaldehyde was stated if the specific wavelength UV detector response was lacking at the specific retention time in the chromatogram. Otherwise it was checked whether the detection limit (5-10 µg/m³) was exceeded. In this case the identity was finally checked by comparing full scan sample UV spectra with full scan standard UV spectra.

1.3.4 Testing of Ammonia after 28 days

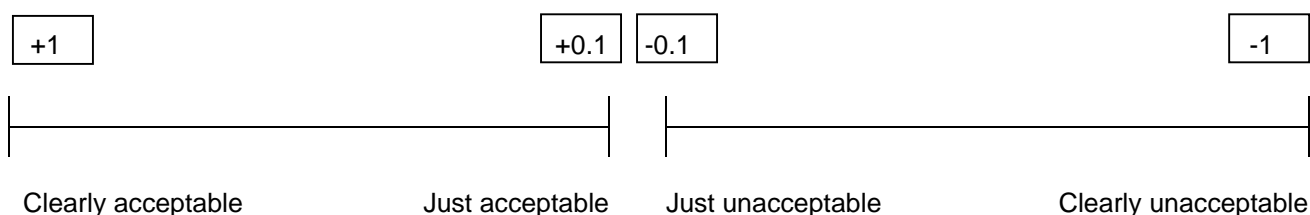
The presence of ammonia was tested by drawing air samples from the chamber outlet through silicagel tubes coated with sulphuric acid after 28 days. Analysis was done by solvent desorption and UV/VIS spectroscopy (internal methods: 9812 / 4430). The uncertainty amounted to $\pm 20\%$ (RSD).

The absence of ammonia was stated if the signal was lacking at the specific wavelength. Otherwise it was checked whether the detection limit was exceeded.

1.3.5 Sensory Testing after 28 Days

The sensory testing was done after 28 days storage under controlled conditions in the testing chamber. 15 persons assessed the odour first of the room air and then give the odour rating twice for each chamber. Between two assessments there was a minimum break of 2 minutes. Each single judgement was based on the odour impression after 2-3 inhalations. The odour was rated immediately after each assessment on a continuous scale with values between +1 (clearly acceptable) and -1 (clearly unacceptable), with just acceptable = +0.1 and just unacceptable = -0.1. The scale was read with an accuracy of ± 0.1 . The result was calculated as the average of the 30 assessments from the odour rating of the 15 persons. Only panel members rating clean moistened air as acceptable (< 0.8) were considered in the calculation.

Sensory acceptance:



1.3.6 Deviations from the M1 Test Method

No deviations.

1.3.7 Accreditation

The sensory testing method is not yet covered by the accreditation (ISO 17025-1) by DANAK (no. 168). Anyway, Eurofins is accepted by RTS, Finland, for M1 testing - including sensory testing.

The testing methods described above have been accredited (ISO 17025-1) by DANAK (no. 168).

2 Results

2.1 Testing after 28 days

Ecophon Venus	CAS No.	Retention time min	ID-Cat.	Concentration $\mu\text{g}/\text{m}^3$	Emission rate $\mu\text{g}/\text{m}^2\text{h}$	Criteria $\mu\text{g}/\text{m}^2\text{h}$
TVOC (C6-C16)				< 2	< 2.5	200
Single VOC Substances: n.d.						-
Total VVOC (< n-C6)				< 2	< 2.5	-
Single VVOC Substances: n.d.	-	-	-	< 2	< 2.5	-
Total SVOC (> n-C16)				< 2	< 2.5	-
Single SVOC Substances: n.d.	-	-	-	< 2	< 2.5	-
Total Carcinogens				< 1	< 1	1
n.d.	-	-	-	< 1	< 1	-
Formaldehyde	50-00-0	-	1	35	44	50
Ammonia	7664-41-7	-	1	< 20	< 25	30

n.d. Not detected
< means less than

Categories of identity:

- 1 = definitely identified, calibrated as toluene equivalent
- 2 = identified by comparison with a mass spectrum obtained from a library, identity supported by other information, calibrated as toluene equivalent
- 3 = identified by comparison with a mass spectrum obtained from a library, calibrated as toluene equivalent
- 4 = not identified, calibrated as toluene equivalent

2.2 Sensory testing after 28 days

Sample	Ecophon Venus	
Overall average	0.7	
	First assessment	Second assessment
Average	0.7	0.7
1	0.5	0.5
2	1.0	1.0
3	0.7	0.7
4	0.7	0.7
5	0.9	0.9
6	1.0	1.0
7	1.0	1.0
8	0.1	0.1
9	0.4	0.4
10	0.5	0.5
11	0.9	0.9
12	1.0	1.0
13	0.1	0.1
14	0.9	0.9
15	0.5	0.5

3 Interpretation of the Results

The results of **Ecophon Venus** can be summarised within the scope of M1 classification as follows.

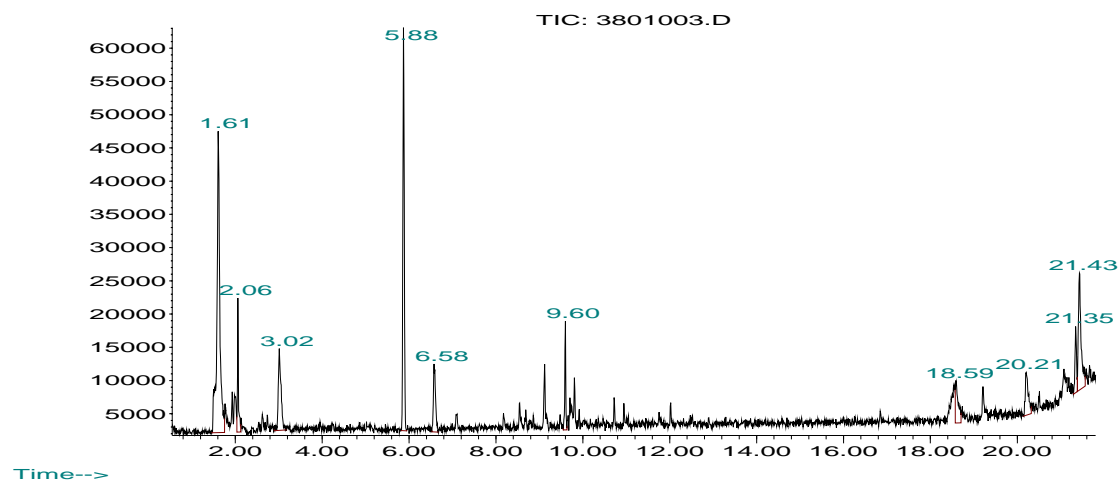
The emission rate after 28 days was

- **Below** the classification threshold of 200 µg/m²h for TVOC
- **Below** the classification threshold of 1 µg/m²h for carcinogens
- **Below** the classification threshold of 50 µg/m²h for formaldehyde
- **Below** the classification threshold of 30 µg/m²h for ammonia
- The sensory acceptance **meets** the classification criterion (+0.1 or higher)

The tested product Ecophon Venus complies with the requirements of M1 for the tested parameters.

Appendix 1: Chromatogram VOC after 28 days

Abundance



The results are only valid for the tested sample(s).

This report may only be copied or reprinted in its entirety, parts of it only with a written acceptance by Eurofins Miljø A/S.

Appendix 2: Test Report for Delivery to RTS, Finland

Emission measurements for the emission classification of building materials

Product: Ceiling panel					
Product name	Ecophon Venus				
Production date (by the manufacturer)	13 th of September 2006				
Sending date (by the manufacturer)	13 th of September 2006				
Description of packaging and transport	Properly packaged and not damaged				
Product received at the testing laboratory, date	14 th of September 2006				
Thickness of the sample	-				
Test period started, date	20 th of September 2006				
Conditions during ageing (C°, RH%)	23 °C, 50 % RH in test chamber				
Emission sampling, date	18 th of October 2006				
Chamber technique					
Parameter	Chamber volume (m ³) and type	Air change rate (h ⁻¹)	Temperature (°C ± °C)	Relative humidity (%)	Test specimen loading factor (m ² m ⁻³)
VOC, TVOC, Formaldehyde, Ammonia	stainless steel	0.5	23 ± 1	50	0.42
Sensory evaluation	200 litres BIG-PAC	16	23 ± 1	50	3.24
Emission sampling and analytical methods					
Parameter	Method, Standard or own validated method	Adsorbent / Absorbent	Sampling volume (l)	Quantification / Analysis method	Detection limit of the method used
VOC, TVOC	2808	Tenax	10	GC/MS	2,5 µg/m ² h
Formaldehyde	8400	DNPH-coated silicagel	43.8	HPLC/UV	7 µg/m ² h
Ammonia	4430	Sulphuric acid coated silicagel	94.4	Spectro-fotometry	25 µg/m ² h

The results are only valid for the tested sample(s).

This report may only be copied or reprinted in its entity, parts of it only with a written acceptance by Eurofins Miljø A/S.



Sensory evaluation	9800 mod.	-	-	Human nose	-
--------------------	-----------	---	---	------------	---

Results – Specific emission rates, SER

TVOC	µg/(m ² h) as toluene equivalent between C ₆ to C ₁₆	< 2.5
Single VOCs C ₆ to C ₁₆ the emission of which exceed 0,005 mg/(m ² h)	See separate table	
Single VOCs outside the frame C ₆ to C ₁₆ the emission of which exceed 5 µg/(m ² h)	See separate table	
Formaldehyde	µg/(m ² h)	44
Ammonia	µg/(m ² h)	< 25
Carcinogens, SER > 1 µg/(m ² h)	µg/(m ² h) as toluene equivalents	< 1
The chromatogram with identified main components	APPENDIX 1	
Sensory evaluation	Average of acceptability	0.7

Single VOCs C6-C16 the emission of which exceed 5 µg/(m²h) as toluene equivalent

Retention time	Name	CAS Number	µg / (m ² h)
No single VOC's detected			
		TVOC	< 2.5
		Identified	-
		Identification %	-

Single VOCs outside the frame C6-C16 the emission of which exceed 5 µg/(m²h) as toluene equivalent

Retention time	Name	CAS Number	µg / (m ² h)
No single VOC's detected			
		TVVOC+TSVOC	< 2.5
		Identified	-
		Identification %	-

Measurement uncertainty

The uncertainty of the testing procedure including all steps from material or product sampling to final results.

SER _{TVOC}	± 20 % RSD	SER _{NH3}	± 20 % RSD	SER _{Formaldehyde}	± 20 % RSD
---------------------	------------	--------------------	------------	-----------------------------	------------