GreenBase® BioTechnology AG

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RESEARCH & DEVELOPMENT

Applicant

HYLA International
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CERTIFICATION REPORT

Object: **HYLA GST**
AIR AND ROOM CLEANING SYSTEM

Conceptual definition and analysis foundation

Analysis of a room cleaning system related to its performance and efficiency regarding the bonding of respirable dust in a defined ambient air for reduction of „allergy causing substances".

Abstract

The HYLA GST mechanically produces aerosol Ø particles < 5 µm. Those allow a highest possible amount of loading of the respirable dust or pollutants in a suction angle of the ground position due to the enlarged water surface at the swirling effect of 20,000 ROT/min. In this process, volumetric loadings up to Ø particles < 2 µm are concentratedly collected in the suction flow, so that respirable dust particles with adapted spores and harmful germs are removed from the air of the room. Particles and germs keep bond in the water of the water pan and need to be poured out to a public sewer system directly after usage of the GST.

Allergy causing substances of organic or synthetic origin that had beforehand been measured in the room air via its adaption to spores (also odour molecules), are liable to the surface aerosol bonding in the HYLA GST with > 1 Mln / Ø particles < 5 µm / sec operation time.
Converted to the flow capacity of 2.5 m^3 / min it corresponds to > 50 M aerosol particles, able for bond, in the GST water pan.
In contrast, the test room for a reference point measurement, had available a contaminated volumetric loading of approximately 10,000 cfu/ m^3 (colony-forming units).
After the application of the HYLA GST, the diagonal space axis x-y showed < 50 cfu / m^3 at the measuring points.
The solid matter and water analysis (extraction from the water tank after application) showed the existence of spores and germs of pathogen nature (germs harmful to health). The high level of efficiency regarding the air cleaning method of the HYLA-GST physical cleaning system is demonstrated.
The HYLA GST air cleaning system performs a degree of purification of > 90% at an ascertained operation time of 15.3 sec/ m^3 room volume, especially in terms of allergy causing substances and VOC (volatile organic hydrocarbon).

Oberägeri, 16th February 2010

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Certified by GreenBase BioTechnology AG Switzerland
RESEARCH DEVELOPMENT

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Scientific Advisory Council

Annexe: Certification Report

Product information HYLA GST

Application range:

- air cleaning / air refreshment
- deep cleaning with electro brush and turbo
- wet sucking
- wet cleaning of smooth floors
- wet cleaning of carpeted floor, carpets and upholstery

Technichal data:

- Voltage : 220 - 240 V, 50/60 Hz
- HYLA rating : 500 W – at the air cleaning mode
  850 W – at the sucking mode
- Electro brush : 150 W
- Max. air flow : 2.5 m^3 / min
- Volume water pan : 4 litre (ckeck mark)
- noise level : 75 - 78 dB
- Separator : 20 000 ROT / min (air cleaning mode)
  25 000 ROT / min (sucking mode)

Abstract from reference point measurement
Quick facts

Item	Experiment description	Table Nr.	Results	
			positive	negative
1	Loading amount, Air humidity, temp.		••• ••	
2	Loading amount, Air humidity, temp.		••• ••	
3	Air exchange		•••	
4	Dilution effect	1	•••	
5	Room penetration depth	2	••••	
6	VOC/ CO2 Test chamber Measurement - Respirable dust	3	 ••• ••••	
7	Room air cfu / m3	4	•••	
8	Sewage cfu / ml	5	•••	o

•••• very good +
••• very good
•• good – specifically dependent
• reapeat application more often
o danger of microbial contamination at holding time without draining and cleaning of the HYLA GST

General informationen

From a microbiological point of view, room air quality primariliy examines the respirable dust as suspended particles that are bonded to organic or mineral loads and can be sighted microscopically. Bonded to this load are organic but also chemical odour molecules. Chemical caused emissions do not underlie an organic aerobiosis process and are not measurable at an air space measuring concerning the identification of cfu (colony-forming units).
Our evaluations, thus, bases on a long-term measuring with a germ accumulation process of the air that had been intermitted extreme organic emissions in cycles for measuring as well as a test chamber process within a defined room[1].
Further, it was conducted a compartment glass test regarding the volumetric loading with VOC and CO2.

Therefore was chosen a test room meeting following parameters.

a) *Location Switzerland, 21 Km radius to the city Zurich, situated in the East ;*
b) *Hight 1000 m (actual = 970 m) ;*
c) *Air humidity ∅ 48% (term of measuring = 90 days) ;*
d) *Period spring 2009 February until April ;*
e) *Nature reserve with mixed forest ;*
f) *Agricultural used area with pig fattening holding > 300 animals ;*
g) *Low VOC - loads (low rate of volatile hydrocarbonate bonds) ;*
h) *Co2 – loads ;*
i) *Pollen- loads ;*
j) *Allergenic substances ;*
k) *Respirable dust –loads ;*

The measuring was conducted by order of a Dutch Commission „ Agricultural pollution in boarder areas of pig fattening holdings."

Throughout the testing various methods and metrological auxiliary devices were applied. Therewith the air cleaning system of the company **HYLA- International** with its **new development of GST** was included in the test.

Out of it the following results and measurements arised which could be formulated in the certification report.

Intake volume => load + air humidity

1. Reference point measurement / 1

At a measured room temperature of 24°C and an air humidity of 15% a temperature reduction of 2°C (to 22°C) and an air humidity rise of 44% (delta = 4°C) can be measured after an operation time of 15 minute the HYLA GST.

Remarks:

1. Within the first 5 minutes of operation, a dehumidification of the room air < 40% was measured at an unchanged stable room temperature.
2. With half a room air exchange (15 minutes operation time), the temperature reduction and the significant rise of air humidity proves an air cleaning at a large water surface.

2. Reference point measurement / 2

At a measured room temperature of 22°C and an air humidity of 39% a temperature reduction of 3°C (to 19°C) and an air humidity rise of 48% (delta = 9°C) can be measured after an operation time of 30 minutes of the HYLA GST.

Remarks:
That proves the fact that the HYLA wet vacuum cleaner guarantees a high degree of efficiency also in the air cleaning mode. This especially applies for regions with an extreme low air humidity.
In reverse, it remains to examine in how far an air dehumidification is possible at high air humidities > 70% and a short operation time.

3. Reference point measurement / 3- air exchange

The ordinary air exchange (closed-off room) calculates from the maximum air flow rate of 2.5 m^3 / min, consequently a theoretical freighting of a room air volume of 80 m^3 at a time of 32 minutes is possible in the air and water swirl. This means a humidification of the air flow with a maximum air humidity saturation of 99.99% after flow-through at the exit stub.

Remarks:
The relative air humidity saturation underlies a thinning factor that is dependent from room volume, temperature, air humidity and operation time.

4. Reference point measurement / 4 – thinning effect

The thinning effect between untreated (unsaturated) room air (measurement 1) => 48% air humidity at a room temperature of 20°C (measurement 2) and an operation time of only 16 minutes (measurement 3) => 52 % air humidity (measurement 4) corresponds a load of 35 ml water (+ - 0.5 ml tolerance) (measurement 5) at a room volume of 80 m^3.

Thinning effect
Table: 1

Measurements	Room temp. / °C	Air humidity / %	Operation time / min	Load ml / m^3
Measurement 1		48%		
Measurement 2	20 °C			
Measurement 3			16 min	
Measurement 4		52%		
Measurement 5				0.437 ml

Remarks:
Within 16 min, a load of 0.437 ml / m^3 was freight at a temperature of 20°C. Hence, an air accumulation via aerosols to 0.437 : 16 = 0.03 ml / min / m^3 room air results.

5 . Reference point measurement / 5 – Room penetration depth

The room penetration depth (measurement 6) at an air flow rate of 2.5 m^3 / min causes a mass flow, that could be measured due to entering and emergent air volumes at the installed measuring plates (measure point (x) +(y) – measurement 7) of the diagonal room axis after a 15.3 sec operation time (measurement 8).

Room penetration depth
Table: 2

Measurement	Air volume flow / 2.5 m^3 / min	x - y / m Room axis	Operation time / seconds	Load ml / m^3
Measurement 6	2.5			
Measurement 7		8.51 m		
Measurement 8			15.3 sec	0.0075

Remarks:

The maximise load of 0.43 ml /m^3 allows a bond of the dust and dirt particles in a suction angle of the ground position of the HYLA GST. At the same time, volumetric loadings (Ø particle < 2 µm) are collected in the input volume and bond in the water of the water pan. Air flow and aerosol distribution in interaction form an effective mechanism to bond dust particles with adapted spores and harmful germs in the room hygiene.
Since particles < 2 µm show a possible respirability, adapted spores and harmful germs in the room hygiene can be removed most effectively by an air cleaning system.

6. Reference point measurement / 6 – VOC Test Chamber Measurement / Respirable Dust

Test Chamber Process in maximise referring to DIN V EN 13419 sheet 1 to 3.

With the Test Chamber Process examinations, concerning which emissions are released by movables, equipment materials or building products, are possible under practically oriented conditions.
With the help of a Test Chamber Process the emission performance in the defined room [1] could be examined.

Result of the air sample „Internal space pollutants" from the compartment glass chamber in comparison to the AGÖF benchmark for volatile air substances (µg /m^3).
Method: VOC-Screening via gaschromotograph mass spectrometer (GCMS)
High Concentrations (370 µg /m^3, of the, as main components of the room air contained alkanes undecan, dodecan and tridecan) were verifiable in the test chamber air at the standard value of 4 µg /m^3.

Internal Test- No. 494 sheets 1-16

Conclusion:
Table: 3

Parameter	Room temp. 20 °C	Air humidity 48 %	Operation time /16 min	Load 0.437ml / m^3	HYLA application
Measurement 4					
	Air sample from defined room [1]	**Target value**	**Standard value**	**Ment worth**	**Air sample from defined room [1]**
Total VOC µg / m^3	2870	100	300	1000	< 600
Miscellaneous					
Cyclohexanamin	< 5	< 5			
Respirable dust				> 50 µm / m^3	
Ø particles < 10 µm	ca. 12 M	100 000	500 000	1,000 000	< 300,000

Remarks:

The Test Chamber report Reference point measurement/ 6 - Internal Test - No. 494 sheets 1-16 showed an accumulation of alkanes in the room air after application of the HYLA GST system in interior spaces.
The VOC – total amount after single application could be reduced below the ment worth.
This is an obvious hint to the relevance of the pollutant source and a regular (weekly) use of the HYLA GST system is recommended for air hygiene.
The loading of respirable dust could be reduced below the standard value by an operation time of only 16 min.

7. Reference point measurement / 7 – Room air cfu / m^3

The Test Chamber report / Internal Test - No. 495 sheets 1-4 showed a reduction of germ cultivating respirable dust loadings in the room air due to the application of the HYLA GST system.

Conclusion
Table: 4

Parameter air	**Room temp. 20 °C**	**Air humidity 48 %**	**Operation time / 16 min**	**Load 0.437ml / m^3**	**HYLA-application**
Measurement 5					
Cfu / m^3	**Cfu from defined room [1]**	**Target value**	**Standard value**	**Ment worth**	**Air sample from defined room [1]**
	> 1 500	100	100 -1000	> 1000	< 50

Remarks:

The load of respirable dust could be reduced below the standard value at an operation time of only 16 min. Therewith, also the load of germs in the room air becomes standard value (see reference point measurement 7).

8. Reference point measurement / 8 – Sewage from water pan cfu / ml

Conclusion
Table: 5

Parameter Sewage	Room temp. 19 °C	Air humidity 50%	Operation time / 16 min	Load 0.437ml / m^3	HYLA- application 2.5 m^3 / min flow capacity
Measurement 1			2 o'clock p.m.		
Cfu / ml	Cfu from defined 4 ltr pan	Target value -/-	Standard value -/-	Ment worth -/-	defined room [1] 40 m^3
= >	4 x10^4				
Time difference			60 min		
Measurement 2	21 °C	48 %	3 o'clock p.m.		defined room [1] 40 m^3
= >	1 x 10^2				

Remarks:

The detected germ loading in the water pan could be evaluated in the nutrient medium at sampling as well as 6 days of incubation at 24 + / -0.5° C.
The evaluation confirms the germ reducing effectiveness of the HYLA GST air room cleaning system even in extremely loaded living spaces at agricultural building complexes.

System application HYLA GST can be used for room air hygiene in closed-off rooms as well as half-open rooms. The medium air serves as means of transport to collect dust particles concentratedly and to bond in the GST water bed.
The special technology **HYLA GST** allows a homogenous (ØPartikel < 2 µm) bond of the dust and dirt particles in the medium water. For this purpose, a special technology regarding the suction process and lasting bond has been developed. This permits a room air cleaning of large volumes in short periods of time.
The positioning of the HYLA in the primary air cleaning effectively is carried out on the floor, if possible in combination with warm water (40°C) in the water pan (fill level amount => 4 ltr). The emergent hot air (relative air humidity x %) physically conditioned enters the upper air layers that are produced in the air swirling effect by the exhausting air (air exhaust duct).

Regarding the accessory units the mentioned parameters show an optimal dirt bond and a clean method for room hygiene concerning each application.