



National Public Health Institute
1097 Budapest, Albert Flórián út 2-6.

For G and G Instruments
Ltd. 1182 Budapest,
Hímesháza u. 12.

Reg. no.:KÖZ-7298-3/2017
Referent:
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Subject: Testing effectiveness of air
decontamination equipment

EXPERTISE

on testing effectiveness of „POTOK” air decontamination
equipment, distributed by
G and G Instruments Ltd.

National Public Health Institute
2017.



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1. INTRODUCTION

The Air Hygiene and Aerobiology Department of the National Public Health Institute (further Institute received a request from G and G Instruments Ltd. (1182 Budapest, Hímesháza u. 12., further Principal) for testing „POTOK” air decontamination equipment distributed by the Principal on the efficiency of the operation of the equipment.

The Principal considered the investigation to be necessary because it would like to justify the effectiveness of the equipment on the basis of the Institute's investigations and expert opinion.

2. HISTORY

The Principal has provided the Institute with its promotional material, which states that the "POTOK" air decontamination device inactivates the airborne microorganisms (bacteria, viruses, molds) with 99% efficiency and removes the inactivated biological contaminants and fine aerosol particles from the air.

The Principal indicated that the use of the appliance is primarily intended to improve the air quality of medical offices and hospital premises.

3. OBJECTIVE/PURPOSE

The purpose of the air quality test shall be the determination of the concentration of aerosol particles with an aerodynamic diameter of less than 1, 2, 5 and 10 μm diameter (ranges $\text{PM}_{1,0}$, $\text{PM}_{2,5}$, PM_{10}), volatile organic compounds, aldehydes, biological agents) in the airspace of a room of relevance for prior to use and after use of the equipment.

4. SAMPLING/TESTING PLAN

The staff of the Institute's Department of Air Hygiene and Aerobiology have designed a sampling / measurement plan for the efficiency of air purification equipment, which is used equally for all air purification equipment.

The sampling/testing plan is the following:

Determination of the mass concentration of aerosol particles with an aerodynamic diameter of less than 1, 2,5 és 10 μm with Grimm 1.108 aerosol spectrometer on a single point continuously during the test period (1 minute time resolution).

Active sampling of volatile organic compounds on a Tenax TA thermal desorption sampling tube at a sampling point two hours before activation of the air purification system two hours after switch-on, one-hour sampling time (sample volume of 4.8 liters) and analysis of samples by thermal desorption / capillary gas chromatography (according to ISO 16017-1: 2001).



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Active sampling of aldehydes (sodium iodide and 2,4-dinitrophenylhydrazine coated silica-gel sampling tube) at a sampling point two hours before the air cleaner was switched on and two hours after the device was switched on, with a sampling time of one hour (volume of sample: 60 L) and sample analysis by liquid chromatography (according to ISO 16000-3: 2011 standard).

In the case of molds and bacteria, sampling was carried out with an Andresen-type (MAS 100) air sampler at the given test day 4 occasions:

- a) Approx. two hours before the air decontamination device was switched on;
- (b) The room volume of air has been exchanged once;
- (c) After two times exchanged the air volume of the room;
- d) After three times exchanged the air volume of the room.

During the air sampling operation, 100-100 L of air is sucked by the sampler, and the air intake is collided by the inserted medium, which adsorbs the bacteria/fungal spores from the air. To determine allergenic molds, chloramphenicol containing 2% malt extract agar was used, incubated at 25 ° C for 5 days. To detect all colony-forming bacteria, we used blood agar at 37 ° C for 3 days incubated. The results are given in colony-forming units (CFU / m³).

During the evaluation, the total bacterial counts were determined (CFU). The number of colony-forming units was adjusted according to the Feller table assigned to the device. For molds, each colony-forming unit was typed on a genus level, and a total number of colonies were given per sample. Here we also made the Feller correction

Measurement of temperature and relative humidity (IAQ-CALC indoor Air Quality Meters 7545; TSI Inc.) continuously on a test point during the test period (with 1 minute time resolution).

Further specifications, recommendations for sampling, measurements and evaluation, we considered:

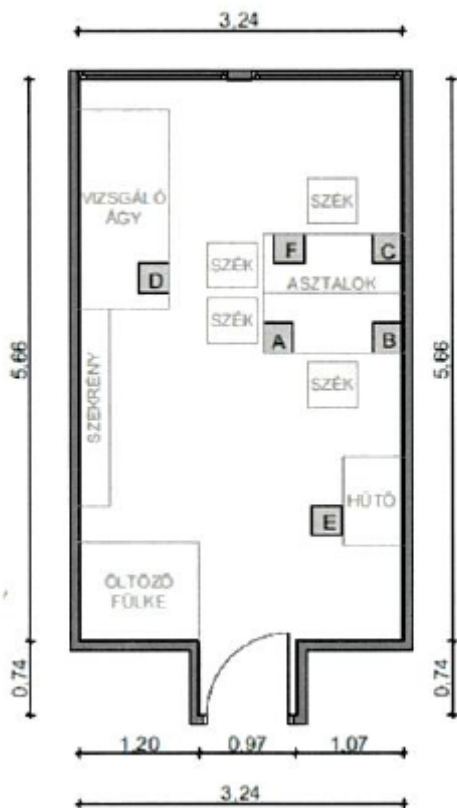
- 1995. LIII. Act on the Protection of the Environment;
- 306/2010. (XII.23) Government Decree on Air Protection;
- 4/201 1. (1.14.) VM Regulation on limit values for airborne loads and emission limit values for stationary sources of air pollutants;
- MSZ 21460-1: 1988 Definitions of air purity protection. Definitions of general terms (MSZ – Hungarian Standard);
- MSZ ISO 4225: 1995 Air quality. General considerations. Concept Definitions;
- WHO: Guidelines for indoor air quality: selected pollutants, 2010.



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Sampling / on-site measurements were performed in a medical office (Figures 1 and 2) at the National Public Health Institute on 3 November 2017. Nominal data of the equipment (130 m³/h air flow) and volume of room air space (57.18 m³) based on the air purifier unit for about 26 minutes once full air volume of the test room.

1. Fig. Lay - out of POTOK air decontamination equipment testing.



- A: sampling bacteria and fungi
- B: sampling of aldehydes
- C: sampling of volatile organic compounds
- D: POTOK air purification equipment
- E: temperature, relative humidity measurement
- F: mass concentration of aerosol particles

2. Fig. Sampling location





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5. TESTING RESULTS AND CONCLUSIONS

The results of the studies are shown in Figures 1-4. and in Figure 3.

Table 1: Time variation of the concentration of aerosol particles with an aerodynamic diameter of less than 1, 2.5 and 10 μm .

	Prior to switch on	1 hour after switching	2 hours after switching on	3 hours switching on
PM ₁₀ [$\mu\text{g} / \text{m}^3$]	8,4	2,1	1,9	2,1
PM _{2,5} [$\mu\text{g} / \text{m}^3$]	4,2	1,7	1,5	1,4
PM _{1,0} [$\mu\text{g} / \text{m}^3$]	3,1	1,5	1,2	1,1

The concentration of aerosol particles in the room was low even before the equipment was switched on but the mass concentration of the aerosol particles continued to decrease during the intended operation (Table 1).

Table 2: Time-varying concentrations of selected volatile organic compounds and aldehydes.

Organic compounds	Before switching	After switching
Formaldehyde	17,0	16,9
Acetaldehyde	34,1	30,7
Benzaldehyde	1,7	<0,75
Hexaldehyde	3,2	3,2
Benzene	1,1	< 0,1
Toluene	3,4	2,8
Ethylbenzene	< 0,1	< 0,1
Xylene	1,2	< 0,3
Alpha-pinene	1,4	1,5
s-limonene	3,0	2,6
Naphtalene	<2,0	<2,0

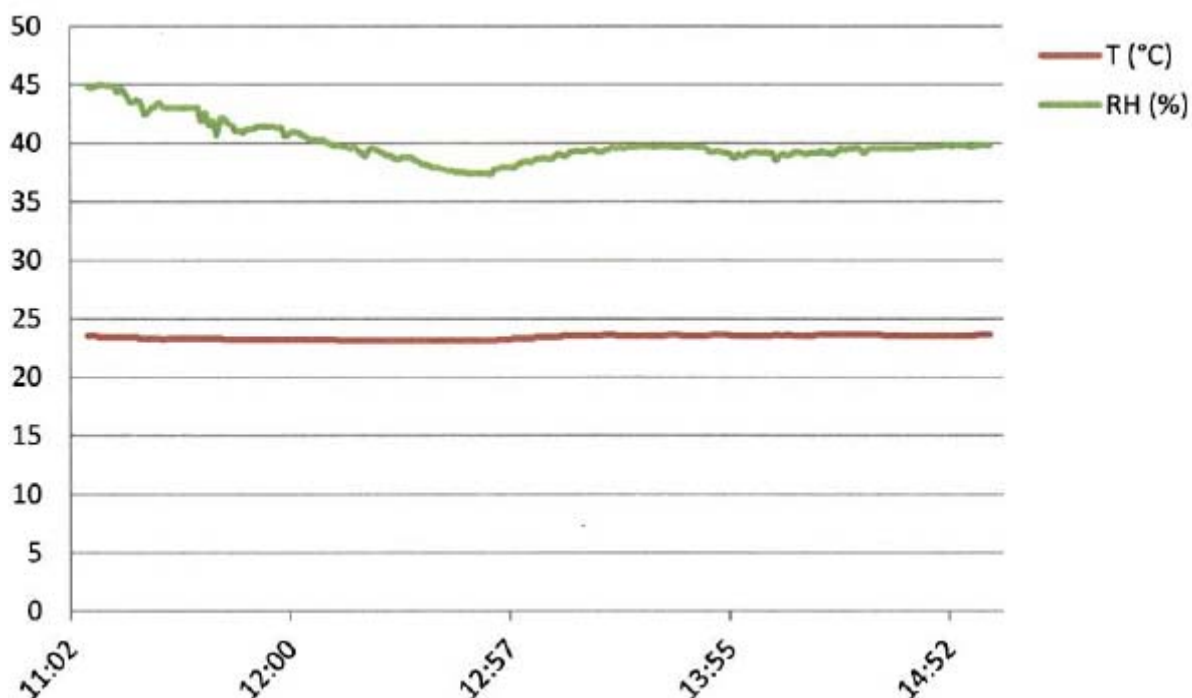
The equipment did not reduce the concentration of volatile organic compounds and aldehydes during their intended use (Table 2).

During normal operation of the equipment, the temperature and relative humidity did not change significantly (Figure 3).



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3. Fig. Changes in temperature and relative humidity during the test.



3. Table: Changes of total number of bacteria during the testing

Time of measurement	Marks of measurement	POTOK air decont. device test (PL=PAD)	Total number of Bacteria, CFU / m ³
2017.11.03_10:01	5LEG1B	Control PAD before testing	470
2017.11.03_13:02	5LEG2B	POTOK changed the air 1x in the room	150
2017.11.03_14:01	5LEG3B	POTOK changed the air 2x in the room	40
2017.11.03_15:01	5LEG4B	POTOK changed the air 3x in the room	80

All bacterial counts in the air samples significantly decreased by the use of POTOK air decontamination equipment. After three times the air reversal a 83% reduction of bacteria counts in atmospheric concentration was measured.



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4. Table: Changes of total number of Molds during the testing

Time of measurement	Marks of measurement	POTOK Air decont. device tests (PL=PAD)	Total number of Molds, CFU / m ³
2017.11.03_10:06	5LEG1B	Control, before switching on POTOK	85
2017.11.03_13:05	5LEG2B	POTOK changed the air 1x in the room	75
2017.11.03_14:04	5LEG3B	POTOK changed the air 2x in the room	45
2017.11.03_15:05	5LEG4B	POTOK changed the air 3x in the room	25

A more detailed evaluation of the mold growth test is provided in the Annex.

In the air samples, the total number of molds in molds significantly decreased the use of POTOK air decontamination equipment. After three times the air revolutions, 70% of the atmospheric decreases in molds were measured.

5. SUMMARY

Based on the results of the tests carried out by the National Institute of Public Health, the "POTOK" air decontamination equipment, marketed by G and G Instruments, effectively reduces the concentration of small aerosol particles and the total number of bacteria and molds in the indoor air during normal use. The atmospheric concentration of volatile organic compounds and aldehydes will not be affected.

Based on the results of the examinations, the National Public Health Institute does not raise objections to the intended use of the device and recommends its use and shall award a certificate with serial number 2017/4.

Budapest, 2017. december 18.



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témafelelős

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igazgató



Appendix

Time of measurement	Marks of samples	POTOK Air Decontamination Device tests (PL = PAD)	Molds taxon	Total number of Molds [CFU /m ³]
2017.11.03. 10:06	5LEG1G			
			<i>Cladosporium</i> sp.	30
			Non spore forming	60
			Total	90
2017.11.03. 10:11	5LEG1Gí			
	Control, prior to switching on POTOK		<i>Aspergillus niger</i>	10
			<i>Penicillium</i> sp.	20
			<i>Cladosporium</i> sp.	20
			<i>Scopulariopsis</i> sp.	10
			Non spore forming	20
		Total	80	
2017.11.03. 13:05	5LEG2G			
	POTOK changed the air 1x in the room		<i>Cladosporium</i> sp.	30
			<i>Penicillium</i> sp.	10
			Yeast spp.	10
			Non spore forming spp.	20
			Total	70
2017.11.03. 13:09	5LEG2Gí			
	POTOK changed the air 1x in the room		<i>Cladosporium</i> sp.	50
			<i>Penicillium</i> sp.	20
			Non spore forming spp.	10
			Total	80
2017.11.03. 14:04	5LEG3G			
	POTOK changed the air 2x in the room		<i>Cladosporium</i> sp.	30
			<i>Penicillium</i> sp.	20
			Total	50
2017.11.03. 14:08	5LEG3Gi			
	POTOK changed the air 2x in the room		<i>Cladosporium</i> sp.	20
			Non spore forming spp.	20
			Total	40



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Tine of measur	Marks of samle	POTOK Air Decontamination Device tests (PL	Molds taxon	Total number of Molds [CFU /m³]
2017.11.03. 15:05	5LEG4G			
	POTOK changed the air 3x in the room		<i>Cladosporium</i> sp.	30
			<i>Penicillium</i> sp.	10
			Total	40
2017.11.03. 15:07	5LEG4Gi			
	POTOK changed the air 3x in the room		not sporulating spp.	10
			Total	10