Potok
air decontamination
technology

potok®

Scientific evidence of Potok technology in healthcare

CERTIFICATION

U.S. Food and Drug Administration

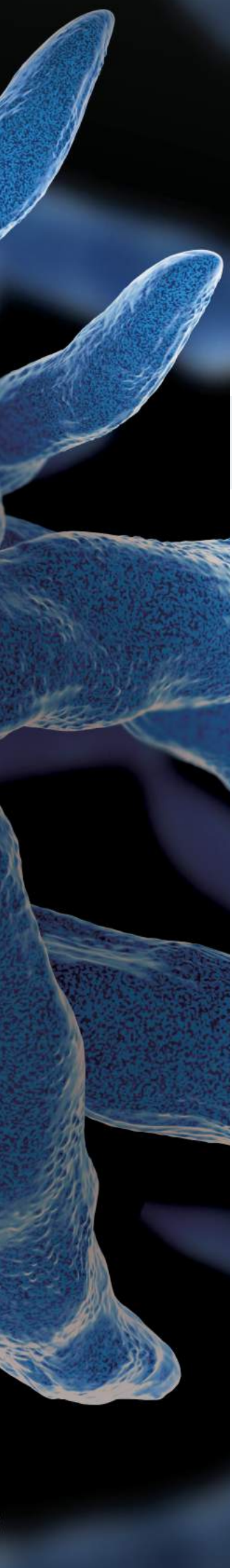
Certificate of conformity

Certificate of conformity

CONTENTS

FOREWORD FROM POTOK

Mission of our company is to protect everyone from all types of bacteria, viruses and other harmful air-borne microorganisms and make breathing safe inside every premise all over the world



You are holding collection of reviews, research reports of Potok air decontamination solutions, that were conducted by a various internationally recognized leading research institutions, state medical facilities and other social and commercial companies.

Potok Inter scientific and production company was founded in 1994 by Russian scientists, who had invented the Potok air decontamination technology, authors of scientific works and methodical instructions and holders of numerous patents.

The technology inactivates 99,99% of any types of airborne microorganisms (SARS-COV-2 and all other viruses, bacteria and mold).

Potok Inter ensures microbiological purity and reduces the level of microbial contamination of the air in orbital stations. In 1995 the Potok equipment solved the problem of colonies of mold fungi in the Mir orbital space station. In 2001 the Potok equipment was modified according to the cosmonauts' requests, delivered to the International Space Station (ISS), and installed in the Russian segment. In 2009 the Potok equipment was delivered to the US segment as ordered by NASA: in one week of operation, the unit reduced the level of molds in the air to zero (tenfold contamination excess was previously recorded).

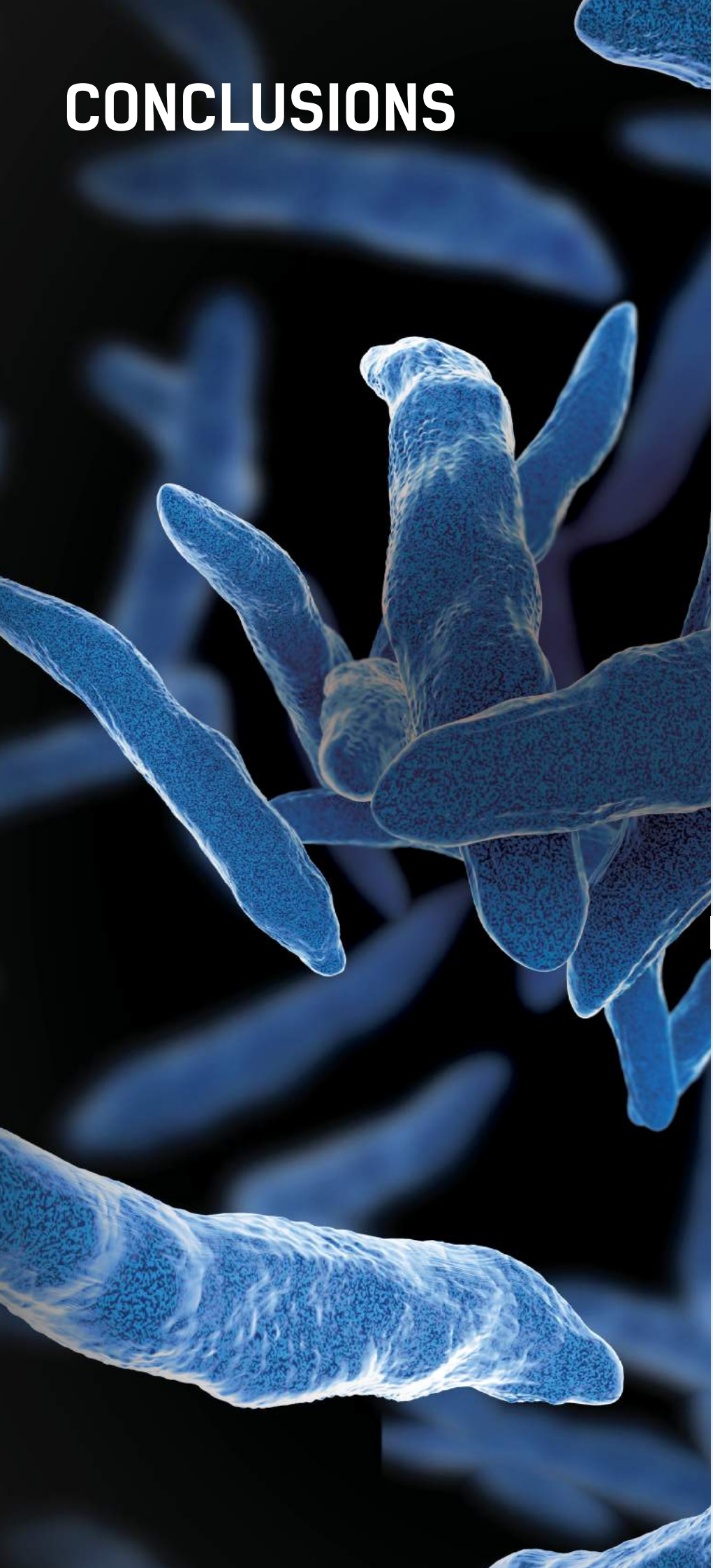
In addition to space technologies, Potok Inter has been dealing with problems on Earth for more than 25 years - conducting research and developing and manufacturing equipment for all spheres, where air purity is a matter of life and death.

Imposes on us special obligations for information transparency and openness of the company. We are confident that constant and effective cooperation with the media is the key to the successful development of our business. That is why we encourage you to familiarize yourselves with our main publications in scientific journals and mainstream media.

The tests are conducted by using the same Potok technology with a different types of air decontamination units. More detailed information about research methods is explained in each report.

We are hoping this publication offers you the required information about Potok technology, that has no analogues in the world.

CONCLUSIONS



HARVARD SCHOOL OF PUBLIC HEALTH

Department of Environmental Health
Environmental Science and Engineering Program

4 February 2003

Progress Report II, Phase I, Potok 150-M-01 Test Program

This is a report of progress to date on a program of microbiological tests performed on an Potok 150-M-01 stand-alone unit. The tests use microbiological aerosols produced by nebulizing selected organisms from an aqueous suspension containing synthetic saliva. After air drying, they are introduced into the entry of the unit under test. Representative samples of the airborne microorganisms are taken simultaneously up- and downstream of the unit under test with identical 6-stage Anderson Biological Cascade Impactors. Analysis of viable microorganisms collected by the impactors gives total numbers in the air up- and downstream of the unit, particle size of the microorganisms, and efficiency of the unit for removing microorganisms from the air passing through it.

Tests were conducted using the unit's low and high electrical settings and at the unit's rated air flow of 77 cubic feet per minute (CFM) and at 100 CFM..

Detailed test results are shown in the five pages of attached tables with statistical analyses that indicate the confidence intervals around the averages of the multiple replicate tests. They are well within acceptable limits for microbiological aerosol studies. The results for the five microorganisms tested up to this date are summarized as follows:

(1) B. subtilis spores, a commonly used surrogate for anthrax spores. When the unit was operated at its characteristic airflow rate (77 CFM) and at the high voltage setting it destroyed 99.5% of the spores. At the same airflow rate and at low electrical setting the kill rate was 94.4%. When operated at 100 CFM and the high electrical setting, spore killing efficiency was 98.8%. These comparative results are in the expected direction, greater lethal effect at higher voltage and at lower airflow rate, i.e., longer treatment time inside the unit.

(2) Serratia marcescens, a vegetative organism commonly found in nature and frequently used in microbiological aerosol studies. At high electrical setting and characteristic airflow rate, reduction in viable bacteria was 99.4%. At the same airflow rate but at the low electrical setting, bacteria reduction was 97.3%. At the higher airflow rate (100 CFM), removal efficiency at the high electrical setting was 99.0% and at the low electrical setting, 92,4%. The relative efficiencies were in an expected mode.

665 Huntington Avenue, Boston, Massachusetts 02115 Program Office (617) 432-1170 Fax (617) 432-3349

(3) Staphylococcus aureus, an organism commonly found in medical settings and currently under suspicion as a pathogen. At characteristic airflow rate and high electrical setting bacterial removal efficiency was 99.8%. At the same airflow rate but at the low electrical setting the removal efficiency was 97.6%. At an airflow rate of 100 CFM, removal efficiency was 99.4% at the high electrical setting and 97.0% at the low electrical setting.

(4) Pseudomonas aeruginosa, a vegetative bacterium sometimes found in medical settings and under suspicion as a pathogen. Unit efficiency for this microorganism at characteristic airflow rate and high electrical setting was 99.4%; at low electrical setting it was 98.0%. At the higher airflow rate, efficiency at high electrical setting was 99.5%. Although the kill percentage was slightly higher at the higher airflow rate in this case, the differences are well within the confidence intervals of each and within the variable nature of microbiological aerosol measurements.

(5) Aspergillus niger spores, a widely dispersed fungus in nature and frequently found in mold infestations in buildings, is a cause of respiratory illnesses. Unit efficiency for these spores was indistinguishable from total destruction when operated at low electrical setting with characteristic and elevated airflow rates. Tests were conducted with spores aerosolized from aqueous suspensions and with dry spores dispersed into the air stream. Efficiency was lower with dry spores. The reason for the difference is not known. Some additional testing may be called for here.

Results at the characteristic airflow rate (77 CFM) and high electrical setting are excellent and could probably be made better still by increasing electrical voltage inside the instrument and increasing retention time by making the treatment chamber larger.

We are nearly ready to test the performance of the unit with a vaccine, namely Vaccinia, the usual surrogate for smallpox.

Best wishes,

Melvin W. First

Melvin W. First, Sc. D.
Professor of Environmental Health
Engineering, Emeritus

Enclosure

UNIVERSIDAD DE GRANADA
FACULTAD DE FARMACIA
Departamento de Microbiología

ESTUDIO DEL TEST REALIZADO A "AIR-CLEANER UNIT POTOK 150"

Departamento de Microbiología.
Facultad de Farmacia.
Universidad de Granada.

Granada, Octubre 1995

UNIVERSIDAD DE GRANADA
FACULTAD DE FARMACIA
Departamento de Microbiología

ESTUDIO DEL TEST REALIZADO A "AIR-CLEANER UNIT POTOK 150"
(Departamento de Microbiología. Facultad de Farmacia. Universidad de Granada.)

Equipo utilizado:

- Unidad Potok 150
- Medio Nutritivo Tripticasa-Soja-Agar (T.S.A. Difco)
- Placas Petri esteriles de 90mm
- Bomba de vacio portatil Millipore
- Atomizador (diametro aproximado de particula en el aerosol de 2 micrones)
- Solución salina fisiológica

El ensayo se realizó en el ambiente de una habitación cerrada de aproximadamente 40 m^3 y con una media de dos personas trabajando en ella durante todo el tiempo de duración del ensayo.

Como microorganismo test se utilizó una cepa de *Micrococcus luteus* (ATCC 13513)

Metodología:

Previo al ensayo se realizó un estudio sobre el número de microorganismos presentes en la habitación en la que se realizaría el test. Para ello se distribuyeron placas con medio de cultivo TSA en distintas zonas de la habitación, y se mantuvieron abiertas los mismos tiempos que se emplearian en el test de la unidad Potok 150. A este estudio se le denominó ensayo control.

Posteriormente el estudio se realizó en dos etapas:

-Etapa I denominada SP (sin utilizar la unidad POTOK)

-Etapa II denominada CP (con el empleo de la unidad POTOK)

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FACULTAD DE FARMACIA
Departamento de Microbiología

En ambas etapas se utilizó una suspensión del microorganismo *M. luteus* en solución salina fisiológica con aproximadamente 10^8 células/ml. Dicha suspensión (15 ml) fué dispersada por la habitación por medio del atomizador durante 1 minuto y sin conectar la unidad POTOK. En el caso de la etapa II a partir de este momento fué conectada la unidad POTOK.

Tanto en la etapa I como en la II, posteriormente y a lo largo de 5 horas, con intervalos de 30 min y 60 minutos, se colocaron 4 placas Petri abiertas con medio nutritivo TSA en distintas zonas de la habitación a cada tiempo del ensayo.

Una vez realizado el ensayo las placas se incubaron a 37°C durante 24 horas.

Resultados:

Los resultados obtenidos se muestran en las tablas 1, 2 y 3.

Tabla 1 . Resultados obtenidos en el ensayo control (nº de microorganismos presentes de forma regular en la habitación de ensayo)

	Número de colonias en placa			
	Zona 1	Zona 2	Zona 3	Zona 4
	9	10	11	13

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Departamento de Microbiología

Tabla 2. Resultados obtenidos en la etapa I (sin utilización de la unidad POTOK).

Solución de microorganismos de partida 1,94 x 10^8 células/ml.

Tiempo en minutos	Número de colonias en placa			
	Zona 1	Zona 2	Zona 3	Zona 4
1	2128	2180	2240	2228
30	1076	1008	997	1044
90	133	110	109	134
150	38	37	46	35
210	33	35	44	33
270	12	11	18	13

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FACULTAD DE FARMACIA
Departamento de Microbiología

Tabla 3. Resultados obtenidos en la etapa II (con utilización de la unidad POTOK).

Solución de microorganismos de partida 2,25 x 10^8 células/ml.

Tiempo en minutos	Número de colonias en placa			
	Zona 1	Zona 2	Zona 3	Zona 4
1	2680	2840	2768	2640
30	288	296	352	332
90	10	12	14	15
150	5	8	5	9
210	1	3	4	4
270	0	1	1	0

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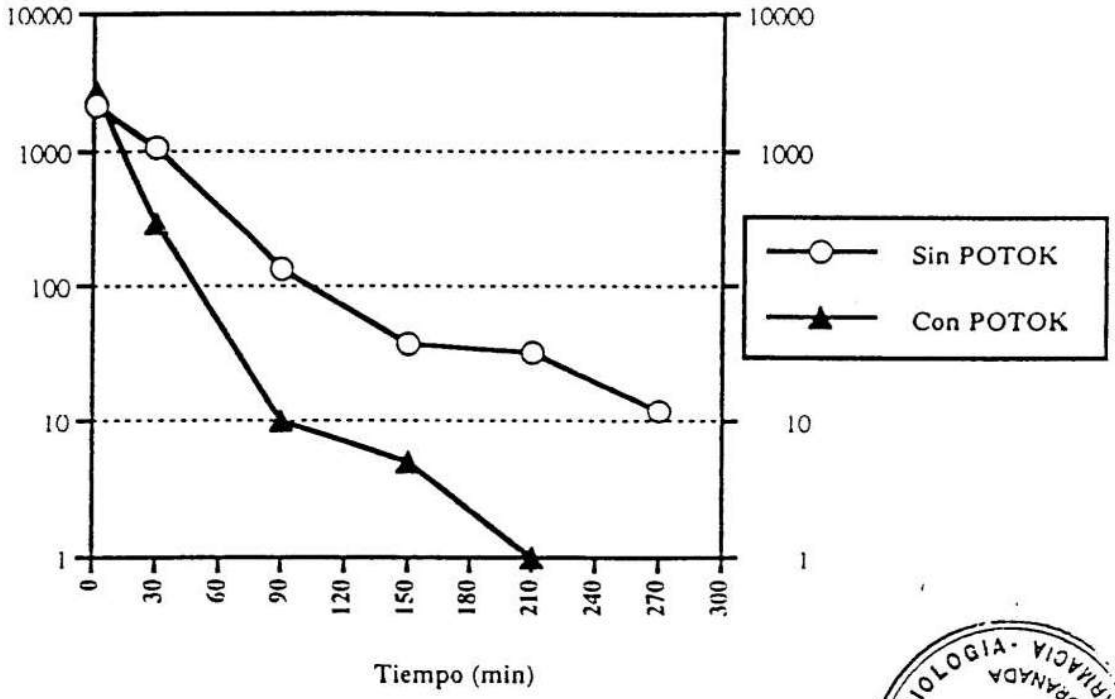
Departamento de Microbiología

Fig.1 Número de colonias



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FACULTAD DE FARMACIA
Departamento de Microbiología

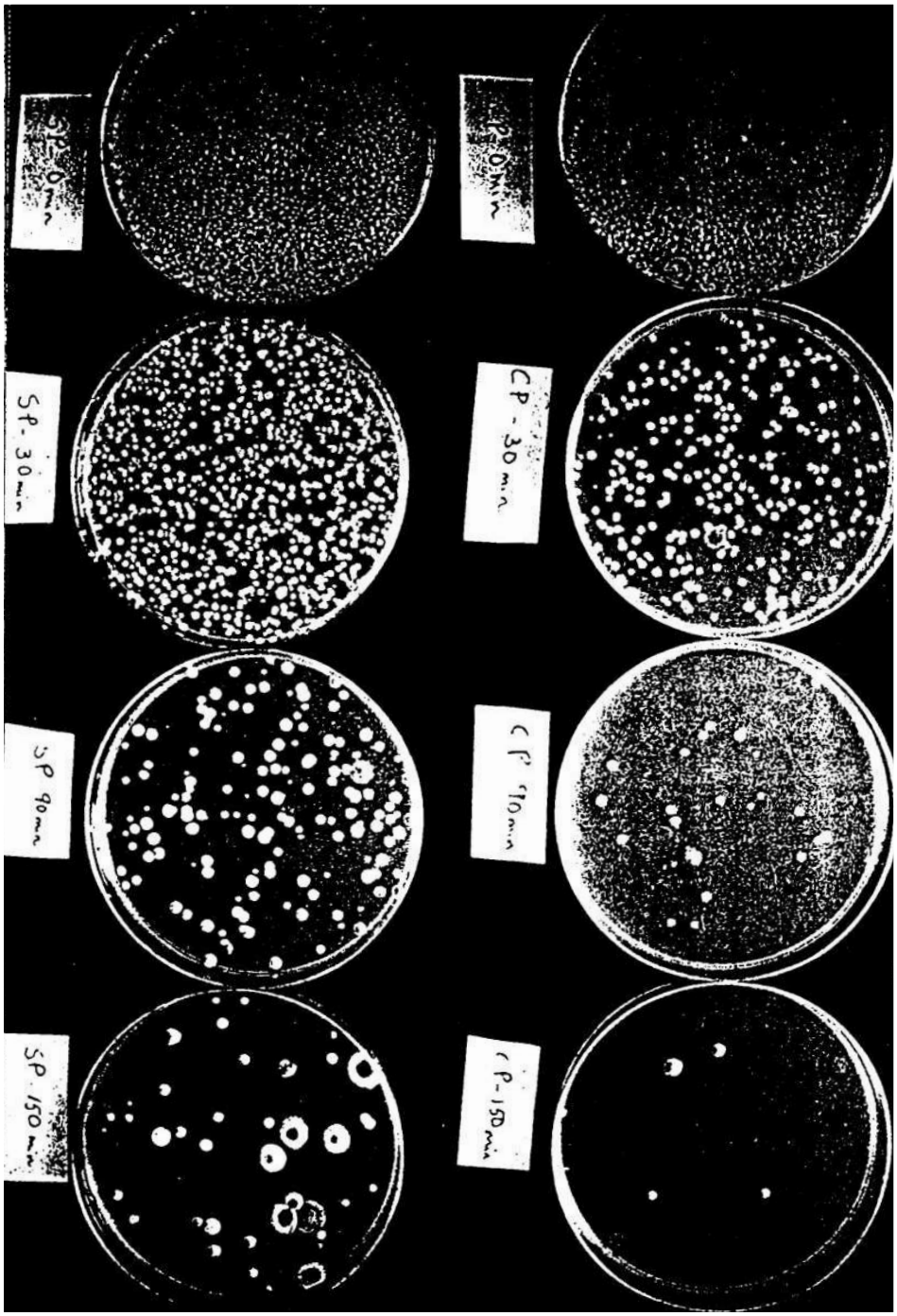
Conclusión

En relación a los resultados obtenidos en nuestro ensayo podemos deducir que el empleo de la unidad POTOK 150 origina una redución de la microbiota presente en el aire de aproximadamente 1/200 en 90 minutos, mientras que la reducción normal sin utilización de la unidad se encuentra sobre 1/20 en el mismo tiempo (Figura 1). Este resultado implica que es posible emplear la unidad POTOK 150 para crear ambientes limpios de microorganismos en un tiempo no demasiado largo y mantener el ambiente en dichas condiciones mientras que la unidad POTOK 150 se encuentra en funcionamiento.

DPTO. DE MICROBIOLOGÍA - UNIVERSIDAD DE GRANADA - FACULTAD DE FARMACIA

Fdo.:Alberto Ramos Cormenzana
Catedrático de Microbiología

Fdo.: Mercedes Monteoliva Sanchez
Prof. Titular de Microbiología


SP-0 min
SP-30 min
SP 90 min
SP 150 min
CP-0 min
CP-30 min
CP 90 min
CP-150 min

-1-

ercem

Président Directeur Général : Philippe GUY

Intervention réalisée par : B. LIGNON
Unité Opérationnelle Rhône Auvergne
14 Rue Gorge du Loup BAL C Bureau 123
69009 LYON
Tel : 78 47 86 10 Fax : 78 47 86 20

Référence : GS 10324 01
Ech / Bac : 34858/2
Type C.R.A : N

ADF
Messieurs Cappeaux et Carbonel
19 Rue de BOULOGNE
62100 CALAIS

Grenoble, le 24 Août 1995

COMPTE-RENDU D'ANALYSE MICROBIOLOGIQUE

Échantillons : APPAREIL DE TYPE POTOK ISOM
Identification du lot : GS 103024 01

Objet : Vérification de la production d'air stérile

RESULTATS

Objectif de l'étude :

Tester l'appareil vis-à-vis d'une souche de Bacillus Subtilis afin de vérifier qu'il produit bien de l'air stérile en sortie d'appareil.

Protocole

Une souche de Bacillus Subtilis est pulvérisée à l'entrée de l'appareil à raison de 5.10 4 micro-organismes par pulvérisation.
Après fonctionnement de l'appareil, un dispositif de réception de micro-organismes (boîte de pétri + milieux de culture) est installé à la sortie de l'appareil. Ce dispositif se trouvant dans un manchon de plastique parfaitement étanche, 5 passages de micro-organismes sont réalisés, les instructions d'usage étant fournies par le client.

Résultats

On note l'absence de culture sur les cinq passages.

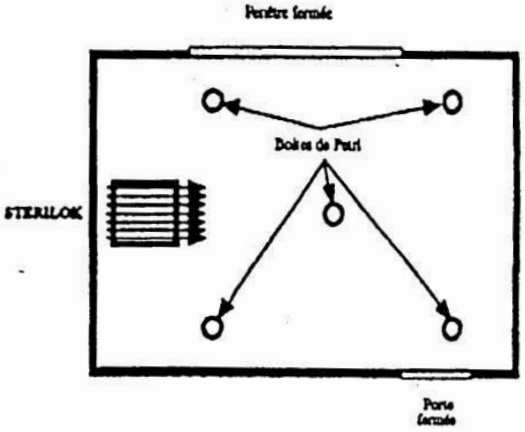
B. LIGNON

TESTS du Laboratoire ERCEM

LYON, le 27 juin 1995

Le laboratoire ERCEM de Lyon a effectué le 27 juin 1995, des mesures pour contrôler l'efficacité de l'appareil STERILOK, pour stériliser une pièce de 36,8 m3.

Le STERILOK était placé dans la pièce suivant le schéma ci-contre :



Modalités du test

Cinq boîtes de prélèvement de 23,7 cm2 contenant un milieu de culture PCA sont mises à 1 m de hauteur dans une pièce fermée de 36,8 m3. L'appareil STERILOK est placé dans cette pièce suivant schéma, à 1 m du sol.

Le test a été répété 4 fois :

- 1 heure après la mise en fonctionnement
- puis 2,3,4 heures après

Les germes recherchés sont des germes aérobies Mésophiles (ensemble des bactéries se développant en milieu présentant de l'oxygène et à température moyenne optimum de croissance : de + 20°C à + 40°C)

Les milieux ont ensuite été incubés 48 heures à 30°C.

Nota: la température de la pièce était de 27,8°C.

RESULTATS

REFERENCES	HEURES	RESULTAT G.A.M.	CONCLUSION
GH 9792801	H+1	Stérile	Excellent
GH 9792802	H+1	Stérile	Excellent
GH 9792803	H+1	Stérile	Excellent
GH 9792804	H+1	Stérile	Excellent
GH 9792805	H+1	Stérile	Excellent
GH 9792806	H+2	Stérile	Excellent
GH 9792807	H+2	Stérile	Excellent
GH 9792808	H+2	Stérile	Excellent
GH 9792809	H+2	Stérile	Excellent
GH 9792810	H+2	Stérile	Excellent
GH 9792811	H+3	Stérile	Excellent
GH 9792812	H+3	Stérile	Excellent
GH 9792813	H+3	Stérile	Excellent
GH 9792814	H+3	Stérile	Excellent
GH 9792815	H+3	Stérile	Excellent
GH 9792816	H+4	Stérile	Excellent
GH 9792817	H+4	Stérile	Excellent
GH 9792818	H+4	Stérile	Excellent
GH 9792819	H+4	Stérile	Excellent
GH 9792820	H+4	Stérile	Excellent

C/C Me CAPIAUX

Référence : GH 97828
Type C.R.A : N

Intervention réalisée par : J. DELPECH
Unité Opérationnelle 3
14 rue gorge de loup - Bat C - Bur 123
69008 LYON
Tel : 78.47.86.18 Fax : 78.47.86.23

RESULTATS DES ANALYSES BACTERIOLOGIQUES D'ATMOSPHERE DU 27 JUIN 1995

Appareil testé : POTOK

1 - MODALITÉ DU TEST :

Cinq boites de prélèvements de 23,7 cm2 contenant un milieu PCA sont mises à 1 mètre de hauteur dans une pièce fermée.

Les boites sont disposées de la manière suivante :

1 boite au centre de la pièce et 1 boite dans chaque angle.

Le test a été répété 4 fois :

1 heure après la mise en état de fonctionnement de l'appareil POTOK puis 2 heures, 3 heures et 4 heures.

L'apparcil POTOK est situé à 1 mètre du sol au milieu des 2 boites placées dans des angles.

2 - RESULTATS

REFERENCES	HEURES	RESULAT GAM	CONCLUSION
GH 9792801	H+1	Absence	Satisfaisant
GH 9792802	H+1	Absence	Satisfaisant
GH 9792803	H+1	Absence	Satisfaisant
GH 9792804	H+1	Absence	Satisfaisant
GH 9792805	H+1	Absence	Satisfaisant
GH 9792806	H+2	Absence	Satisfaisant
GH 9792807	H+2	Absence	Satisfaisant
GH 9792808	H+2	Absence	Satisfaisant
GH 9792809	H+2	Absence	Satisfaisant
GH 97928010	H+2	Absence	Satisfaisant
GH 97928011	H+3	Absence	Satisfaisant
GH 97928012	H+3	Absence	Satisfaisant
GH 97928013	H+3	Absence	Satisfaisant
GH 97928014	H+3	Absence	Satisfaisant
GH 97928015	H+3	Absence	Satisfaisant
GH 97928016	H+4	Absence	Satisfaisant
GH 97928017	H+4	Absence	Satisfaisant
GH 97928018	H+4	Absence	Satisfaisant
GH 97928019	H+4	Absence	Satisfaisant
GH 97928020	H+4	Absence	Satisfaisant

Les germes recherchés sont :

Les Germes Aérobies Mésophiles
(ensemble des bactéries se développant en milieu présentant de l'oxygène et à température moyenne optimum de croissance : +20 à +40°C).

Les milieux ont ensuite été incubés 48 heures à 30°C.

Remarque : La température de la pièce était de +27,8°C.
Ce résultat ne peut en aucun cas être interprété comme un comptage particulaire.

J. DELPECH

7220-1060-8752-3070

TEST REPORT

1. NO : CT18-092506

Reissuance(R1)
Date : 2018.12.10

2. Client
   - ○ Name : Loofen Co.,Ltd.
   - ○ Address : 916-ho, C-dong, 40, Imi-ro, Uiwang-si, Gyeonggi-do, Republic of Korea
3. Date of Test : 2018.08.24 ~ 2018.10.24
4. Use of Report : Quality control
5. Test Sample : Air-decontamination appliance(Potok 150-M-01)
6. Test Method
   (1) Client's requirement method

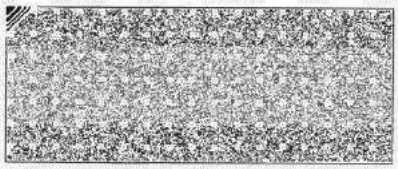
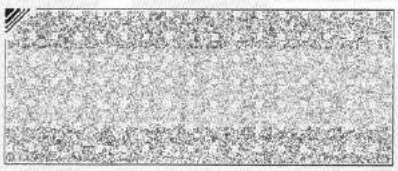
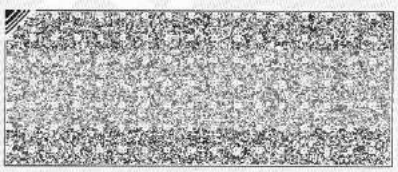
Affirmation	Tested By Name : Kye Seung Chang JKS	Technical Manager Name : Sang Bok Bae Sangbok

Our report apply only to the standards or procedures identified and to the sample(s) tested unless otherwise specified. The test results are not indicative of representative of the qualities of the qualities of the lot from which the sample was taken or of apparently identical or similar products. The authenticity of this test report can be checked on KCL website(www.kcl.re.kr).

2018.10.24

Korea Conformity Laboratories President Yoon, Kap Seok Yoon, Kapseok

Address : #805, I' VALLEY Gunpo,149,Gongdan-ro,Gunpo-si,Gyeonggi-do,15845,Korea 82-31-389-9100
Result Inquiry : The Center of Green Complex Technologies 82-31-389-9184

TEST REPORT

No : CT18-092506

7. Test Results

Test Items		Test method	Test Results			Testing Environment
			Before operating Conc.(CFU/㎥)	After operating Conc.(CFU/㎥)	Reduction rate of bacteria(%)	
Reduction test for Airborne microbes (*Escherichia coli*)	Air-decontamination appliance (Potok 150-M-01)	Client's requirement method	1.1×10^4	< 10	99.9	(23.2 ± 0.2) ℃ (50.3 ± 2.0) %RH

※ CFU : Colony Forming Unit

※ Test strain : *Escherichia coli* ATCC 25922

※ Chamber size : 8 ㎥

※ Measurement equipment : MAS-100 NT (MERCK, Flow rate : 100 L/min)

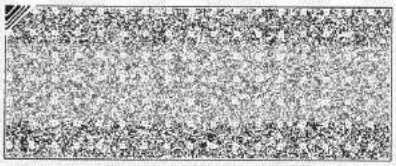
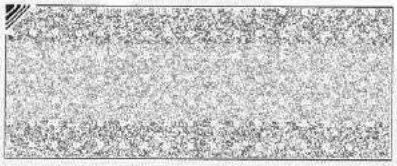
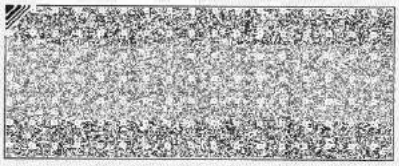
※ Sample : Air-decontamination appliance(Potok 150-M-01)

※ Operating time : 3 hours

※ Result concentration : Feller Conversion Table application

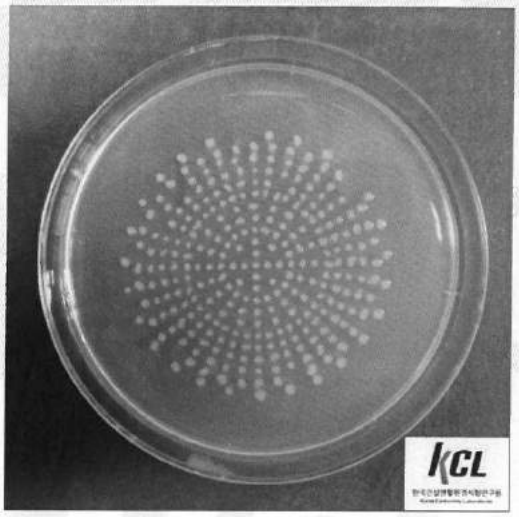
※ Client's requirement method : After injecting a constant concentration of target bacteria inside the test chamber and operating the sample for 3 hours, measure the reduction rate of bacteria.

※ Chamber environment and sampling method : KS I 2008:2013 Mod.

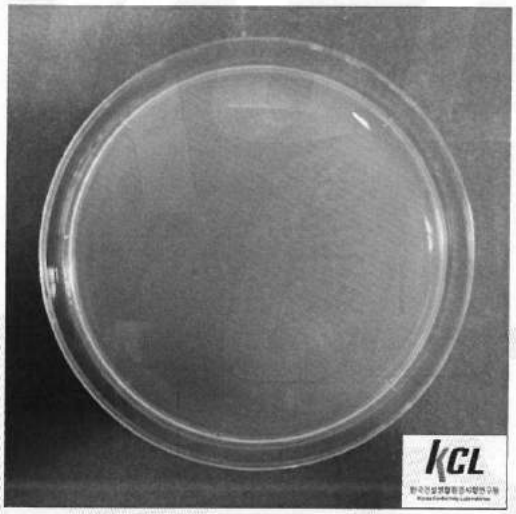




TEST REPORT

No : CT18-092506



<Picture 1. *Escherichia coli* - BLANK (0 h)>



<Picture 2. *Escherichia coli* - Air-decontamination appliance (Potok 150-M-01) (3 h)>

TEST REPORT

No : CT18-092506

<Picture 3. Sample[Air-decontamination appliance(Potok 150-M-01)]>

----- End of Report -----

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:
Dr. Szigeti Tamás, Dr. Magyar Donát
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.

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

Content:

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 $PM_{1,0;}$ $PM_{2,5}$, 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).

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 / m^3).
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.

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

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} [µg / m^3]	8,4	2,1	1,9	2,1
$PM_{2,5}$ [µg / m^3]	4,2	1,7	1,5	1,4
$PM_{1,0}$ [µg / 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).

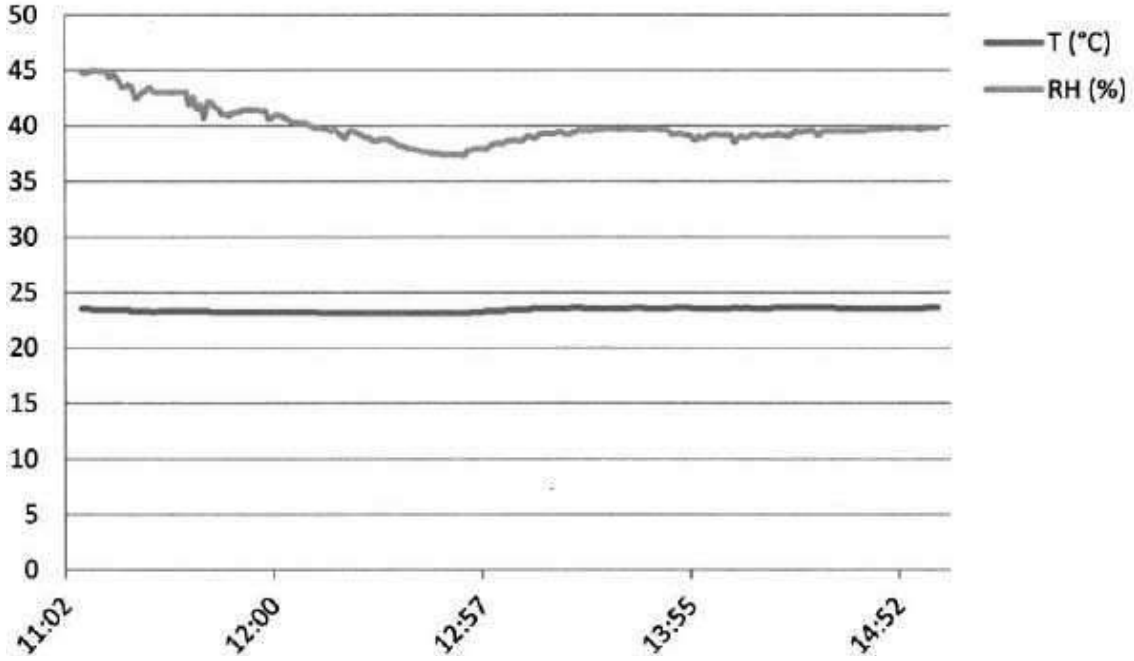
Table 2: Time-varying concentrations of selected volatile organic compounds and aldehydes.

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
Ethilbenzene	< 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).

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.

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.

……... ..…
Dr. Szigeti Tamás
témafelelős

.....
Dr. Pándics Tamás
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			
			Cladosporium sp.	30
			Non spore forming	60
			Total	90
2017.11.03. 10:11	5LEG1Gí			
	Control, prior to switching on POTOK		*Aspergillus niger*	10
			Penicillium sp.	20
			Cladosporium sp.	20
			Scopulariopsis sp.	10
			Non spore forming	20
			Total	80
2017.11.03. 13:05	5LÉG2G			
	POTOK changed the air 1x in the room		*Cladosporium* sp.	30
			Penicillium 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		*Cladosporium* sp.	50
			Penicillium sp.	20
			Non spore forming spp.	10
			Total	80
2017.11.03. 14:04	5LEG3G			
	POTOK changed the air 2x in the room		*Cladosporium* sp.	30
			Penicillium sp.	20
			Total	50
2017.11.03. 14:08	5LEG3Gi			
	POTOK changed the air 2x in the room		*Cladosporium* sp.	20
			Non spore forming spp.	20
			Total	40

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

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

Ostbayerische Technische Hochschule
Amberg-Weiden

Experiments for the evaluation of effectiveness for the Potok system

1. Introduction

Potok Inter Engineering Company is a renowned expert on air decontamination with a unique technology. It inactivates all types of airborne microorganisms (bacteria, viruses, fungi, mold, etc.) with approx. 99.999% efficiency within 1 second. The POTOK inactivation technology is based on a physical influence method with constant electric fields as well as with changing polarity and additionally fine filtration of inactivated biomass and aerosol particles. The Potok Inter Engineering Company designs and produces air decontamination devices of various types, but all based on inactivation technology:

• standalone units
• duct-in units
• laminar flow devices

All devices are patented in Russia, Ukraine, Japan, the US and some European countries.

The purpose of this work was to evaluate the decontamination potential of the Potok system both in an experimental setting in the research OR of the Ostbayerische Technische Hochschule Amberg-Weiden with standalone Air Decontamination Units (Potok 150-M-01) and in a clinical setting in an operating theater in a Moscow hospital where the laminar flow device is based on the Potok system.

2. Material and Methods

Two units of the system "Potok 150-M-01 standalone Air Decontamination Unit (ADU)" were available for the evaluation of the effectiveness at the Ostbayerische Technische Hochschule (Fig. 1).

Fig. 1: Potok 150-M-01 standalone Air Decontamination Unit (ADU)

The units were positioned in an experimental OR-setting according to the Swedish standard SIS-TS 39: 2015. The microbiological examination of the room air was done with the active air sampler Impaktor FH6 from Markus Klotz GmbH. Three parallel samplings were performed at predefined measuring points. These are located directly on the operating table (1.2m above the ground and ≤0.5m from the operating site), on the instrument table and in the periphery of the room near an exhaust opening. Sampling was done by impaction method, in which an air volume of 1000 liters was collected per 10 minutes via a columnar opening onto a blood agar plate. The culture media were then incubated for 3 days at 35 °C +/- 1 °C. After incubation the plates were photographed and colonies were counted manually and documented as colony forming units per cubic meter of air (cfu/m³).

Already in the pilot studies to this work the impact of the surgical clothing on the germ load in the operating room was investigated. On the basis of these results, Swedish surgical gowns were chosen as standard for further experiments. This so-called "Clean Air Suit" from Mölnlycke Healthcare is a disposable product and consists of polypropylene. (Fig. 2)

Fig. 2: Example of Swedish surgical clothing

The measurements were performed during a one-hour surgical simulation (6 measurements a 10 minutes). The simulated surgery was performed by 7 people. In order to simulate as much as possible a reality-oriented process, 4 persons represent the surgical team directly at the operating table, one person acts as an

anesthesiologist and 2 other persons move through the room during the surgical simulation. (Fig. 3)

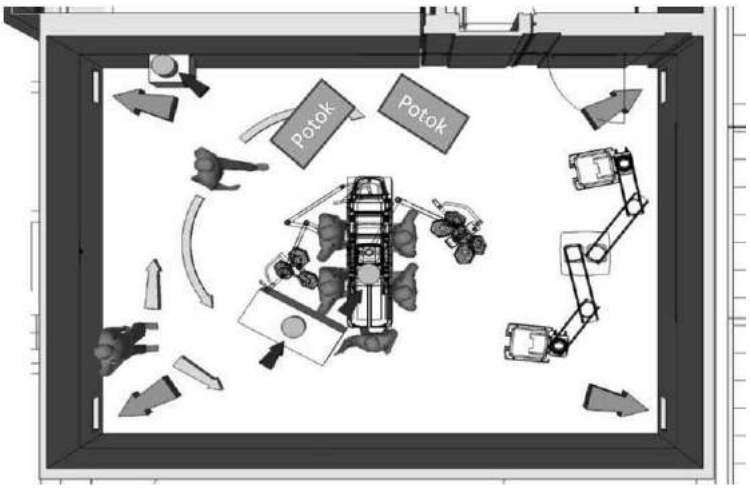


Fig. 3: Movement profile of the OR simulation, measurement points of the active air sampling and location of the Potok devices

In contrast to the standard systems the research OR at the Ostbayerische Technische Hochschule is equipped with a new temperature controlled airflow ventilation system (Opragon) that was developed by the Swedish company Avidicare AB. Opragon supplies the operative zone with slightly cooled, HEPA-filtered air (class H14) from an external air treatment unit equipped with a heating/cooling battery. The supply air is discharged through hemispherical air showers. To minimize the impact of the ventilation system it was set to at rest mode for the experiments (air exchange rate: 500m³/h). The OR in Weiden has a ground area of 41,78m² and a height of 2,90m. The Volume of the room amounts to 121,16m³.
In order to examine the influence of the Potok units on the bacterial burden of the room air and therefore the decontaminating capacity these experiments were initial performed without the Potok devices to obtain the background contamination of the research OR. Then the Potok units were switched on and after 24 hours a second identically measurement was done. It must be pointed out, that the standalone units are designed to provide local sterile zones at the OR table and the instrument board.

In order to compare the Potok technologies to other established ventilation systems the measurements were repeated in a clinical situation. Therefore the activity and

effectiveness of the Potok system was tested in a real-life setting in an operating theater in a hospital in Moscow. (Fig. 4)

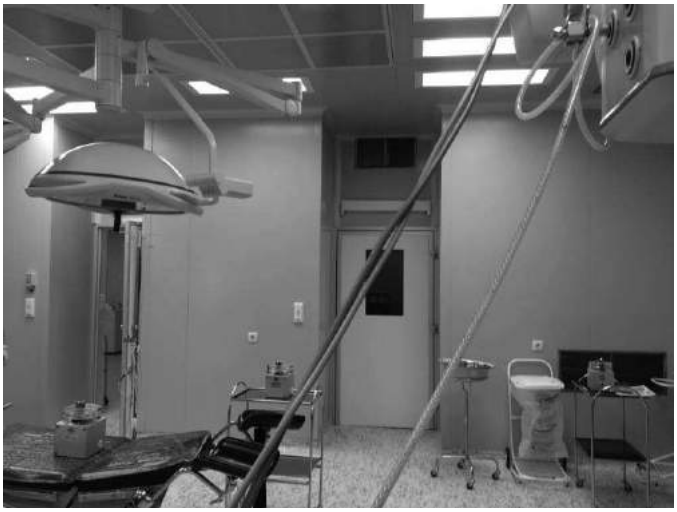


Fig. 4: Russian operating theater with installed Potok system

The OR was chosen after its technical details. (Fig. 5) Therefore it represents an average operating theater and ventilation system ideal for comparison with other technical solutions like temperature controlled airflow ventilation system [TAF], low turbulent uni-directional airflow [TAV] or turbulent mixed ventilation [TML].

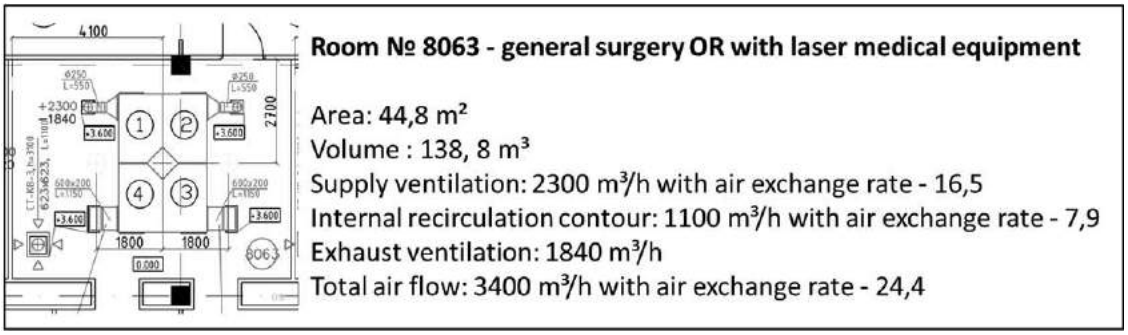
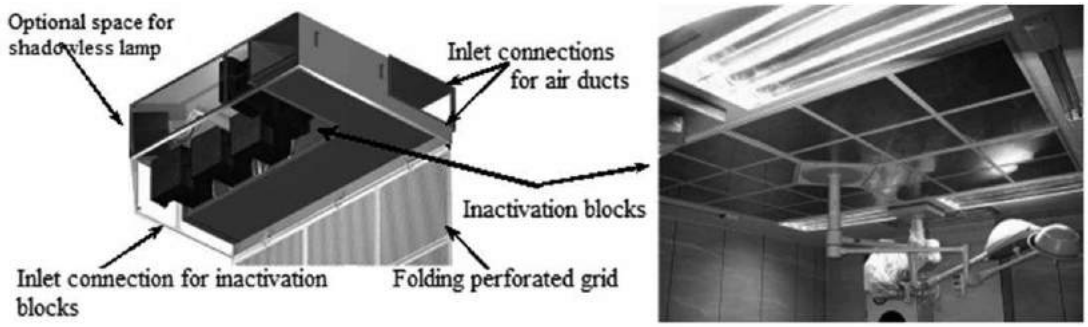


Fig. 5: Technical details of the Moscow operating theater

The OR is equipped with a TAV system based on POTOK technology. The unit consists of 4 inactivation blocks (to be installed as a part of hermetic false ceiling) with optional space for shadow less lamp. (Fig. 6)



Power Supply	220 V / 50 Hz
Power consumption of 4 blocks assembled	Max. 40 W
Capacity of 4 blocks assembled	2160 m^3/h - 3600 m^3/h
Inactivation efficiency rate	99.999%
One pass inactivation time	1 sec
Filtration class	H11-H14 (max.)
Aerodynamic resistance at nominal capacity	Max. 110 Pa
Inactivation efficiency control	Automatic
Dimensions of 4 blocks assembled	3600x2400x350 mm
Dimensions of inlet connections	600x200 mm
Warranty	5 years
Service life	Min. 10 years
Expendables	None

Fig. 6: Composition of the inactivation blocks and technical specifications

Again this was done according to the Swedish standard SIS-TS 39: 2015. The measurements were done for two hours during the surgical simulation (12 measurements a 10 minutes). The first measurements were done with the ventilation system of the OR switched off. Because of the technical situation of the OR the supply ventilation could not be turned off completely and led to an air circulation of 2300 m³/h. After that the complete system with the Potok devices was started again and after 24 hours the experiment was repeated adequately.

3. Results

Our experiments showed an impact of the Potok 150-M-01 standalone Air Decontamination Unit (ADU) on the bacterial contamination of the room air. For the

initial measurements in the research OR at the Ostbayerische Technische Hochschule in Weiden this could be shown by a decrease of the bacterial burden at all three different measurement points. It is to mention that the bacterial burden at the OR table and the instrument board are under the threshold level for the Swedish standard of ≤5 cfu/m³ (Fig. 7)

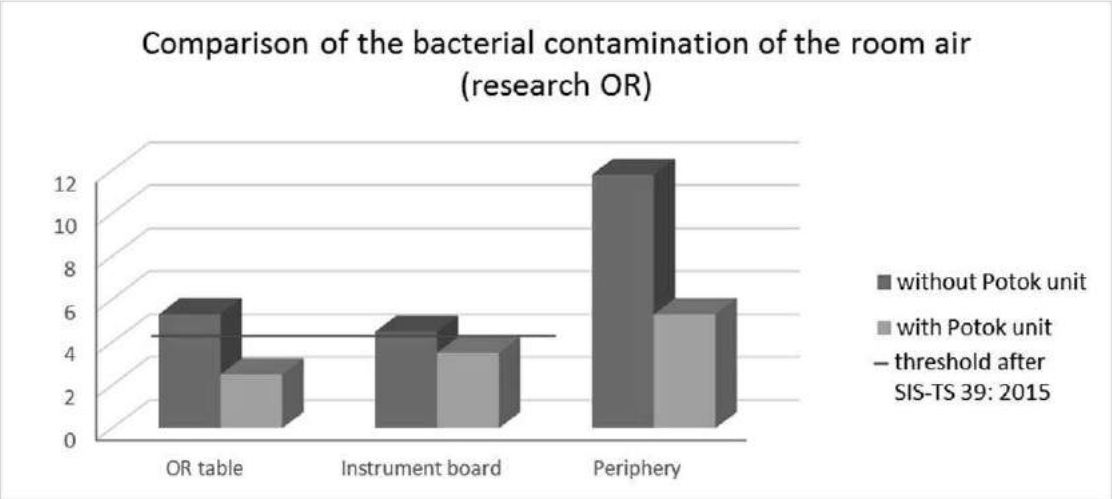


Fig. 7: Comparison of the bacterial contamination of the room air in the research OR

For the measurement directly on the OR table the activity of the units led to a decrease of the bacterial air contamination from 5 cfu/m³ to 3 cfu/m³ in average. For the Instrument table and the Periphery of the room this reduction was from 5 cfu/m³ and 12 cfu/m³ down to 4 cfu/m³ and 5 cfu/m³ respectively. (Tab. 1)

	without Potok unit		with Potok unit	
OR table		5		3
Instrument board		5		4
Periphery		12		5

Tab. 1: Average cfu/m³ for the 3 different measurement locations

Also the subsequently done measurements in the Moscow hospital verified this decontaminating effectivity of the Potok system. Because of the more realistic setting of the experiment the results of these measurements seem to be more conclusive. In this case the initial bacterial background of the operating theater was higher than in the research OR in Germany. This bacterial burden could be

effectively decreased by the use if the installed Potok based TAV ventilation system. (Fig. 8)

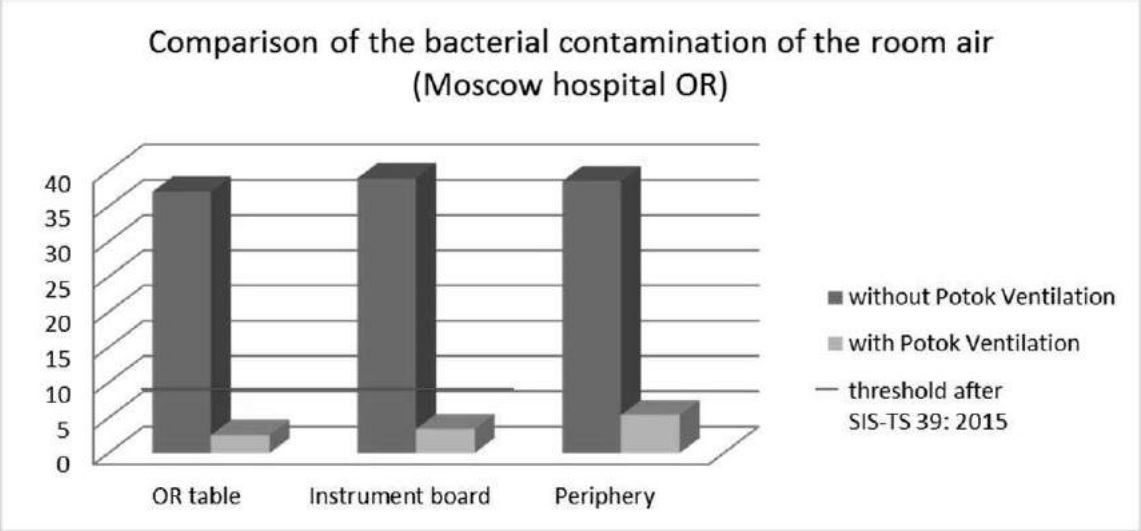


Fig. 8: Comparison of the bacterial contamination of the room air in the OR of the Moscow hospital

For the three different measurement locations our results showed a decrease of more than 87%. The initial bacterial burden of 37 cfu/m³ on the OR table and 39 cfu/m³ on the instrument board and the periphery of the room had been reduced to ≤5 cfu/m³ in average for every measurement point. (Tab. 2)

	without Potok unit		with Potok unit	
OR table		37		3
Instrument board		39		3
Periphery		39		5

Tab. 2: Average cfu/m³ for the 3 different measurement locations

4. Discussion

Our results showed a significant effect of the Potok system on the bacterial burden of the room air. In the experimental setup at the Research OR of the Ostbayerische Technische Hochschule Weiden this effect was rather slight due to the minimal initial microbiological contamination of the room and because of the use of only mobile units. However a decrease could be observed for every measurement point.
This decontaminating effect of the Potok technology was confirmed by the results of the measurements in the real-life setting of the operating theater in a Russian

hospital. Here the Potok ventilation system showed a significant and strong decrease of the airborne bacteria. In average the microbiological burden could be reduced down to ≤5 cfu/m³ for each measurement point. Compared with the results of measurements of already established ventilation systems (e.g. temperature controlled airflow ventilation system [TAF], low turbulent uni-directional airflow [TAV] or turbulent mixed ventilation [TML]) with the same experimental setup the Potok system proofed to be capable of achieving similar effectiveness as TAV and TAF system. The investigated operating theaters (TAF/TML/TAV) were certificated after DIN 1946 4:2008-12. They are classified as Ia and Ib and have an overall air exchange rate of 4120 m³/h (TML) and 9200 m³/h (TAV). The OR at the Hochschule Weiden (TAF) has an air exchange rate of 7700 m³/h. All Operating theaters are comparable regarding room size and furniture. (Fig. 9)

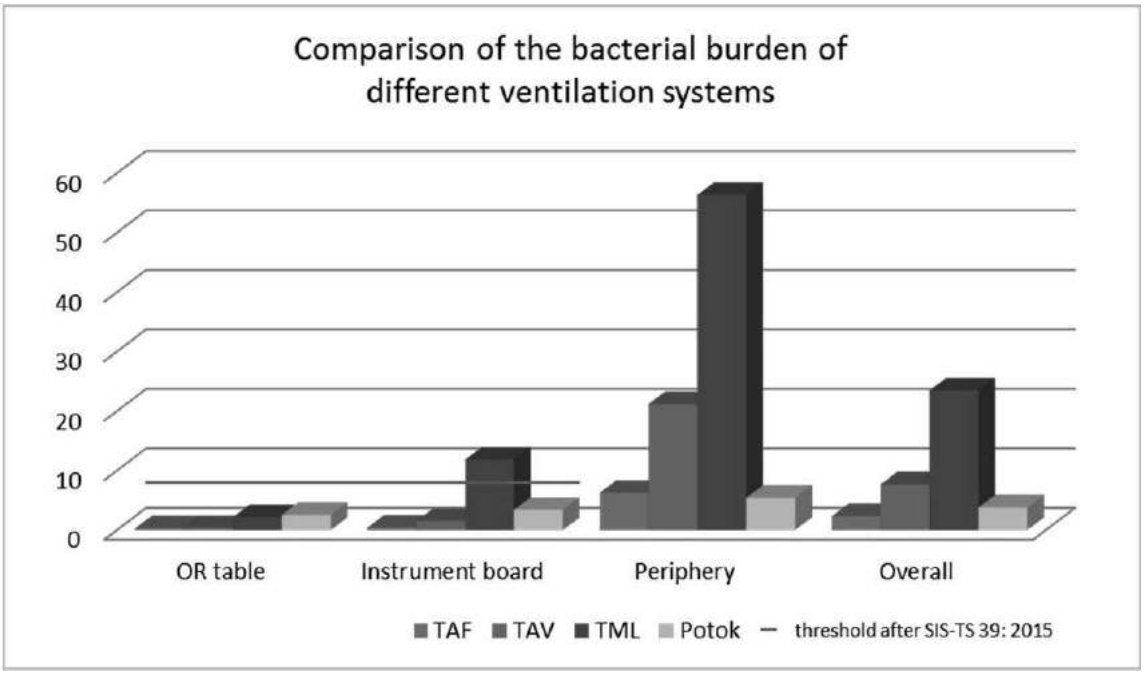


Fig. 9: Comparison of the bacterial burden in cfu/m³ for current types of ventilation systems

Additionally it is to point out that the bacterial burden on the OR table is reduced to ≤5 cfu/m³ in our measurements with the Potok decontamination system. This means that the Potok system is able to fulfill the specification for ventilation systems in the OR according to the Swedish SIS-TS 39: 2015.

With its high rate of decontamination and the following low germ contamination in the room the solution could also find use in the field of clean room technology. According to the EU GMP-Guide the threshold for a class B clean room is 10 cfu/m³. In our experiments this standard could be fulfilled with the Potok technology.

Another advantage of the Potok system is that there is no need for HEPA-filters. This means a reduced maintenance effort for the operator because there is no regular filter change.

A notable point is the energy saving aspect of the system. In our tested OR the total air exchange rate of the room was 3400m³/h with the Potok system. A comparable OR with a TAV technology has approximately an air exchange rate of 9200m³/h. And even the more energy efficient TAF system at the Ostbayerische Technische Hochschule has an total air exchange rate of 7700m³/h running with the 22 air shower set-up (air volume per shower = approx. 350 m³/h).

Based on our findings with the Potok system it should be discussed whether the technology has to be considered as a viable alternative to other currently used ventilation systems and whether it represents another potential solution for infection control of airborne microbiological burden of operating theaters.

RUSSIAN ACADEMY OF MEDICAL SCIENCES

STATE INSTITUTION
N.F. GAMALEYA RESEARCH INSTITUTE OF EPIDEMIOLOGY AND MICROBIOLOGY
of the Order of the Red Banner of Labor

APPROVED BY
I.S. Tartakovsky */Signature/*
Head of Legionellosis Laboratory,
Doctor of Biological Sciences, professor
April 17, 2002

/Seal:
Moscow
State Institution No. 30030
N.F. Gamaleya Research Institute of Epidemiology and Microbiology
Russian Academy of MEDICAL Sciences/

REPORT
on the results of microbiological studies of Potok 150-M-01 air disinfection unit

Moscow, 2002

SUMMARY

1. Potok 150-M-01 unit, after working for 60–90 minutes in a room with a volume of up to 100 m^3, both in the absence of people and with people working, reduced the contamination of the air to 0 CFU/m^3 with the initial concentration of up to 10^9 CFU/m^3.
2. Efficiency of air disinfection unit (ADU) indoors does not change in continuous operation at both low and high concentrations of microorganisms (up to 10^9 CFU/m^3).
3. Potok 150-M-01 ADU performs single-pass complete inactivation of microorganisms.
4. Potok 150-M-01 ADU performs complete inactivation of microorganisms after a single pass of the air through its active element without a precipitation section.
5. Potok 150-M-01 ADU can be effectively used for air sterilization in locations, as well as for creation of "clean" workspaces when working with various biological objects.

CONCLUSIONS

Results of the studies carried out in 1992-2000 can serve as a basis for drawing the following conclusions on the Potok technology used in Potok 150, Potok 150M and Potok 150-M-01 air disinfection units.

1. The technology ensures inactivation of airborne microorganisms with an effectiveness of up to 100% (above 99%).

2. No accumulation of living microorganism occurs inside the active element of the device.

3. Microorganism inactivation (sterilization) process is localized within the inactivation zone of the functional element.

4. A single Potok 150-M-01 device is capable of disinfecting rooms as large as 100 m^3, thus decreasing the airborne bacterial contamination level from 10^{11} CFU/m^3 down to 0 CFU/m^3 within 90 minutes.

Head of Immunoprophylaxis Team
of Legionellosis Laboratory,
senior research fellow,
Candidate of Medical Sciences *[Signature]* V.V. Petrosov

FINAL REPORT

on the effectiveness of Potok 150-M-01 unit in air disinfection and inactivation of the avian influenza virus.

Novosibirsk September 15, 2005

Effectiveness of Potok 150-M-01 unit was estimated based on the results of tests that were carried out using a purpose-made aerosol stand. There were three series of experiments using an aerosol containing avian influenza virus [strain A/Chicken/Suzdalka/Nov-11/2005 isolated by the specialists of Federal State Unitary Enterprise State Research Center of Virology and Biotechnology VECTOR 27.07.05 during epizootic outbreak of avian influenza among chickens in Novosibirsk region] with the initial activity of 8.0–7.0 lg TCD_{50}/ml by chick-embryo culture, with mass-average concentration of 0.23 g/m^3 and parameters of fraction-dispersion composition (FDC) of aerosol (MMAD ≅ 1.5 μm, $\sigma_g \cong 2.4$).

The organization has a license of the Ministry of Healthcare of the Russian Federation for the right to work with microorganisms of pathogenicity groups 1–4 (registration number of Russian Federation Oversight Committee for Sanitation and Epidemiology 117-2D dated June 11th, 2003) and individual sanitary-epidemiological permission of the Chief Sanitary Doctor of the subject and Koltsovo for the right to work with microorganisms of pathogenicity group 4, including aerosol works (registration number B-1-2002 dated October 24th, 2002).

A virus-containing suspension was used as a dispersible liquid. 10% (by volume) of glycerol and uranine with a final concentration of 10^{-4} g/ml were added to the suspension.

Biological activity was determined by the cytopathogenic effect (CPE) of the virus on MDCK sensitive cell cultures.

Uncoloured Hank's solution, with 2% by volume of bovine serum, 100 U/ml of penicillin and 100 μg/ml of streptomycin, was used as an absorbing fluid.

We used impinger samplers MTs-2 filled with 10 ml of absorbing fluid. Uptime of the samplers was 5 minutes, with an air flow through the samplers of 10±0.5 l/min. We began sampling in 1 minute after the puffer started to work, to conduct research at a constant aerosol concentration. Samplers were attached to the tubes and vacuum line wiring using rubber and silicone tubes.

The results of these tests are presented in the table below.

Table: Effectiveness of single-pass filtration and inactivation of the avian influenza virus aerosol with Potok 150-M-01 unit

Air disinfection unit operation mode	Air flow, m^3/h	Aerosol by weight filtration effectiveness ($E_{m,G} \pm I_{0.95,\ Em,G}$), %	Avian influenza virus inactivation effectiveness ($E_{h,G} \pm I_{0.95,\ Eh,G}$), %
"0" (off)	135	50.75±3.28	52.74±0.07
"II"	135	98.33±0.54	99.63±0.04

Summary

The following conclusions can be drawn from the results obtained from the work on phase 3:

- the modes of dispersion and sampling of aerosol containing the avian influenza virus were practiced;
- techniques of fluorescent and virological analysis of samples were practiced;
- parameters of FDC of aerosol were found to be almost identical before and after ADU operation (MMAD ≅ 1.5 μm, $\sigma_g \cong 2.4$);

- the values of parameters of the effectiveness of filtration and inactivation of highly concentrated aerosol of avian influenza virus in some experiments and three series corresponding to the two ADU operation modes, as well as their 95% confidence intervals, were determined;
- ADU operation mode “0” causes practically no inactivation of viral aerosol;
- ADU operation mode “II” with volume flow of 135 m^3/h provides in a single pass:

– aerosol filtration effectiveness by weight of up to 98.33%;

– avian influenza virus inactivation effectiveness of up to 99.63%;

– no significant differences in the structure of the avian influenza virus particles of aerosol, before and after ADU operation modes “0” and “II” with a flow of 135 m^3/h were found.

Conclusions

Potok-150-M-0,1 ADU in the operation mode “II” with an air flow of 135 m^3/h in a single pass of highly concentrated aerosol containing avian influenza virus, with an average MMAD of particles 1.5 μm provides:

- aerosol filtration effectiveness by weight of up to 98.33%;
- avian influenza virus inactivation effectiveness of up to 99.63%.

The test results suggest that Potok-150-M-0,1 ADU of recirculation type provides high aerosol filtration effectiveness and effectiveness of inactivation of avian influenza virus.

Head of the agreement,
Doctor of Medical Sciences, professor *[Signature]* A.N. Sergeyev

[Seal:
Bioton
Limited Liability Company
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Novosibirsk]

Перевод с русского языка на английский язык
Translation from Russian into English

APPROVED BY
CEO of Potok Inter Engineering Company, LLC
/Signature/ A.V. Nagolkin

/Seal: Moscow, Limited Liability Company,
State Registration No. 707816, Potok Inter Engineering Company/

Report
on the results of estimation of the efficiency of air disinfection with Potok 150-M-01 units in premises of Pediatric Oncology and Hematology Research Institute of Federal State Scientific Institution of the RAMS N.N. Blokhin Russian Cancer Research Center (RCRC)

Moscow April 5, 2016

Objective:

Determination of the efficiency of air disinfection with Potok 150-M-01 air disinfection unit (ADU) in a joint stay ward and in the ward air lock chamber of the hematology unit of Pediatric Oncology and Hematology Research Institute of Federal State Scientific Institution of the RAMS N.N. Blokhin Russian Cancer Research Center (RCRC)

Procedure:

In the course of works, the total microbial count (TMC) and the mold count in the air of premises was determined before Potok 150-M-01 ADU activation and several days after the activation of the unit. The works were performed in accordance with MUK (Methodical instructions) 4.2.2942-11 Methods of sanitary-bacteriological studies of the environment, air and sterility control in medical organizations. The air sampling was implemented with PU-1B aspirator (Ximko, Russia). The efficiency of air disinfection with Potok 150-M-01 units was estimated by comparison of the data on the air microbial content before and after the unit activation.

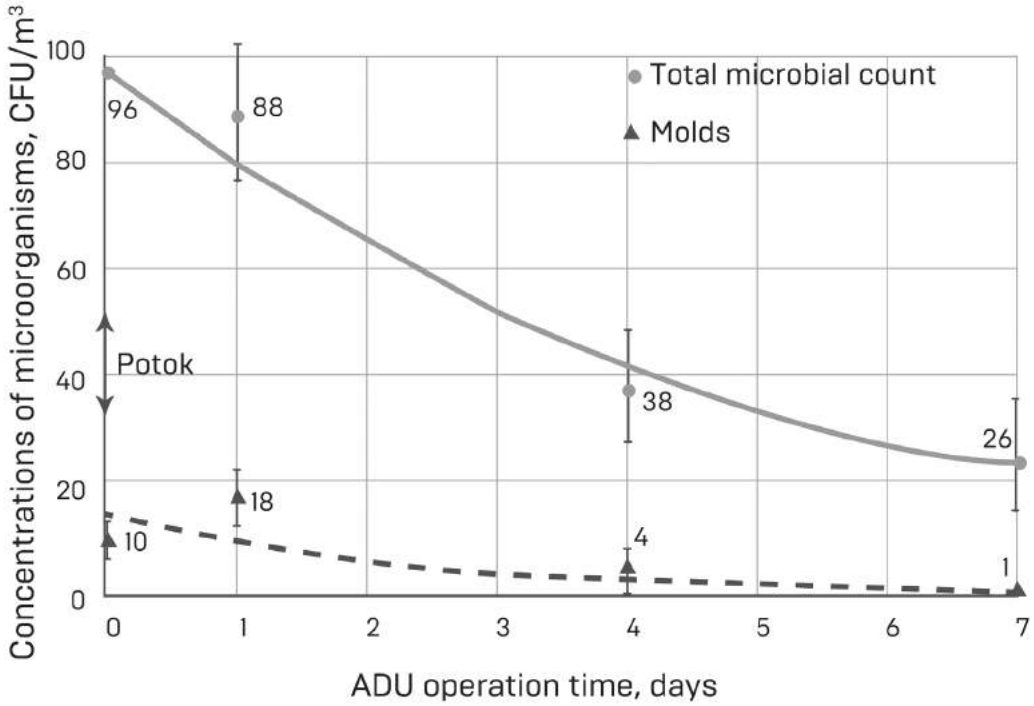
STUDY RESULTS.

Ward air lock chamber.

The air lock chamber is a transition area between the contaminated area (unit corridor) and clean area (joint stay ward); therefore, the air quality in the air lock chamber affects the air quality in the ward. Consequently, the concentration of microorganisms in the air of the air lock chamber was estimated. For measuring the background level of microorganisms (before the ADU activation) 6 air samples were collected and analyzed, in particular, 3 aerosol samples were precipitated on plates with meat infusion agar to determine the total microbial count, and the remaining 3 aerosol samples - on plates with Sabouraud agar to determine the yeast and mold count. Prior to the experiments the TMC average background concentration in the air of the air lock chamber was 533 CFU/m^3, the yeast and mold concentration was 13 CFU/m^3 (Fig. 1).

The measurements taken in 24 hours after the activation of Potok 150-M-01 air disinfection unit demonstrated that the TMC in the air of the air lock chamber decreased by a factor of 6 (from 533 to 90 CFU/m^3). 7 days after the unit operation the TMC decreased to 30 CFU/m^3, 22 days after it decreased to 3 CFU/m^3. The total TMC decrease in the air of the air lock chamber within 22 days of the unit operation was by a factor of 178 (from 533 to 3 CFU/m^3).

The mold concentration in the air of the air lock chamber within the first 4 days after the ADU activation scarcely changed, remaining at the level of 13-17 CFU/m^3. 7 days after the unit operation the mold concentration in the air of the air lock chamber dropped to zero (molds were found in none of the 3 air samples). On day 22 the mold concentration in the air of the air lock chamber was 3 CFU/m^3, which was probably caused by the mold ingress from the adjacent premises (corridor).



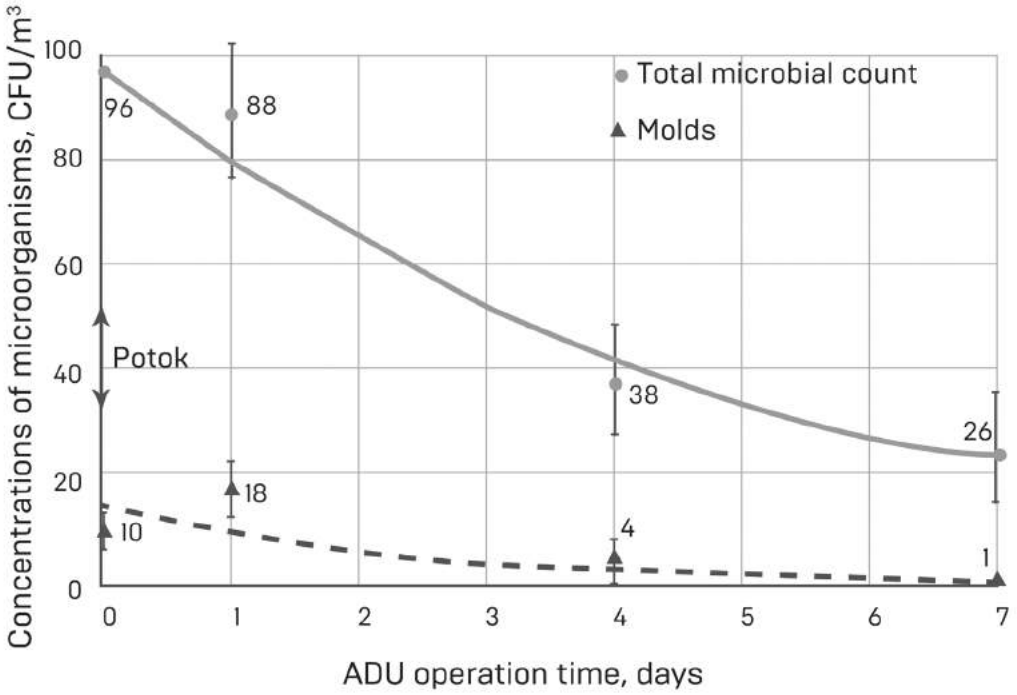
Концентрация микроорганизмов, КОЕ/м^3	Concentration of microorganisms, CFU/m^3
Общее микробное число	Total microbial count
Плесневые грибы	Molds
Поток	Flow
Время работы УОВ, сутки	ADU operation time, days

Figure 1. The concentration of microorganisms in the air of the air lock chamber before and after Potok 150-M-01 ADU activation.

Joint stay ward

For measuring the background level of microorganisms in the ward (before the ADU activation) 18 air samples were collected and analyzed, in particular, 9 samples were precipitated on plates with meat infusion agar to determine the total microbial count, and the remaining 9 samples – on plates with Sabouraud agar to determine the yeast and mold count. Prior to the experiments the TMC average background concentration in the air of the ward was 96 CFU/m^3, the yeast and mold concentration was 10 CFU/m^3.

The preliminary identification of mold species made it possible to find a significant diversity of molds (approximately 6 species), among which predominantly there were aspergilli: *Aspergillus terreus, Aspergillus sydowii, Aspergillus fumigatus, Aspergillus versicolor.*



Концентрация микроорганизмов, КОЕ/м³	Concentration of microorganisms, CFU/m³
Общее микробное число	Total microbial count
Плесневые грибы	Molds
Поток	Flow
Время работы УОВ, сутки	ADU operation time, days

Figure 2. The concentration of microorganisms in the air of the joint stay ward before and after Potok 150-M-01 unit activation.

The measurements taken in 24 hours after the activation of Potok 150-M-01 ADU demonstrated that the TMC in the air of the ward decreased from 96 to 88 CFU/m3. Subsequently, there was the continued TMC decrease, and 7 days after the unit operation it decreased by a factor of 4 (from 96 to 26 CFU/m^3).

The mold concentration in the air of the ward within 24 hours of operation increased from 10 to 18 CFU/m^3. It was probably related to the fact that in the course of the ADU operation the indoor air exchange increases, and the mold spores entered the total indoor airspace from stagnant areas. 4 days after the unit operation there was the mold concentration decrease in the air of the ward to 4 CFU/m^3, 7 days thereafter – to 1 CFU/m^3, 22 days thereafter – to 0 CFU/m^3.

It must be noted that the use of Potok 150-M-01 ADU resulted in the decrease in the mold culture species diversity in the air of the ward – before the ADU activation there were about 6 mold species identified (predominantly, representatives of *Aspergillus spp.),* and 4 days after the ADU operation there was only 1 mold species found, which was probably directly related to the ADU operation.

CONCLUSIONS

1) The studies conducted demonstrated that the use of Potok 150-M-01 air disinfection units (ADU) made it possible to reduce the total microbial count in the air of the air lock chamber by a factor of 178 (from 533 to 3 CFU/m^3), and the mold concentration by a factor of 4 (from 13 to 3 CFU/m^3).
2) The use of Potok 150-M-01 ADU made it possible to reduce the total microbial count in the air of the joint stay ward by a factor of 4 (from 96 to 26 CFU/m^3), and the mold concentration – from 10 CFU/m^3 to zero.
3) The use of Potok 150-M-01 ADU resulted in the decrease in the number of mold species in the air of the joint stay ward from 6 to 1.

Chief of the laboratory
of Potok Inter Engineering Company *[Signature]* E.N. Kobzev

Expert's report on the indiscriminate effect of the air decontamination unit "Potok 150-M-01" on all types of airborne microorganisms

Impact assessment of the air decontamination unit "Potok 150-M-01" on various types of airborne microorganisms was based on an analysis of the following materials:

1. The air decontamination method and unit for its implementation [Text]: Pat. 2541004 Russian Federation: IPC A 61 L 9/22, B03C 3/01 / Nagolkin A.V., Volodina E.V.; Applicants and patent holders Nagolkin A.V., Volodina E.V. - N 2013152726/03; declared 11/17/13; publ. 02/10/15, Bull. N 4. - 15 p.: Ill.

2. Device for inactivation and fine filtering of viruses and airborne microorganisms [Text]: Pat. 2344882 ROS. Federation: IPC B03C 3/14 / Volo effectiveness din A. M.; Applicant and patent holder A. Volodin M. - N 2007118919/12; declared 05/21/07; publ. 01/27/09, Bull. N 3. - 16 p.: Ill.

3. The study on the effectiveness of the air decontamination unit "Potok 150-M-01" on the inactivation of microorganisms and the impact on the structure of microbial cells [Text]: report on research / Research Center "BioResources and Ecology", Institute of Biochemistry and Physiology of Microorganisms named after G.K. Scriabin RAS (IBPM RAS); hands. V.A. Dmitrieva, A.M. Boronin, Doctor of Biological Sciences T.V. Kulakovskaya - Pushchino, 01.30.2012. - 16 p.

4. Investigations of the Potok air decontamination unit on inactivation of non-specific microflora and mycobacterium tuberculosis [Text]: report on research (conclusion): 89-309 / Central Research Institute of Tuberculosis RAMS; hands. V.V. Erokhin - Moscow, 03/26/2001. - 1 p.

5. Microbiological studies of the air decontamination unit "Potok 150-M-01" [Text]: report on the research study / RAMS of the GUNII of epidemiology and microbiology named

after honorary academician N. F. Gamalei; I. S. Tartakovsky; Performer: V.V. Petrosov - Moscow, 2002 .-- 28 p.

6. The effectiveness of the air decontamination unit "Potok 150-M-01" on the air decontamination which is used for removing avian influenza [Text]: report on research (conclusion) / Bioton LLC; hands. A.N. Sergeev - Novosibirsk, September 15, 2005. - 2 p.

7. The effectiveness of the air decontamination unit "Potok 150-M-01" which is used for removing the vaccinia virus [Text]: report on research (conclusion) / Bioton LLC; A.N. Sergeev - Novosibirsk, 10/05/2005. - 2 p.

8. Effectiveness evaluation of air decontamination with the “Potok 150-M-01” units in the premises of the Research Institute of Pediatric Oncology and Hematology of the Federal State Budget Scientific Center named after N. N. Blokhin "Ministry of Health of the Russian Federation [Text]: report on research / FSBI" RONTs . N. N. Blokhin "; A.V. Popa, G.L. Mentkevich - Moscow, 05.16.2016. - 2 p.

Examination of the documents submitted lets us make a conclusion, that the air decontamination unit "Potok 150-M-01" inactivates all types of airborne microorganisms (destroys them), as the technology is used to decontaminate air by exposing microbial cells or virus receptors to constant electric fields of a given orientation and tension. The value of the electric field is designed to destroy any microorganisms and viruses, regardless of the type.

Microorganisms are repeatedly exposed to constant electric fields that rapidly vary in intensity, gradient and ions of opposite signs, which completely destroy the microbial cells and cellular receptors of viruses.

Depending on the type of microorganism irreversible degradation of cellular structures is expressed in the following:

• in yeast - in the complete destruction of membrane organelles, plasmalemma and cytoplasm;

• in gram-negative bacteria - in the appearance of multiple local zones of rupture in the cytoplasm and the outer membrane;

• in gram-positive bacteria - in the appearance of single, but extensive zones of cytoplasm ruptures and rejection of cell wall fragments;

(The study on the effectiveness of the air decontamination unit "Potok 150-M-01" on destruction of microorganisms and impact on the microbial cells structure p. 15).

The influence of a constant electric field on viruses leads to the fact, that the positive mass particles of nucleic acid molecules (for example, that are part of the virion, full-fledged virus consisted of a nucleic acid and a capsid and located outside a living cell) go to the negative electrode, and negatively charged to the positive.

As a result of multiple recharges, intermolecular bonds are broken, thereby violating the protein's tertiary and secondary structure. This leads to the destruction of not only the membranes (cell membranes), but also the irreversible degradation of the protein structures of non-enveloped microorganisms, regardless of their type and resistance to chemical disinfectants.

Conclusion

The air decontamination technology used in air decontamination unit "Potok 150-M-01" is non-selective. The impact of this unit on microorganisms does not depend on their structure and degree of resistance to disinfectants.

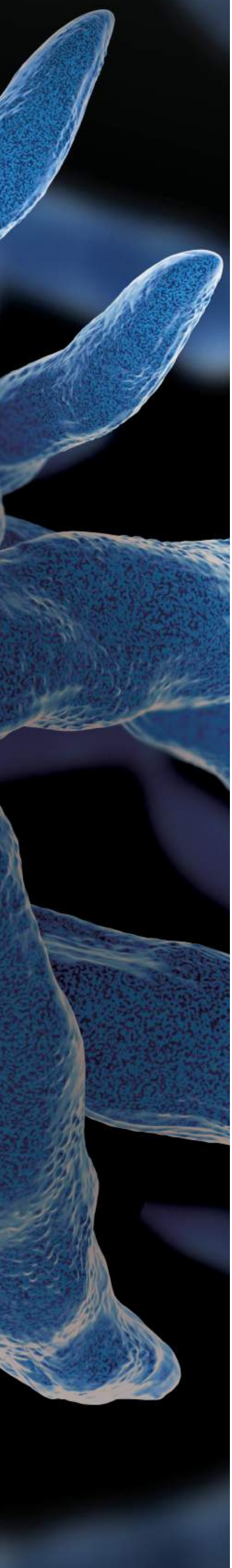
In view of the above, it may be considered appropriate, to recommend the appliance of the air decontamination unit "Potok 150-M-01" for inactivation (destruction) of all types of airborne microorganisms, including:

- bacteria, including sanitary representative microorganisms of the intestines (Escherichia coli, Enterococcus spp., Proteus mirabilis, Pseudomonas aeruginosa, etc.) and the upper respiratory tract (Staphylococcus spp., Streptococcus spp., Etc.), including those resistant to antibiotic strains;
- mold fungi and yeast, including Aspergillus niger, Mucor ramosissimus, Saccharomyces cerevisiae, etc.;
- viruses, including Influenzavirus, Grippus avium, Coronaviridae, etc.

Acting Director of Smorodinntsev Research Institute of Influenza **Dmitry A. Lioznov, MD**

REFERENCE LIST

The Scientific & Manufacturing Firm «Potok Inter» (LLC), an established and reputable manufacturer of Potok Products (Air Decontamination Appliances), hereby indicates where the Potok Products are used to reduce the concentration of mold fungi and yeasts, bacteria and viruses in the air.



Blokhin Russian Cancer Research Center
(the wards air lock chamber, the joint stay wards, Russia)

INTERNATIONAL SPACE STATION
(NASA and Roscosmos segments)

Infectious diseases clinical hospitals No. 1 and No. 2
(Aseptic wards in coronavirus red zones, Russia)

City clinical hospital
(Resuscitation Halls, wards, Belarus)

City clinical hospital named after S. P. Botkin
(24 ORs, 1 Resuscitation Hall, Russia)

City clinical hospital №1 named after N. I. Pirogov
(3 Resuscitation Halls, 8 ORs, Russia)

AKFA Medline
(ORs, Resuscitation Halls, ICU wards, Uzbekistan)

Scientific-practical center of medical aid for children with craniofacial abnormalities and congenital diseases of excitatory system
(7 ORs, Russia)

Les trois santes fitness club
(fitness dance classes, Russia)

Odintsovo linguistic gymnasium
(classrooms and medical office, Russia)

Moscow ZOO and other social, healthcare and commercial companies
(Russia and CIS countries)

Nursing homes in Serbia and in the Netherlands

Covid-19 modular infection centers
(Russia)

City clinical Hospital №24
(Russia)

And a lot of other medical and social facilities.

potok®

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305 Aggarwal Mall
Sector 5, Plot 3, Dwarka
New Delhi 110075, India.

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