NATIONAL HEALTH INSTITUTE
Šrobárova 48
Praha 10
100 42

Příhoda s.r.o.

Za radnicí 476

53901 Hlinsko

YOUR LETTER REF.: Order
YOUR LETTER OF: 17 March 2005
OUR REF.: 537/05, E-012015,
ZŽP 19-372/05, Ex 5207519
RESPONSIBLE PERSON: RNDf. K. Klánová, CSc.
TEL./FAX 267082345
E.MAIL:klank@szu.cz
DATE: 13 April 2005

SUBJECT
Assessment of applicability of use of textile air distribution ducts for the distribution of air particularly in food industry

SUBJECT OF APPLICATION
You have provided us with five products (see below) enclosed with your application for assessment of applicability of textile air ducts to distribution of air in food industry considered from the microbiologic-hygienic standpoint. The fabrics are of the same chemical basis (100% PES), they differ in the colour and permeability only. The catalogue number was not stated. The producer of the textile air diffusers and the address: Prihoda s.r.o., Za Radnici 476. Application: The textile air diffusers are designed for providing ventilation, cooling and heating of industrial buildings, in food industry especially.

PROVIDED SAMPLES
Sample No.1: NHI fabric, white, sample size 1 m^2, 100% PES
Sample No.2: PLS fabric, white, sample size 1 m^2, 100% PES
Sample No.3: PMS fabric, white, sample size 1 m^2, 100% PES
Sample No.4: PMI fabric, white, sample size 1 m^2, 100% PES
Sample No.5: PLI fabric, white, sample size 1 m^2, 100% PES

PROVIDED DOCUMENTATION
We learned further information concerning the application of the textile air diffusers from www.prihoda.cz - the application of the textile air diffusers. We learned of the possibility of distribution of air by means of your system, including maintenance (washing) instructions.

INTRODUCTION
Air handling equipment, in particular ducts distributing air, can be the source of microbial contamination, and therefore it is essential to pay attention to the cleanliness of such equipment. The most common reason for survival and reproduction of microorganisms in those ducts is the condensation of water vapors and consequent presence of water in which the microorganisms, in microscopic impurities, find nutrition. Water is the fundamental prerequisite of life and reproduction.

Not only microorganisms, but also their biologically active matters, such as toxins or volatile organic matters can enter the ambient air from the polluted air distribution ducts. When these microorganisms, it means bacteria, fungi or biologically active matters, are inhaled from the ambient air, the health of people can be jeopardized.

The microorganisms from the air jeopardize not only the health of people, but can also cause problems for instance in food industry, where they are particularly involved in decomposing processes, which is spoilage of basic material, half-finished product or products. Foodstuff and food basic material that contain enough water can also become a nutrient medium for propagation of pathogenic microorganisms, if such microorganisms get from the foodstuff to the ambient air.

Due to the above mentioned reasons the ambient air in food processing industries must contain the least possible amount of microorganisms. Therefore the air condition system, which is to conduct microbiologically clean air to the food plant or operation, is an important mechanical device.
From the practical point of view it is, however, very difficult to maintain the air distribution ducts clean, mainly due to their difficult cleaning. The ducts are too long, and have many parts which are very difficult to be accessed (ducts' bends), etc.

The assessed textile air distribution ducts have two important advantages in contrast to classical ducts. They are divided into smaller parts that are connected through classical zips; it means there are no parts that would be difficult to access.
The second important advantage of those systems is the possibility to wash tem, which is the easiest method of cleaning. With regards to these facts, in clear majority of cases there is no need to use disinfectants.

Using microbiological testing we have tried to determine if the presented textiles specified as NHI, LS and PMS that are used for the distribution of air are not an optimum substrate for survival of microorganisms, and if those do not represent hygienic risk.
Considering that there is no available binding methodology for such testing, we have used the method of our laboratory.
In the experiments we have simulated a situation of high concentration of microorganisms that were put on the textile samples; and at certain time intervals we have documented the presence of microorganisms on the samples.
As a check for the above mentioned samples of textiles we have used aluminum folio that simulated a sample of metal piping.

MATERIAL AND METHODS

For the purpose of testing we have selected the following microorganisms that are most commonly traced in the foodstuff (Decree No. 132/2004): representative of coagulase-positive staphylococcus *Staphylococcus aureus,* one of coliform bacteria *Escherichia coli,* further bacteria *Pseudomonas aeruginosa* and concerning yeasts and fungi we have tested *Candida albicans* and *Aspergillus niger.*

The tested materials were adjusted to samples with dimensions of 5 x 5 cm. We have inoculated 0.1 ml of suspension of microorganisms in concentration of 10^8/ml. Textile samples along with aluminum folio and microorganisms were put in clean Petri dishes that were closed and placed into a thermostat without temperature regulation (18-24 °C). High humidity of the air in the thermostat was achieved by inserting an open bin with sterile water. Each material has been inoculated five times for each microorganism.

At certain time intervals the dishes with the samples were removed from the thermostat and the samples were put on respective agar media. After the incubation which was in line with common laboratory practice (it means the structure of cultivation media, incubation temperatures and incubation time), we have used the following assessment to find out the increase of microorganisms:

- **-** not done
- **nd** not found (no increase)
- **+** weak increase
- **++** average increase
- **+++** heavy increase

<u>The results</u> of the experiments are tabulated hereunder.

EXPERIMENT 1

Tested material		Microorganisms														
		Staphylococcus aureus			Escherichia coli			Pseudomonas aeruginosa			Candida albicans			Aspergillus niger		
NHI	days	3	9	20	3	9	20	3	9	20	3	9	20	3	9	20
	increase	**nd**	-	-	++	+	**nd**	++	+	**nd**	-	+	+	-	+++	+++
PLS	days	3	9	20	3	9	20	3	9	20	3	9	20	3	9	20
	increase	**nd**	-	-	+	+	**nd**	++	+	**nd**	-	++	++	-	+++	+++
PMS	days	3	9	20	3	9	20	3	9	20	3	9	20	3	9	20
	increase	**nd**	-	-	++	+	**nd**	++	+	**nd**	-	++	+	-	+++	+++
Aluminum folio	days	3	9	20	3	9	20	3	9	20	3	9	20	3	9	20
	increase	**nd**	-	-	+++	+	**nd**	++	++	**nd**	-	+++	+++	-	+++	+++

EXPERIMENT 2

Tested material		Microorganisms														
		Staphylococcus aureus			Escherichia coli			Pseudomonas aeruginosa			Candida albicans			Aspergillus niger		
PLI	days	0	2	7	0	2	7	0	2	7	0	7	17	0	7	17
	increase	+++	+++	**Nd**	++	**nd**	**-**	++	**nd**	**-**	++	++	++	+++	+++	++
PMI	days	0	2	7	0	2	7	0	2	7	0	7	17	0	7	17
	increase	+++	++	**Nd**	++	**nd**	**-**	++	**nd**	**-**	++	++	++	+++	++	++
Aluminum folio	days	0	2	7	0	2	7	0	2	7	0	7	17	0	7	17
	increase	+++	+++	**Nd**	++	**nd**	**-**	++	**nd**	**-**	++	++	++	+++	+++	+++

EXPERT OPINION

With given experiment 1 conditions we have proved that even a minimum quantity of water can enable the microorganisms to survive. In our test it was 0.1 ml of water that we have added to the material and microorganisms. Under these conditions and at the laboratory temperature the bacteria *Escherichia coli* and *Pseudomonas aeruginosa* survived more than 9 days on all tested materials. The yeasts *Candida albicans* and fungi *Aspergillus niger* remained viable thorough the entire time of experiment and on all tested materials.
Aluminum folio was slightly better concerning the survival of Escherichia coli and Pseudomonas aeruginosa bacteria, and aluminum folio, in contrast to textiles, was considerably better for the survival of Candida albicans yeasts. This situation is probably connected with the ability of the mentioned materials to retain water that is the highest with aluminum folio (it has simulated sheet-metal or stainless steel piping).

With given experiment 2 conditions we have proved that neither the bacteria Escherichia coli nor Pseudomonas Aeruginosa managed to survive more than 2 days on all the tested materials, the bacteria Staphylococcus aureus did not remain viable more than 7 days.
Candida albicans yeasts and fungi Aspergillus niger remained viable through the entire time of experiment, i.e. 17 days.
From the microbiological-hygienic point of view we consider textile air ducts used for the distribution of air suitable and applicable; and the application does not need to include only food industry.

No material differences have been found among the tested materials. Aluminum folio was slightly better concerning the survival of *Escherichia coli and Pseudomonas aeruginosa* bacteria, and aluminum folio, in contrast to textiles, was considerably better for the survival of *Candida albicans* yeasts. Aluminum folio was slightly better concerning the survival of the fungi Aspergillus niger under the experiment 2 conditions.
This situation is probably connected with the ability of the mentioned materials to retain water that is the highest with aluminum folio (it has simulated sheet-metal or stainless steel piping).

The comparison of various materials regarding potential survival of microorganisms can be done only under the laboratory conditions where the conditions for all materials are identical. The testing was carried out under extreme conditions that cannot be found in normal standard environment, i.e. under the conditions of massive inoculation with microorganisms and with sufficient amount of fluid matter. Therefore in no case the results can be interpreted such that bacteria and fungi will grow on the tested materials under normal usage of the material.

CONCLUSION

From the microbiological-hygienic point of view we consider textile air ducts used for the distribution of air suitable and applicable in food industry if the required maintenance instructions are observed.
This expert opinion concerns the provided samples only, the drawn conclusions can be applied to the same products only if they are made of the same material and in the same technological and hygienic conditions.

Doc. MUDr. L.Komárek, CSc
The Head of the Centre of Health and Living Conditions

razítko
NATIONAL HEALTH INSTITUTE
The Centre of Health and Living Conditions
Šrobárova 48
100 42 Praha 10