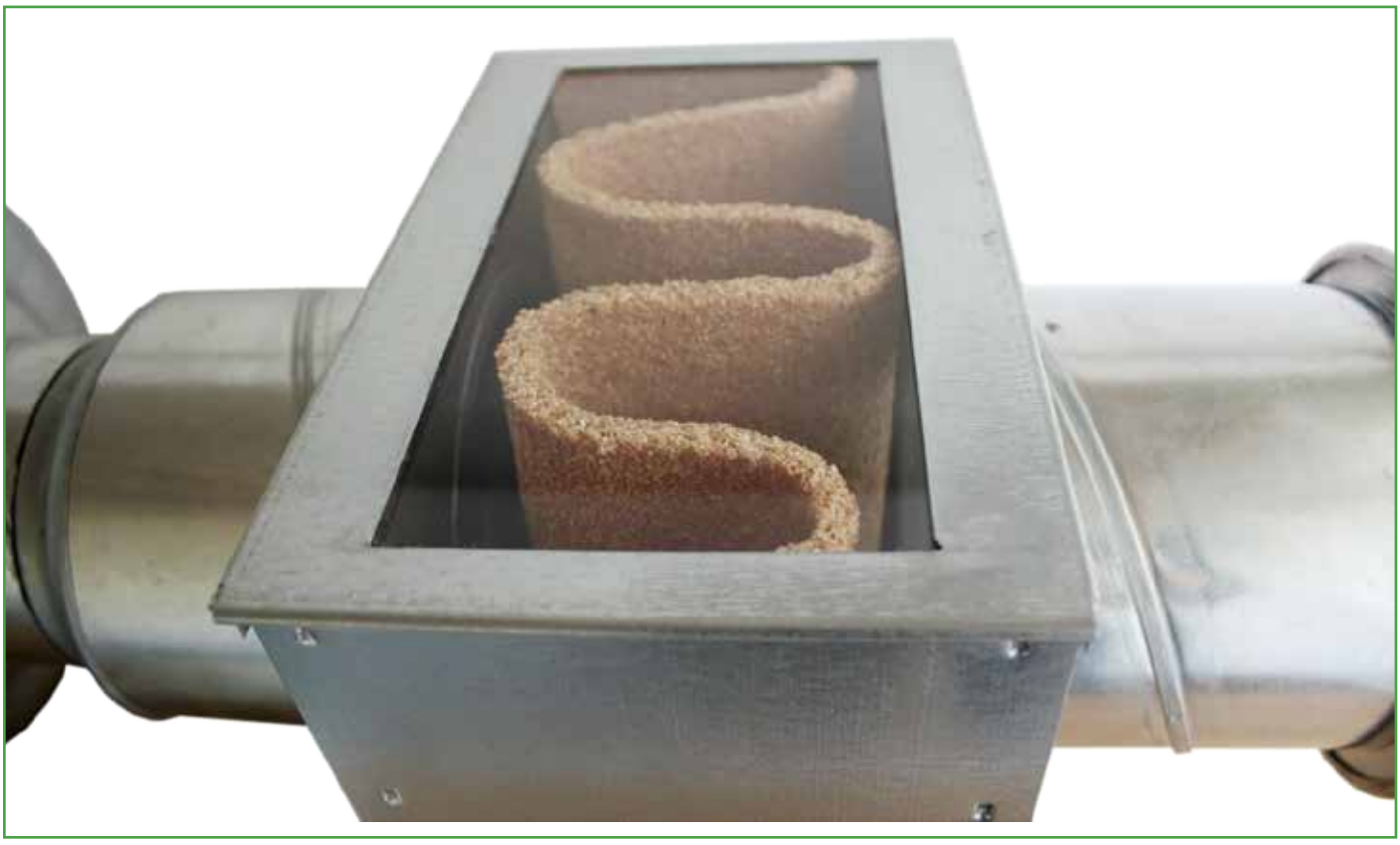
Wilms Hygienic Wood Air Filter Mats

Naturally germ-free air through pine heartwood.



Preface

More than beautiful and practical.

Many people appreciate wood for its beauty, its aesthetic appearance and the pleasant, warm atmosphere it creates. All too few people, however, are aware of the healthy properties of wood. Pine heartwood in particular has interesting and so far largely unexploited health promoting properties.

Numerous universities and institutes have conducted studies and research projects in which they show that pine heartwood does not only increase the well being of people, but is also able to effectively and purely naturally kill germs, bacteria, certain moulds and viruses.

Development for a healthy living environment

Company Wilms has developed various products on the basis of these effects.

The natural anti-bacterial properties of pine heartwood are now used for the most diverse Wilms products, such as mite repelling sleeping mats, athlete's foot inhibiting bathroom mats and also a watery extract, in which the ingredients of pine heartwood are dissolved and form, among other things, the basis for some cosmetic products.

Latest development – air filter made of hygienic wood

Our most recent research project, which we carried out together with the Deutsches Institut für Lebensmitteltechnik e.V. (DIL) (German Institute of Food Technology)in Quakenbrück, deals with the filtration and disinfection of air by means of hygienic wood. This project was supported by the Federal Ministry for Economic Affairs and Energy within the framework of a ZIM project (Zentrales Innovationsprogramm Mittelstand = central innovation programme for small and medium-sized companies) and was presented in Berlin during the 20th Innovation Day for small and medium sized companies.

The result of the research work was a flexible filter mat made of small pine heartwood chips, which can be employed in almost all heating, ventilation and air-conditioning installations, in particular for circulating air systems in buildings and in mobile installations such as in shipping and aviation or in the filtration of exhaust air from stables.

In addition to the effective air filtration, the filter mats turned out to be self-regenerating due to the anti-bacterial properties of pine heartwood, i.e. the contamination is considerably lower than in normal fleece filters. Furthermore, the enrichment of air with wood components should be mentioned too, as it leads to an improvement of the indoor climate and thus to an increase in well being.

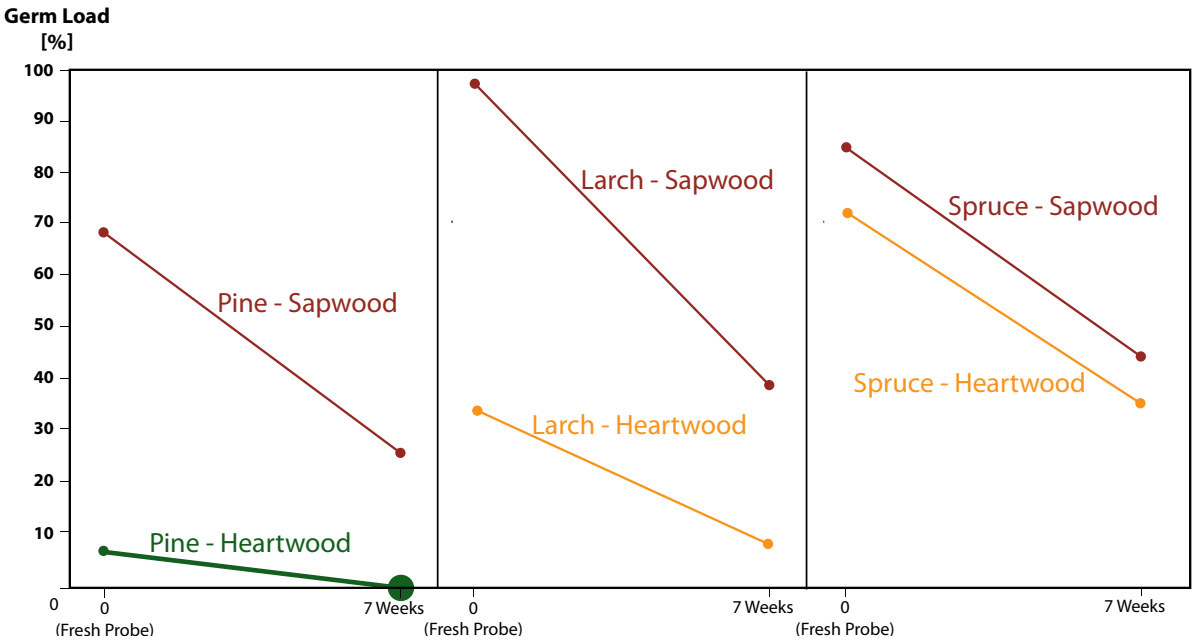
Wilms Hygienic Wood

History

Company Wilms, founded as a sole proprietorship in 1893 is still family owned and run by the owners Heinrich and Katharina Wilms. From the initial operation of a sawmill for cutting timber, an innovative producer of special pallets and provider of industrial services developed.

In the 1970s, chips from mainly processing pinewood were increasingly asked for as litter for cowsheds by local farmers. It turned out that using pine chips brought about a significant reduction in the number of diseases and inflammations, which were diagnosed in the animals. As the frame conditions had not changed in any other way, the only cause for the reduction was to be looked for in the new chip litter. Triggered off by these observations, Heinrich Wilms decided in 1996 to have this phenomenon analysed by the Biologische Bundesanstalt Braunschweig (BBA) (Biological Federal Insitute). This was followed by numerous research projects at renowned German universities and institutes.

Within the framework of basic research, various types of wood were initially examined for their anti-bacterial properties. It turned out that not only the type of wood, but also its fraction was of decisive importance for the germ reduction, whereby the pine heartwood proved to be the fastest and most effective agent.

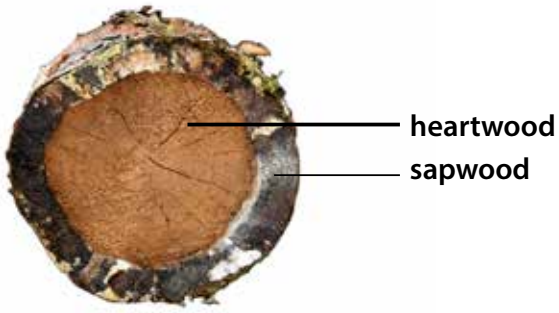


Germ load on different sapwoods and heartwoods[1]

bba

[1] *Data: Schönwälder, Annett (2000), S. 17; Graphical composition: Fa. Wilms GmbH; Graphical composition: Fa. Wilms GmbH*

Mode of action



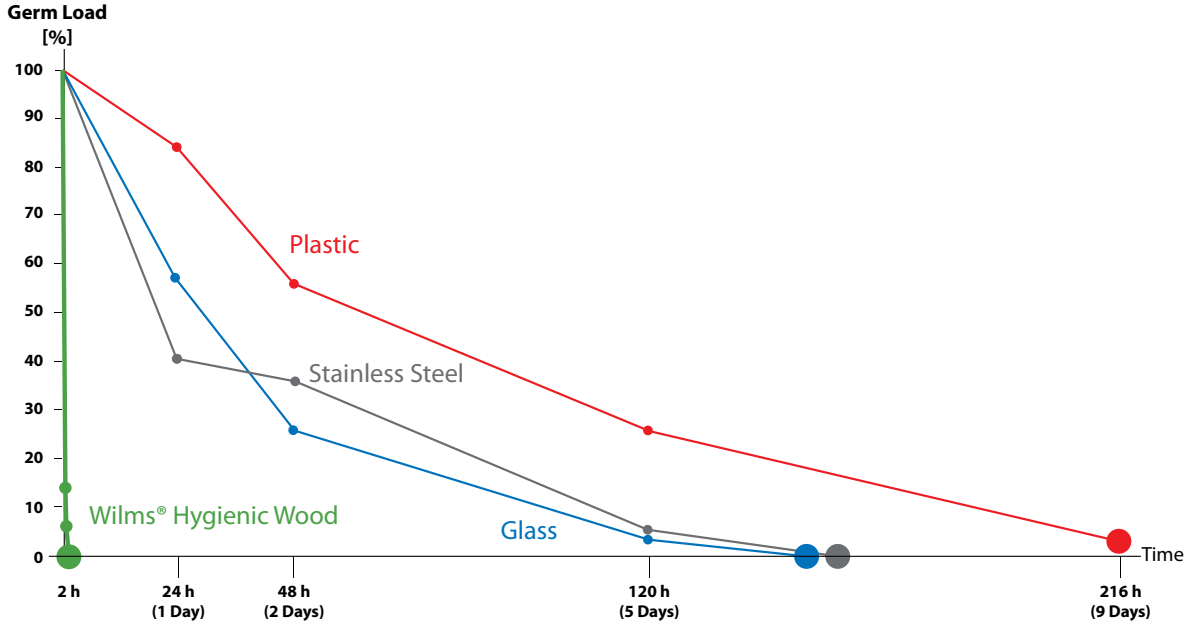
In pinewood, the core, i.e. the interior of the cross-section of the trunk, is clearly recognisable. By nature, this part of the tree is particularly resistant against germs, bacteria and fungi.

The anti-bacterial effect is based on the interaction between bacteria and the substances in the wood of the pine tree. Phenols and pinosylvin are particularly effective. Furthermore, wood has the property to absorb moisture and release it in a delaying process. This property deprives bacteria of the moisture needed for activity and reproduction. That means the effect results from the interaction between dehumidification and the substances in the wood of the pine tree. Thus bacteria, germs and other pathogens are not only relocated into the interior of the wood, but also effectively killed.

The speed of germ reduction and therefore the anti-bacterial effect depend on the suction effect of the wood, i.e. how fast the wood absorbs germs and other pathogens.

Building on these findings, the Wilms company has developed a procedure that improves the hygroscopic properties of pine heartwood so that liquids can be absorbed much faster. Microorganisms that are in the liquids get therefore sooner in contact with the substances in the wood and kill the germs even faster. Pine heartwood that has been refined in such a way is called Hygienic Wood (EP.-Patent No. 1005964).

Further studies did not only prove the effectivity but also the speed of germ reduction on hygienic wood in comparison with other materials, e.g. plastic:



Germ load on Wilms® Hygienic Wood, glass, stainless steel and plastic [2]

[2] *Data: Schönwälder, Annett (2001), S. 66; Graphical composition: Fa. Wilms GmbH*

Various research projects in this field have shown that Wilms Hygienic Wood is to be classified as harmless or even advantageous also in food processing. By nature, Hygienic Wood has an anti-bacterial effect and can therefore render harmless pathogens faster than traditional materials.

For example: on the basis of the results the DIN 10528 – food hygiene – was changed accordingly: wood was readmitted in the field of food processing. Apart from the hygienic aspects, wood has further positive properties and features.

Thus, the use of wood furnishings does not only create an indoor climate that everybody perceives as being pleasant, but it also has a positive effect on the human organism at the same time.

Studies, e.g. by the Joanneum Research Forschungsgesellschaft mbH (Austria), show that Swiss pine furnishings lead to an improvement of the general condition. Swiss pinewood or pine wood respectively effects a distinctly lower heartbeat rate and thereby significantly influences the stress capability and recuperativeness of human beings.

Institutions involved in and significantly contributing to research projects:

DIL

bba
Biologische Bundesanstalt
für Land- und Forstwirtschaft

INSECT SERVICES

UKM
Universitätsklinikum
Münster
Virologie

HN

The Hygienic Wood Air Filter Mat

Composition and properties

The hygienic wood air filter mat mainly consists of fine pine heartwood chips. These chips are glued layer by layer onto a polyester fabric by means of a heat-activated adhesive based on polyolefins that is also used for food packaging. In order to enclose the chip mat and to prevent wood chips from peeling off, it can be furnished with a fleece coating. The synthetic materials used are characterised by being odourless and free of vapours. The TÜV Rheinland certified in an inspection that no pollutant emissions from the hygienic wood mat can be verified. The process of air filtration through hygienic wood is patented.

Material-related advantages of the hygienic wood air filter mat

- High microbiological separation efficiency at a low pressure loss (energy saving).
- Pinewood is an indigenous raw material that is renewable and available in large quantities.
- Resource-friendly production: the exclusively used heartwood in particular is always readily available, as it is a by-product of the veneer production.
- In contrast to all fleece filters, there are no accumulations of micro-organisms, but there is an efficient and fast killing.
- In doing so, the filter does not require any chemical disinfectants, nanoparticles etc.
- Germs and pathogens cannot build up any resistance to heartwood.
- Service life is expected to be longer (no danger of contamination).
- Handling and disposal of used filters are unproblematic, as germs and pathogens are killed off and the filter consists mainly of wood.
- Due to the emission of natural wood ingredients, there is a positive influence on the state of health with regard to:
    - power of concentration
    - heart rate
    - sleep pattern
    - Meteorosensitivity (depending on atmospheric pressure)

Ranges of application

By using various thicknesses of filter mats, optimum filter properties can be implemented for almost any application. Because of their properties, filter mats are suitable for use in heating, ventilation and air-conditioning installations, in particular where there is a high proportion of recirculated air, e.g. in mobile applications such as shipping or aviation, but also in the ventilation of buildings, e.g. in hospitals.

It is here, in particular, where the advantages of restraining and naturally killing germs, pathogens and mildews emerge, whereby the emission of natural wood components demonstrably contributes to increase well-being and performance in humans. An essential factor for life and work respectively in confined spaces.

As practical trials on the filtration of exhaust air from stables have shown, hygienic wood mats are also suitable for technical applications. For example, apart from applications in the stable area, they can also be used for the emission limitation of biogas plants or sewage treatment plants.

Development History

2010

ZIM project (Zentrales Innovationsprogramm Mittelstand = central innovation programme for small and medium-sized companies): Studies concerning the use of wood products for degerminating air:

- Developing testing methods
- Developing and building a test rig
- Creating the most diverse filter samples
- Carrying out 283 laboratory tests at DIL e.V.
- Identifying the best filter shape

2012

Successful completion of ZIM-Project

Practical test of hygienic wood filter-Long-term test (1,000 hours filtration of pigsty exhaust air)

2013

Production of hygienic wood filter mats on an industrial scale

1M3F mat in practical test

Field test: application of hygienic wood air filters on a cruise ship

Supported by:

Federal Ministry for Economic Affairs and Energy

on the basis of a decision by the German Bundestag

DIL

Cooperation project supported by the Federal Ministry for Economic Affairs and Energy (ZIM-Project)

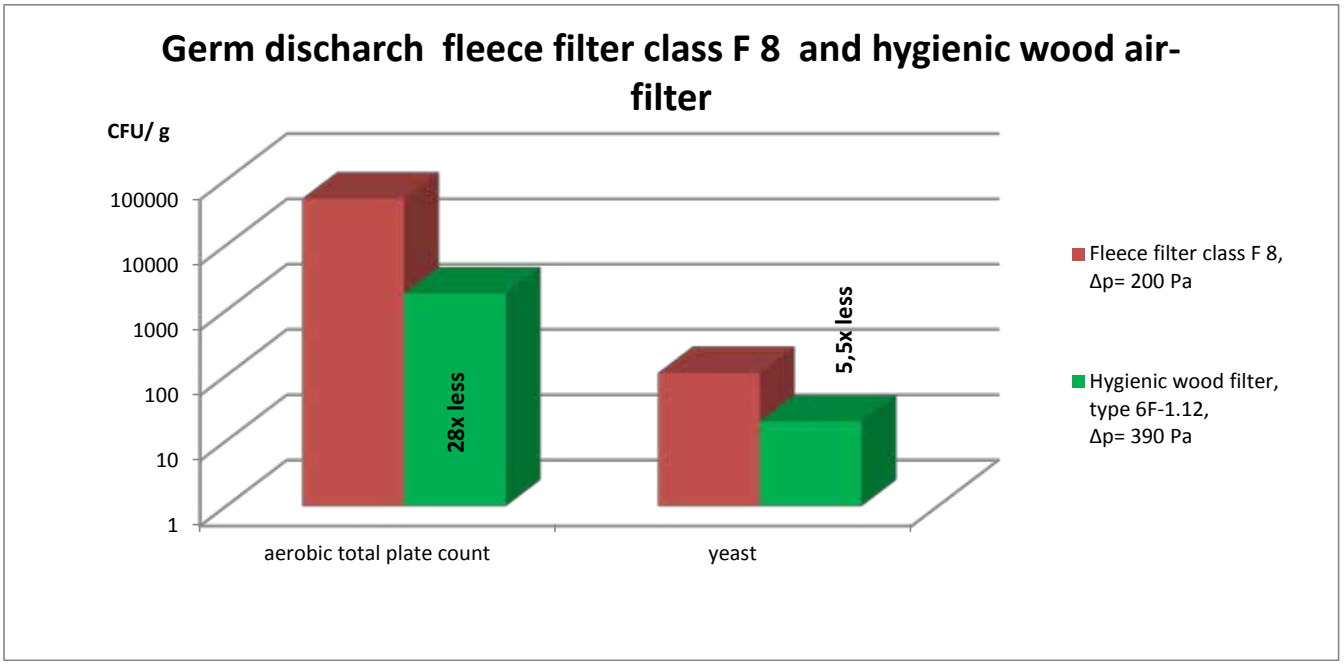
Together with our cooperation partner the German Institute of Food Technology (DIL), we carried out a project with the title "Studies on the use of wood products for the disinfection of air". This project was supported by the Federal Ministry for Economic Affairs and Energy.
The objective of the project was to find an implementable air filter form, in which solely the effect of the germ removing pine heartwood achieves a reduction of microorganisms in air streams.
More than 280 tests were carried out on a test rig, which had been specifically developed for the laboratory tests, in which the most diverse filter forms were tested. Apart from loose pine heartwood chips, some types of wood mats were also tested. In these tests a fine E.coli (intestinal bacterium) test germ was added to the air stream.

It was shown that such filter forms can be made from hygienic wood as are able to reduce even extremely high bacterial loads in the air down to the detectable concentration level. An air filter mat was finally developed as a reasonable compromise between filtering performance and pressure drop. The practical applicability of this mat makes the integration of it into existing ventilation systems easy.

Long-term practical trials - filtration of pigsty exhaust air

In order to prove the practical suitability of the new air filter form, which had evolved from the ZIM cooperation project, a long term test with harsh conditions for the filter mats was carried out.
The hygienic wood filter mats, as well as fine filters class F 8 (EN 779:2012) installed for direct comparison, were exposed to heavily contaminated pigsty exhaust air for 1028 hours. Additionally to a high microbiological load, the filters had to cope with temperatures of up to 40 °C and very variable air humidity levels 38 to 100 %rel.
The physical values such as flows, pressure drops and air condition were continuously monitored, and at the end of the test period the germ discharge was determined.

The results show that the hygienic wood filter mats, which were undamaged even after a heavy duty performance of more than 1,000 hours, have a 28 times lower germ discharge (aerobic total plate count) than the fleece filters class F 8 which had been installed for comparison purposes. The discharge of yeast spores was 5.5 times lower than that of the reference filters.

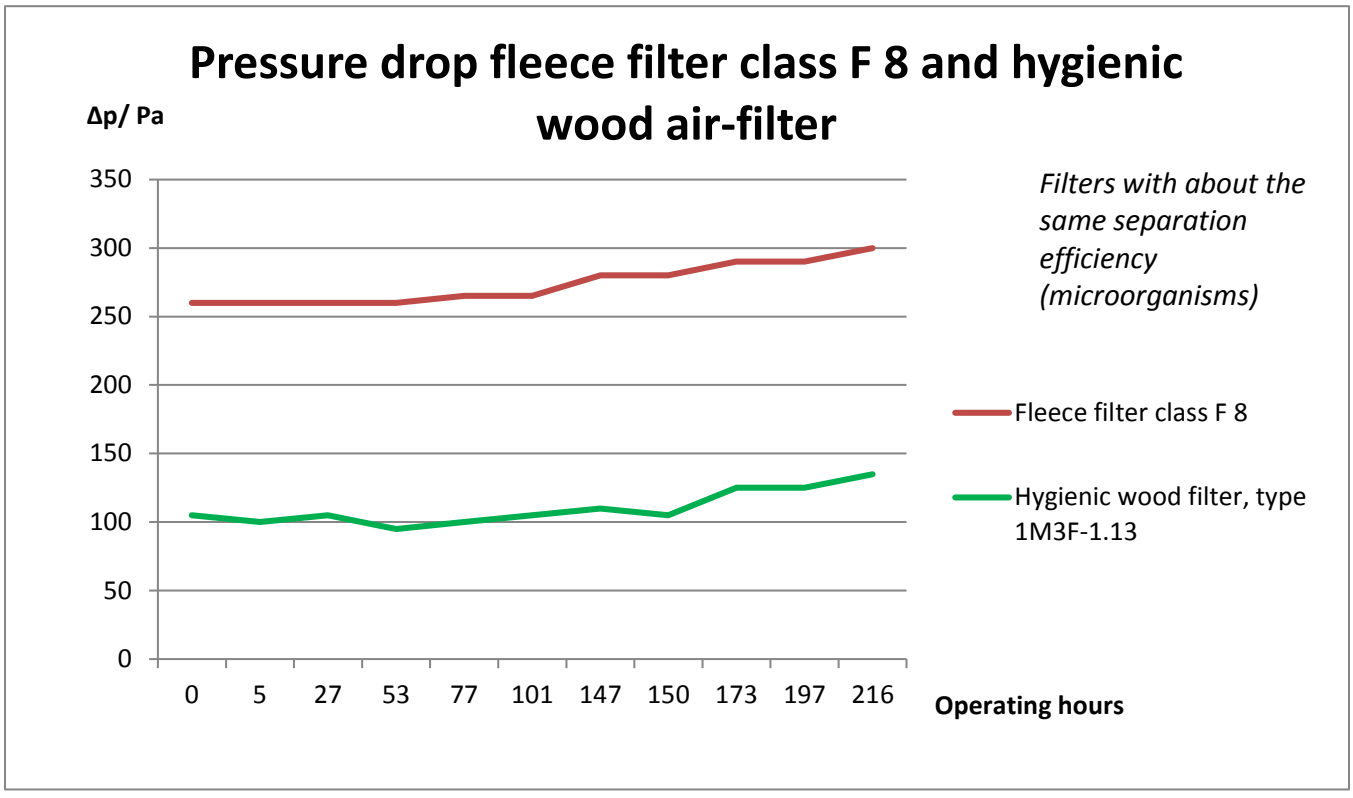


Mat type 1M3F-1.13 in practical trials (filtration of pigsty exhaust air)

By further improving the manufacturing process mat type 1M3F-1.13 was created. The target was to create a hygienic wood air filter mat, which reaches – at good pressure drop values – at least the microbiological separation efficiency of an class F 8 filter – of course with active germ reduction in the filter material itself.

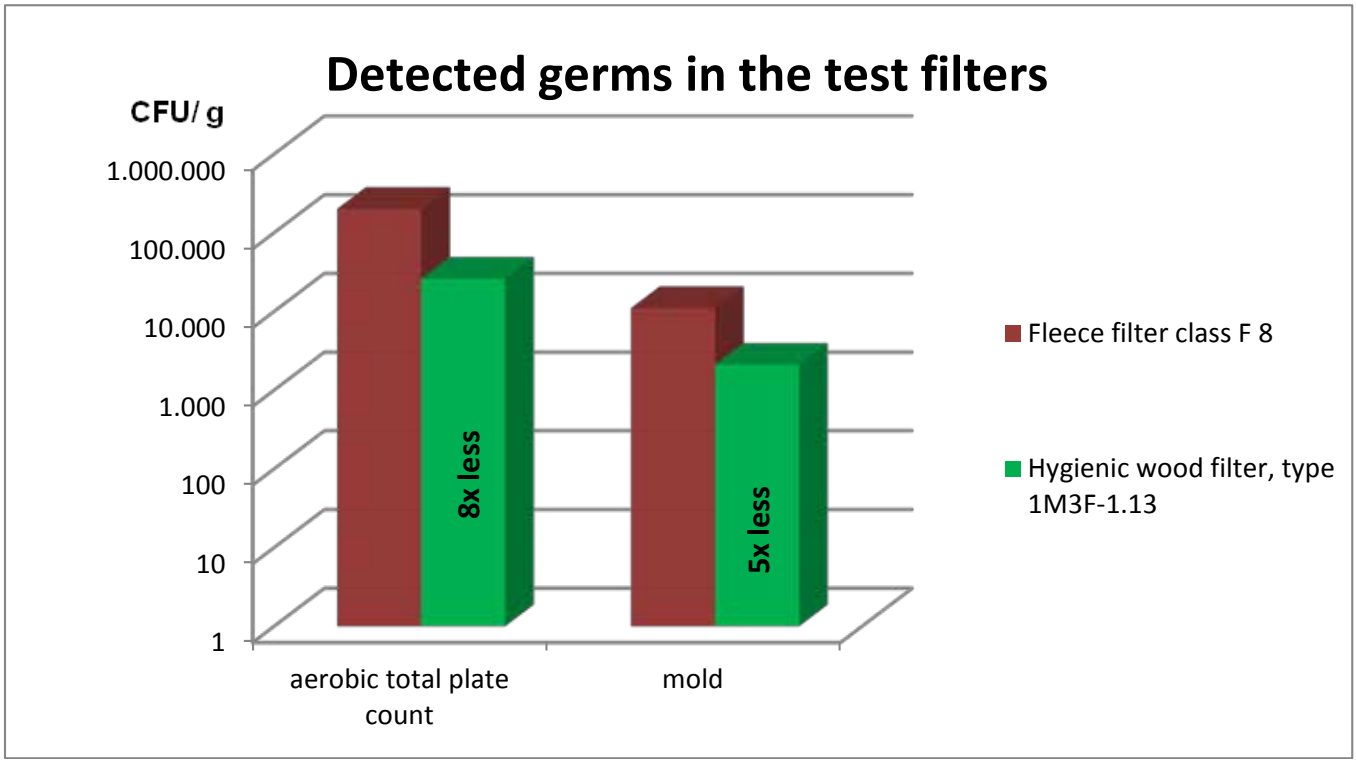
For this reason the hygienic wood filter mats 1M3F-1.13 were compared to F 8 fleece filters as in the long-term test. In this test all filters were evenly exposed to exhaust air from a pigsty for 216 hours.

Conclusion of the test report:
„Climatic conditions vary over a wide range. However, if care is taken that very high humidity over a continuous period of time is avoided, hygienic wood filters do not show fluctuations with regard to pressure drops.
Therefore, the characteristics correspond to those of fleece filters, class F 8:



The bacterial counts determined in the test filters themselves clearly show the advantage of the pine heartwood material: already shortly after the test end the overall number of aerobic germs and mould load in the hygienic wood filters is considerably lower than in the F 8 reference filters (see diagram of germs). On the basis of our present knowledge we can assume a further germ reduction in the following period.

It is essential that the wood mats reach about the same separation efficiency (microorganisms) as the F 8 filter mats used in the test at only 45% of the pressure drop. This can mean significant energy savings in practice. Integrating experiences from the long term test of 1,028 hours, it can be said that the hygienic wood filter mats have a satisfactory service life, are inconspicuous in operation and that the mat type 1M3F-1.13 meets the requirements of a germ reducing filter material at good pressure drop values."



Preliminary technical data sheet

Hygienic wood air filter mat anti-bacterial and germ reducing, with the emission of wood ingredients

Type: 1M3F

Technical Data:

Grammage:	approx. 2250 g/m^2
Thickness:	approx. 7,5 mm
Smallest bending radius:	approx. 25 mm
Nominal flow velocity:	0,3 m/s
Initial pressure drop at Nominal flow velocity:	approx. 110 Pa
Recommended final pressure drop:	400 Pa
Thermal stability in operation[1]:	100 °C
Optimum humidity range:	50 – 85 % relative humidity
Maximum humidity range for continuous operation:	95 % relative humidity (temporarily 100 %)
Fire prevention:	Appropriate fire prevention measures have to be taken in fire prevention sensitive areas.
Material:	Wilms Hygienic wood chips (pine heartwood), fabric (100 % Polyester), hot melt adhesive (Polyolefins)

Hygienic wood air filter mats are produced as reel material (Ø 1,5 m) with a web width of 1m and a length of 250 m. Customised sizes and mat coating with fleece are possible.

[1] When mat is covered with fleece. Thermal stability of raw-mat: 65 °C.

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