Test Report

Assessment of the Permeability to Fine Particles of a Woven Fabric Named "AS Microfibre Silk II"

Sponsor:	Allergosystem S.r.l. Via del Garda 46 / Q I – 38068 Rovereto (TN)
Test Institute:	Hygiene-Institut des Ruhrgebiets Institut für Umwelthygiene und Umweltmedizin Rotthauser Str. 19 D - 45879 Gelsenkirchen
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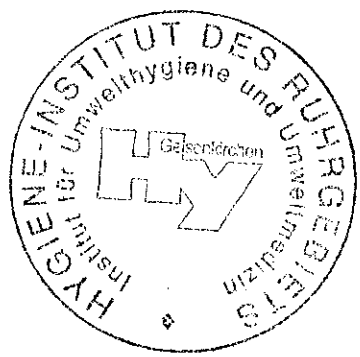

Gelsenkirchen (Germany), August 10th, 2010

1. Objectives

Allergosystem S.r.l., Via del Garda 46 / Q, I - 38068 Rivereto (TN), requested us to assess the permeability to fine particles of a woven fabric named "AS Micro Fibre Silk II". The objective of the test to be performed is to evaluate, if the aforementioned fabric is impermeable for particles, which in regard to their size are comparable to mite feces. Textile materials, which have been proved to be impermeable for such particles are considered as suitable for the production of encasings for matrasses and pillows.

It was agreed that the quantification of the particle permeability should be performed according to a test procedure developed and described by DR. EVA KAINKA, Medizinisches Institut für Umwelthygiene, Heinrich-Heine-Universität Düsseldorf. A description of the test procedure has been published in Pneumologie, Volume 51 (1997), pp. 2 – 9, and in AllergoJournal, Volume 9 (2000), pp. 261 – 270 (see references).

2. Characterization of the Test Material

Figures 1 - 4 show scanning electron micrographic illustrations of both sides of the test material, enlargement 50 x and 100 x, respectively. The pictures show the typical structure of a tightly woven fabric consisting of micro fibres.

3. Assessment of the Permeability to Fine Particles

3.1 Quality criteria for encasings

Encasings are applied to reduce and minimize exposure to house dust mite allergens in the bed. The most pronounced contamination usually is found in the matress. Covering the materess as well as the pillows with a textile impermeable for house dust mite allergens is considered as an effective measure to reduce allergen exposure of sensitized subjects and of subjects with an increased risk of sensitization by repeated exposure.

It is well known that the allergenic potential associated with house dust mites is associated mainly with the feces of house dust mites. The feces consist of small particles with diameters ranging from 10 to 40 µm. Due to drying-up and crumbling smaller particles of feces with diamaters ranging from 1 – 10 µm are formed in the bed (Diebschlag and Diebschlag, 2000). Based on these considerations it can be concluded that textiles used for the production of encasings should be impermeable for particles with diameters in the range of 1 – 10 µm.

3.2 Test Procedure

The test procedure applied has been developed by DR. EVA KAINKA at the Medical Institute of Environmental Hygiene, Heinrich Heine University of Düsseldorf, Germany. A description of the test procedure has been published in scientific journals (see references).

The principle of the test procedure can be described as follows:

A sample of the test metarial is fixed in a filter device. Behind the test material is a polycarbonate membrane filter with pores exhibiting a diamater of 0,4 µm. A defined volume of air is sucked through the test material and the filter. The original volumetric flow rate of the pump is 6,33 m³/hr. With the membrane filter the flow rate is reduced to 1,085 m³/hr.

A continuous flow of test particles is directed to the test material. The test particles consist of coal particles, which are generated by mechanical grinding of a pin produced from coal dust under high pressure. The diameter of the test particles range from less than 1 µm up to about 20 µm.

Test particles permeating the test material accumulate on the polycarbonate membrane filter. The number of test particles located on the filter is quantified by scanning electron miscroscopy (SEM) and is used as an index of the permeabilty to fine particles of the test material.

The quantification of test particles on the membrane filter is accomplished at an enlargement of 5.000 x . In total, the number of particles > 1 µm located in 30 fields of 17,1 x 17,1 µm with a total area of 8.750 µm² is determined.

Each test includes the examination of two or three samples of the test material and two counts of 30 fields according to the procedure described above. The average number of particles / 8750 µm² is used as an index of the particle permeability of the test material.

According to U. EWERS et al. (2000) the particle permeability of a test material is classified as follows:

Number of Particles per 8.750 µm²	**Particle size (µm)**	**Permeability to Particles**	**Retainment of Particles**
< 50	1 – 5	Very low	Very high
50 bis < 100	1 – 5	Low	High
100 bis <1000	1 – 5	High	Low
>1000	1 – 5	Very high	Very low

The aforementioned classification scheme has been used to evaluate the properties of more than 100 test materials with respect to their permeability to particles in the critical size range of 1 – 5 µm. Based on this classification it is possible to differentiate between materials with very low / low and high / very high permeability for particles of the critical size range.

Textiles, which turn out to be highly permeable for particles with diameters > 5 µm are considered as not suitable for the production of encasings.

The reduction of the volumetric flow rate through the test material can be used as an index of the air permeability of the test material.

3.3 Test Results

Under the test conditions applied the volumetric flow rate was only slightly reduced. The air permeability of the test material can thus be classified as sufficiently high.

Figure 5 and 6 show scanning electron micrographic illustrations of the membrane filter at the end of the test procedure, enlargement 500 x and 2.000 x. The photos show the test particles on the filter, which have permeated the textile material. The pores of the polycarbonate filter are clearly visible at an enlargement of 2.000 x .

Standardized to a test duration of 2 hrs the particle counts in 30 fields covering a total area of 8750 µm² were as follows:

<u>Particles 1 – 5 µm:</u>

-	first test	70	particles / 8750 μm^2
-	second test	70	particles / 8750 μm^2
Mean :		70	particles / 8750 μm^2

Particles 5 - 10 µm:

-	first test	16	particles / 8750 µm^2
-	second test	22	particles / 8750 µm^2
Mean :		19	particles / 8750 µm^2

Particles > 10 µm:

-	first test	0	particles / 8750 µm^2
-	second test	0	particles / 8750 µm^2
Mean :		0	particles / 8750 µm^2

4. Conclusions

According to the classification scheme presented in section 3.2 the permeability to particles of the critical size range (D = 1 – 5 µm) of the test material "AS Microfibre Silk II" can be classified as "low".

The permeability to particles of the size range D = 5 – 10 µm of the test material "AS Microfibre Silk II" can be classified as "very low".

The test material is impermeable for particles > 10 µm.

Based on the classification presented in section 3.2 it can be stated that the test material named "AS Microfibre Silk II", with respect to its low permeability to particles of the critical size range, fully meets the quality criteria for textile materials intended to be used for the production of encasings.

It was not the objective of this test to evaluate other properties of the test material such as permeability with respect to water vapour or air.

Gelsenkirchen, August 9th, 2010

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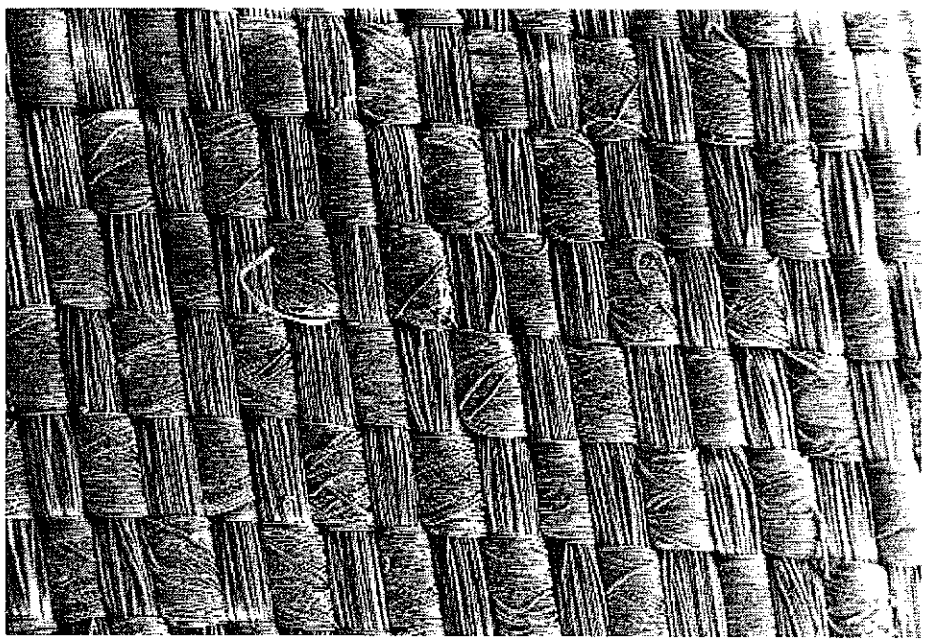


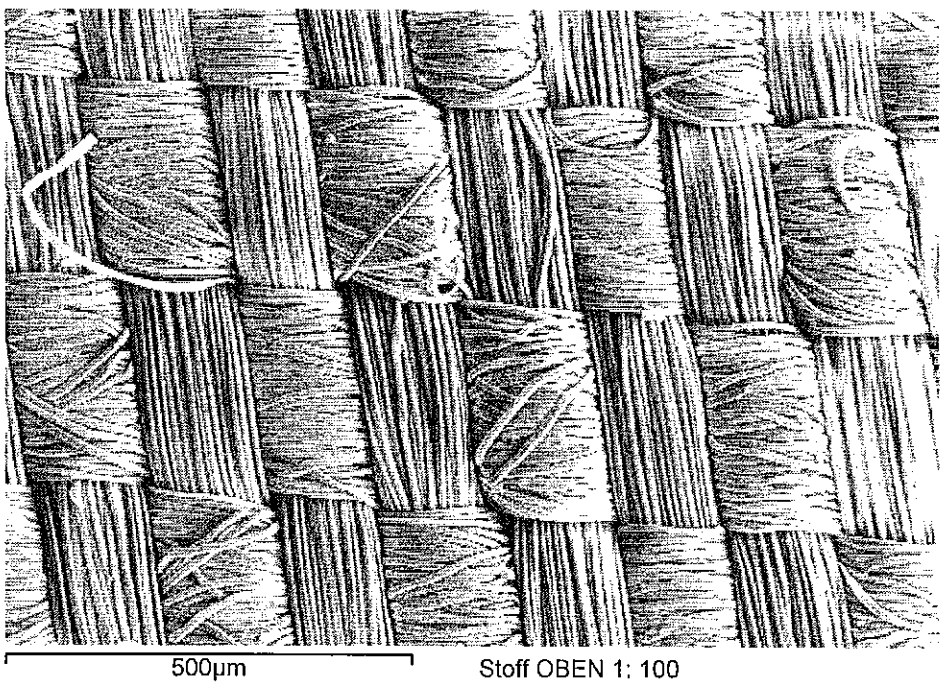
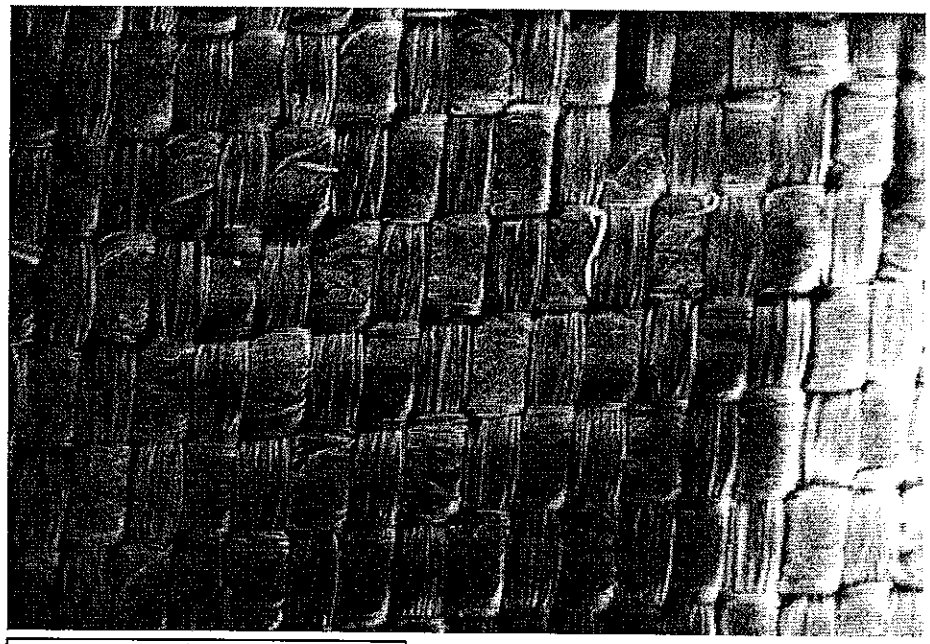


Figure 1 and 2. Scanning electron micrographic illustrations of side A of the fabric "AS Microfibre Silk II". Enlargement: 50 x (above) and 100 x (below).



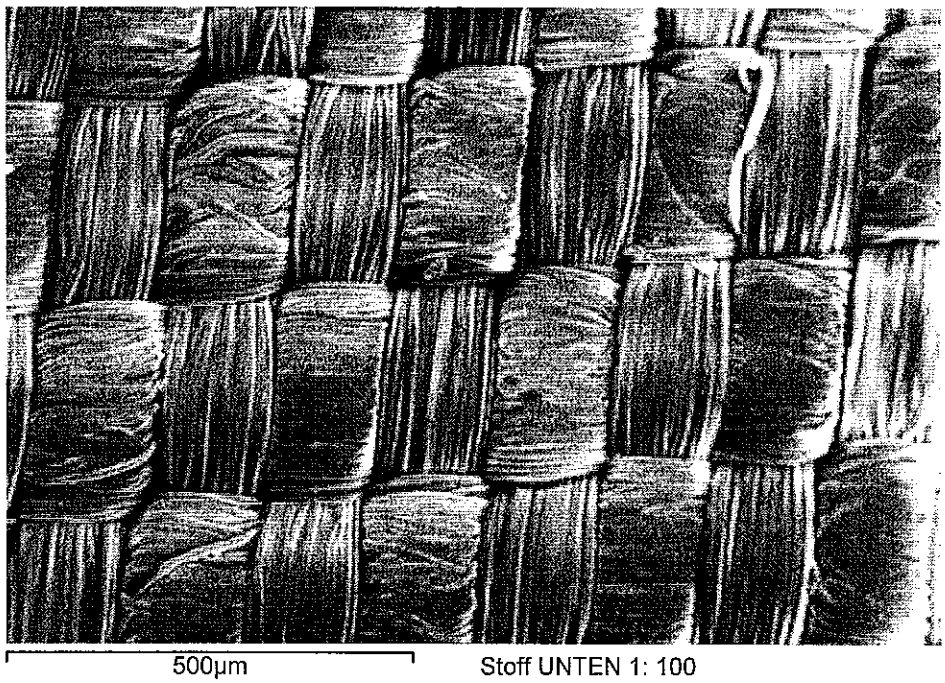
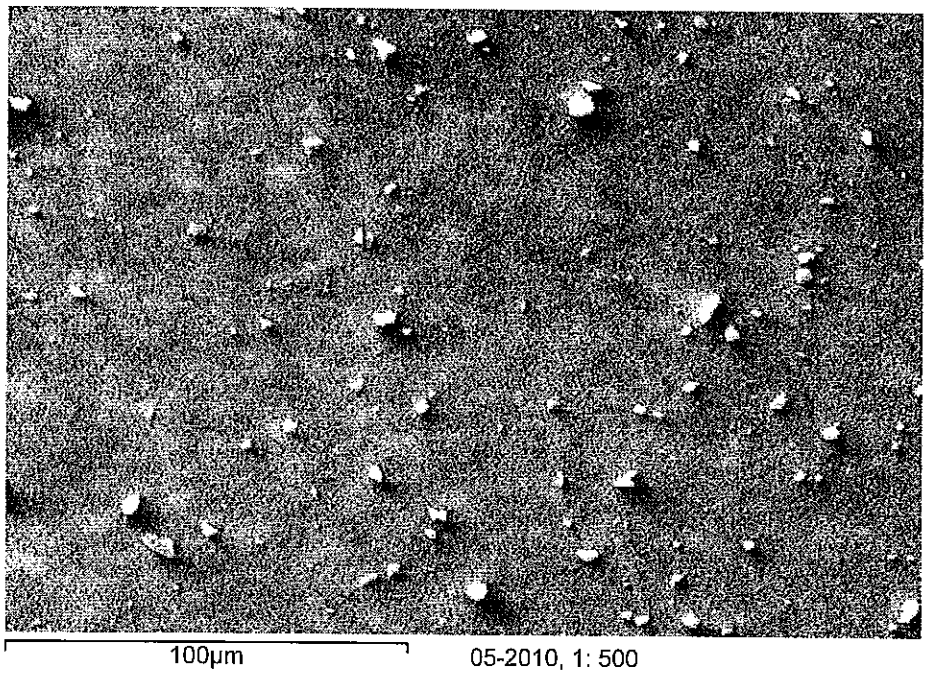


Figure 3 and 4. Scanning electron micrographic illustrations of side B of the fabric "AS Microfibre Silk II" . Enlargement: 50 x (above) and 100 x (below).



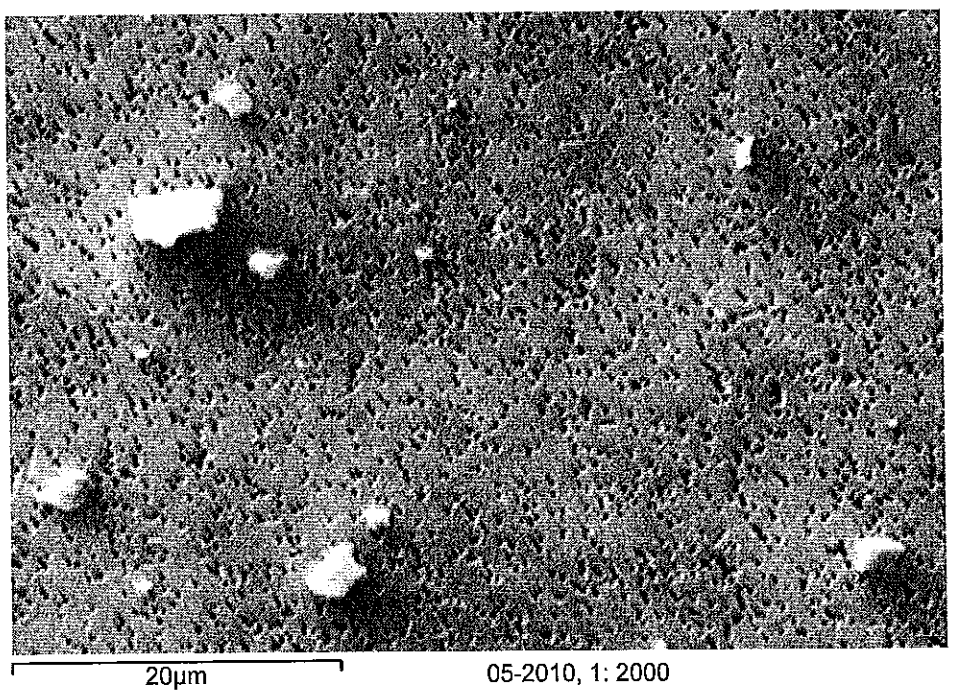


Figure 5 and 6. Scanning electron micrographic illustrations of the polycarbonate membrane filter at the end of the test procedure. Test material: "AS Microfibre Silk II. Enlargement: 500 x (above) and 2.000 x (below).