Test Report

Assessment of the Permeability to Fine Particles of a Textile Material Named „ AllergoSystem Polypropylene Strong" with Respect to Its Intented Use for the Production of Encasings

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1. Objectives

AllergoSystem Srl I – 38068 Rovereto (TN), Italy, requested us to assess the permeability of a textile material named „ AllergoSystem Polypropylene Strong" with respect to fine particles exhibiting particle sizes comparable to those of mite feces. The objective of the test to be performed is to evaluate, if the textile material mentioned above 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.

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

The test material is a white textile fleece consisting of 100 % Polypropylene. One side of the textil material is coated with a thin transparent foil or resin.

Figures 1 – 2 show scanning electron micrographic illustrations of the textil side (upper side) of the test material, enlargement 20 x and 100 x, respectively. The pictures show the irregular texture of the polypropylene

microfibers, which is typical for a fleece. Rectangular deepings are stamped into the fleece. The foil or resin coating on the inner side can be recognized in the deepenings.

Figure 3 and figure 4 show electron micrographic illustrations of the coated side (inner side), which exhibits a more plain surface. However, the typical irregular texture of the polypropylene-microfibers and the deepenings stamped into the other side of the material can be recognized easily.

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 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. 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 m^3/hr. With the membrane filter the flow rate is reduced to 0,9 m^3/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 0.1 to 20 μm.

Test particles permeating the test material accumulate on the 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 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 in the critical size range.

Textiles, which turn out to be permeable for particles with diameters > 5 μm are considered not to be 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 not reduced by the test material. The air permeability of the test material can thus be classified as very high.

Figure 5 and 6 show scanning electron micrographic illustrations of the membrane filter at the end of the test procedure. Obviously, there are some particles on the filter. The pores of the polycarbonate filter are perceptible 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 μm^2 were as follows:

-	first test	80	particles / 8750 μm^2
-	second test	108	particles / 8750 μm^2
	average:	94	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 named „ AllergoSystem Polypropylene Strong" can be classified as low.

Based on this classification it can be stated that the textile material named „ AllergoSystem Polypropylene Strong" with respect to its low permeability to particles of the critical size range 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.

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