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Research Regarding the Influence of Raw Material and Woven Fabric Geometry on the Air Permeability of Mattress

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Abstract

Properties of woven fabrics are influenced by many factors: the nature of raw materials, woven fabric geometry and density, technological parameters of the weaving operation and finishing. The main purpose of this research paper is to increase the performance of woven process during mattress manufacturing by choosing the right woven fabric geometry and raw material. The variation in air permeability depends on the area density, linear density, loop length and thickness of yarns. To obtain woven fabric samples were used several types of classic yarns, also ecological yarns like organic cotton and bamboo viscose.
On the other side, tests results show the fabric resistance regarding air permeability, like one of the main requirement for this type of textile material.

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Keywords: Air permeability; woven geometry; mattress; cotton; polyester; bamboo viscose.

1. Introduction

Air permeability is defined as the volume of air in liters, which passing perpendicularly through a test specimen under specified conditions of test area, pressure drop and time.

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Air permeability is an important factor in comfort of a fabric as it plays a role in transporting moisture vapour from the skin to the outside atmosphere. The assumption is that vapour travels mainly through fabric spaces by diffusion in air from one side of the fabric to the other [1].

For mattress, like we can see in the figure 1(a), can be used woven fabrics like principal layer for the exterior of the entire assembly. The principal properties of a mattress are shown in the figure 1(b).

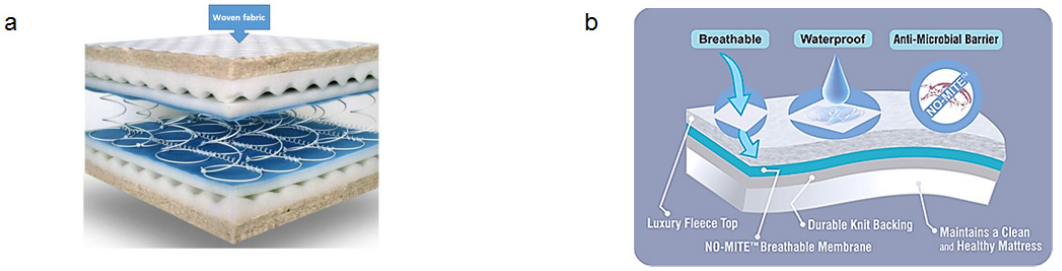

Fig. 1. (a)Woven fabric for mattress; (b) Properties of first layer for mattress [2].

Air permeability of a fabric depends on parameters like the fabric cover and fabric porosity. Total cover of a fabric may be defined as the ratio of area covered by the warp and the filling yarns to the area covered by the fabric.

Other fabric parameters that influence the air permeability of a fabric are type of weave, type of yarn (spun or filament), yarn size (linear density), twist factor in the yarn, thread density (ends and picks), and crimp%.

Type of weave determines the manner in which the yarns are interlaced in fabric. By changing the order of interlacements, the air permeability of the fabrics can be varied. When the size of the yarn changes the area occupied by the yarn in the fabric and therefore the porosity of the fabric also changes [3].

The twist factor in the yarn has a significant influence on the air permeability of the fabric since twist affects yarn size. The air permeability of the fabric increases with twist factor.

Many test regarding air permeability was done taking in account different parameters that can be an influence factor for the permeability. In their paper Marie Havlová [4] shows that the experiment was relatively large and complex because a set of 58 experimental fabrics and another experimental set of 13 control fabrics were used. The assumption that the mutual relationship between permeability and fabric structure cannot be researched only on the basis of fabric porosity characterization was confirmed.

This parameter says how much air is contained in the fabric but says nothing about individual pores – size, relative positions. It is these structural characteristics that are decisive for fabric permeability. It was shown that the characteristic dimension of one interyarn pore (diameter, area or perimeter) correlates with the values of permeability much better. The subsequent detailed analysis of the fabric structure showed that if the fabric structure is not quite regular, the use of the characteristic dimension of one "average pore" may not be even sufficient for the prediction of air permeability [4].

Militký et. all [5] study the prediction of fabric air permeability from predicted ideal porosities; porosities evaluated from image analysis and basic fabrics structural parameters (yarn diameters and weft / warp setts). It was shown that for tightly woven fabrics there exists a good agreement between air permeability and inter fiber pore volume or porosity [6]. For open weaved fabrics the correlation between air permeability and construction parameters of fabrics are not so strong [7].

Mohamad G.A. [8] shows that the permeability of fabric is closely linked to its structure. A number of authors, e.g. [9,10,11,12,13] have dealt with the possibility to predict the value of the permeability of fabrics based on their structural parameters. In some applications woven fabrics are used as filters or protective barriers whose function is to prevent the penetration into the human body of various micro particles or microorganisms. The total porosity of woven fabric usually comprises two types of porosity: the micro porosity (or intra-yarn porosity) is caused by the void spaces between fibers in yarns, the macro porosity (or interyarn porosity) is caused by the void spaces between yarns. Even very small change in the structure of the fabric causes a change in the permeability at the given location