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Air Permeability of Woven Fabrics

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ABSTRACT

Air permeability is an important property for wovens and it depends on many parameters of the fabric. Thus, a theoretical determination is highly complex and difficult in relating the parameters to the air permeability. Therefore, establish of the air permeability is usually made experimentally.

In this study, it has been attempted to establish a simple theoretical model for the air permeability of woven fabrics. For the purpose, a capillary model of porous systems on D'Arcy's law was used, and theoretical values were investigated.

Keywords: Air permeability, woven, fabric structure, warp and weft yarn.

Introduction

The air permeability is a very important factor in the performance of some textile materials. Especially, it is taken into consideration for clothing, parachutes sails, vacuum cleaners, fabric for air bags and industrial filter fabrics. The air permeability is mainly dependent upon the fabric's weight and construction (thickness and porosity).

Woven fabrics are produced by interlacing warp and weft yarns. The warp lies along the length of the fabric whereas the weft (or filling) lies across the width. Every warp yarn is separated from all the others. Thus, the warp consists of a multitude of separate yarns fed to the weaving apparatus. On the other hand, the weft yarn is usually laid into the fabric, one length at a time [1].

There are voids between weft and warp yarns in the fabric. The void volume within a textile fabric plays a major role in a variety of consumer and industrial applications, including apparel comfort, flammability, thermal insulation efficiency, barrier fabric performance, and the precision of filter media [2].

The void volume in woven textile fabrics causes air permeability. The air permeability of a textile fabric is determined by the rate of air flow through a material under a differential pressure between the two fabric surfaces [3]. The prescribed pressure differential is 10 mm of water [4,5].

The air permeability of a fabric is influenced by several factors: the type of fabric structure, the design of a woven, the number of warp and weft yarns per centimeter (or inch), the amount of twist in yarns, the size of the yarns and the type of yarn structure [6]. Therefore, establishing a more complex theory expressing the air permeability related to all fabric parameters will bring out