DR. PETRY
TEXTILE AUXILIARIES

MOISTURE MANAGEMENT

DEFINITION

In general, „moisture management“ is understood to be the ability of a textile to absorb gaseous or liquid humidity from the skin, to transport it from the inside of a textile to the outer surface and to release it into the surrounding air.

To evaluate the „moisture management“ of a textile one has to know about both the basic temperature regulation of the human body, and about the properties of the textile required by this regulation.

TEMPERATURE REGULATION OF THE HUMAN BODY

The human body has different ways of trying to maintain its temperature. For example, in a cold environment, blood circulation in the arms and legs is reduced, in order to minimize heat exchange with the surrounding atmosphere. If the body warms up, the blood circulation increases in an attempt to release surplus heat, and we start to sweat.

During perspiration water (containing salt and other substances) is transmitted through the pores of the skin, from which it then evaporates. Through the cold which is generated during evaporation, the warmth surplus is consumed – in this way the body cools down again, and its temperature is re-adjusted.

FUNCTION AND PROBLEMS OF CLOTHING

Clothing is supposed to protect humans – in accordance with their environment – from cold, heat, wind and weather. If possible, it should fulfil this function without inhibiting the evaporation of humidity caused by perspiration (good moisture management), and thus not interfering with the temperature regulation of the body.

When we start to sweat, our body humidity is more or less absorbed by the textile we are wearing. If the humidity remains in the fabric and is not transported to the surface for evaporation, cooling cannot occur. The body warms up and even more sweat is produced.

After its exercise, the body cools down and sweating ceases. However, any humidity retained in the clothing evaporates after awhile, even if the body does not need to be cooled any more. Then we start to freeze.

GOALS OF OPTIMIZED SPORTSWEAR

In consequence of the described problems in temperature regulation, our goal in the development of optimized sportswear is

- to transport humidity to the outer surface as fast as possible

  In order to evaporate, the humidity has to reach the surface of the clothing first. This occurs by capillary force, also called wicking. The capillary force increases as the gaps between the individual fibres become thinner. That means that the finer the fibres, the smaller the gaps are, and the better the humidity transport.

- to evaporate the humidity as quickly as possible

  Contrary to what is frequently assumed, the evaporation of humidity absorbed does not depend on the type of fibre, but on the surface area of the textile used. The larger the surface – in other words, the finer the fibres and the more fibres there are at the surface – the faster the humidity evaporation.

  Thus, humidity evaporates from a hydrophobic polyester fibre just as fast as it does from a hydrophilic cotton fibre of the same fineness.

- to make the skin feel dry

  Clothes which have a humid feel about them are unpleasant to wear. However, there are differences between materials as to the level from which water content makes the textile feel humid. Whereas cotton can absorb a certain volume of water without feeling humid, polyester feels wet and clammy even with small amounts of humidity stored in it.

  Moreover, thick textiles, on the basis of their mass alone, absorb more humidity compared to thinner fabrics, and their surface does not significantly expand in the process. That's why drying thick fabrics takes considerably longer.

DIFFERENT CONCEPTS

The term „moisture management“ is often used as an advertising slogan. However, ideas differ among textile manufacturers as to how to achieve an optimized moisture management. In order to bring about the different effects, a suitable fibre material is used or a subsequent finishing is applied. It is also possible to combine specialized fibres and finishings.

- **Hydrophobic textiles** (for example those made of polyester) absorb only a very small amount of humidity. This can lead to insufficient transmission of humidity away from the skin and to an unpleasant damp feeling. Furthermore, the water which is not transported to the outer surface is no longer available for the cooling of the body.

- **Hydrophilic textiles** (for example those made of cotton) are known for their greater capacity to absorb humidity. Emerging liquid is absorbed efficiently and transported to the skin surface for evaporation. However, after exercise, a larger amount of liquid has to evaporate, which can cause stronger cooling and freezing.

- **Combinations of inner hydrophobic and outer hydrophilic layers** are designed to transport humidity rapidly from the skin and evaporate it on the outside. The special construction of the material enables transportation of humidity from the inside to the outside of the textile to take place. The two-sidedness of the fabric is either attained by processing different materials during manufacturing or by varied coatings of the fabric surfaces.

- Textiles which are **in part hydrophobic** are manufactured by the application, for example with a puncture technique, of a hydrophobic coating on the inner side of a hydrophilic fabric. The idea is that humidity can be transmitted through the hydrophilic “windows”, while the hydrophobic areas do not absorb water and stay dry, leaving the skin with a dry feeling.

- **Micro fibres**, by virtue of their extreme fineness, form especially small gaps and have a big surface area. This leads to high capillary effect for the transportation of humidity, and rapid evaporation.

- **Special fibres** are designed to increase the capillary force and the humidity transportation, by means of special profiles (for example trilobal). The larger surface area of these fibres also serve to promote evaporation.

Depending on the amount of physical effort made by the athlete, and the degree of humidity released, it could make sense to combine different concepts in order to reach an optimized moisture management.

As far as endurance sports are concerned, which produce continuous, slight sweating, it is not as important to evaporate humidity immediately as it is in the case of intermittent effort, after which cooling is immediately needed. Thus, a runner would choose a thicker cotton T-shirt for doing sports, whereas for a football player, thinner polyester qualities are more suitable.

TESTING METHODS

As there is (still) no official definition of the term „moisture management", no standard is as yet available for testing of moisture management. However, different testing methods have already been developed:

- **ASTM moisture vapor test** (open cup test)
  Cotton Incorporated

  In this test, the textiles are bent over cups containing water. The temperature of the water, the air above the water and the surrounding air is the same. The weight of water evaporated through the textile is measured after a certain time.

- **GATS** (gravimetric absorbency test system)
  Cotton Incorporated

  The fabrics are put on a porous plate through which water is transmitted to the backside of the sample. The water is more or less soaked up there by the fabric. The fastness and value of the water absorption is measured, as well as the speed of drying.

- **Cotton Incorporated Gross Absorbency Test**
  Cotton Incorporated

  In this test, the sample is placed on another textile which is evenly saturated with water. The lower textile is kept saturated by a sponge placed under it, while the sample soaks up the water and evaporates it.

- **Moisture Management Tester** (MMT)
  Textile Research Journal, Hong Kong Polytechnic University

  The sample is placed flat between two plates of different diameters with circular sensors. After application of a special liquid, the sensors measure the changes in resistance between each upper and lower pair of sensors. In that way the duration of moisture absorption, the radius of spreading, the speed of spreading, the amount of moisture transported, and by this, the overall moisture management can be measured.

The term „moisture management“ has been widely used now for some time, especially to advertise sportswear and to add competitive value to the fabric with this property. However, as there is no standard testing method for moisture management, it has more to do with an advertising bonus rather than measurable extra value.

Despite the lack of a standard for objective testing of „moisture management“, there are interesting possibilities for the variation of moisture transportation and skin feeling, also and especially, with the help of a subsequent finishing of fabric.

Because of the various parameters (type of fibre, material construction, technology available, etc.) and different requirements depending on the application purpose of the textile, the finishing must be adapted to each individual case. With our large range of functional products for the application by padder, exhaustion process and coating, we are certainly able to offer you a solution to fit your special demands. Please contact us if you are interested in further information or precise product recommendations.

The above indications are based on the latest state of our knowledge. Due to different operational conditions and requirements these are guidelines only. A legally binding assurance cannot be drawn from our indications. Our technical staff will always be at your disposal to support you in testing our auxiliaries and to answer further technical questions.
06/2008

DR. PETRY
TEXTILE AUXILIARIES

Textilchemie Dr. Petry GmbH

Ferdinand-Lassalle-Straße 57
72770 Reutlingen
Germany

Telefon +49 7121 9589-0
Telefax +49 7121 9589-33

E-Mail office@drpetry.de
Internet www.drpetry.de