

Moisture Buffering

All textile fibres are able to absorb and desorb moisture vapour from the air around them as the moisture levels in this adjacent air rise and fall - a property known as hygroscopicity. Wool absorbs almost 35% of its dry mass at 100% humidity, more than any other fibre.

Wool's Hygroscopicity

Individual water molecules diffuse in and out the fibre structure, loosely binding to chemical groups that have an affinity for water. Because wool has a highly complex chemical structure it has many more of these binding sites than simpler synthetic polymers or cellulose and is thus the most hygroscopic of all apparel fibres (see over).

The weight of water in the fibre expressed as a percentage of the dry weight is known as the regain. There is a fixed relationship between regain and the prevailing conditions in the surrounding air, particularly relative humidity and to a lesser extent, temperature. For wool, regain varies from almost zero in dry air up to a maximum of about 35% in saturated air. The saturation regain of cotton, the next most hygroscopic fibre, is of the order of 24%. Corresponding regain figures for some of the more common textile fibres are shown in the accompanying table. Most synthetic fibres have saturation regains below 10%. Some are modified to improve regain by adding water-attracting groups to the polymer backbone but the improvement is small. Conventional polyester absorbs less than 1% water at

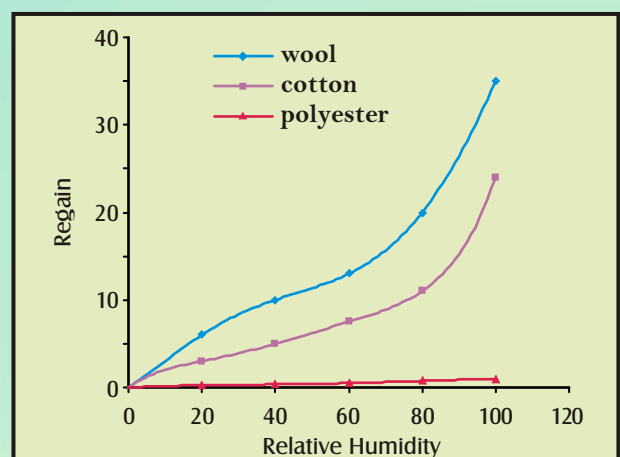
saturation. For modified polyester, this rises to about 5%. The graph below provides a simple illustration of the different regain to relative humidity relations for wool, cotton and polyester.

The ability of textile fibres to passively respond to changes in the external environment gives rise to the wear comfort property known as moisture buffering, more widely known as breathability. Moisture vapour buffering is the process whereby clothing near the skin absorbs moisture from the trapped microclimate as body humidity rises and releases it as the humidity falls. By slowing down the rate of change the textile effectively buffers the effect at the skin.

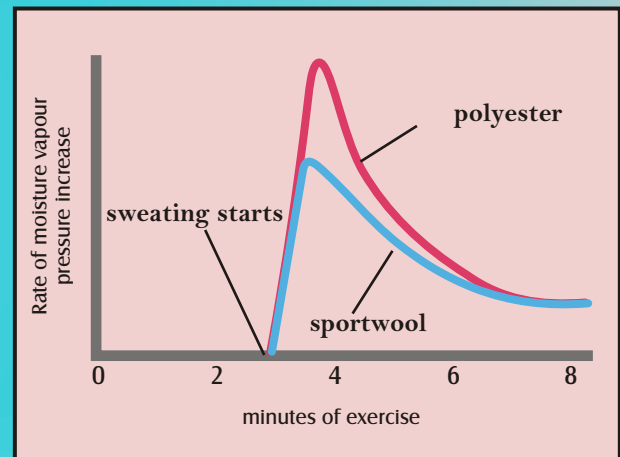
The sensation generated at the skin as the result of external changes depends on both the rate and magnitude of the change. Human skin is not very good at detecting actual levels of temperature and humidity at its surface but it is extremely sensitive to change, even very small changes. It is capable of detecting increases or decreases in temperature as

Fibre	Saturation regain%
Wool	35%
Cotton	24%
Polyamide	7%
Polyester	1%
Polyolefin	.05%
Polyacrylonitrile	7%
Aramid	6.5%

Table 1: Various Fibres at Saturation Regain



Graph 1: Regain - Relative humidity relations for wool, cotton and polyester.



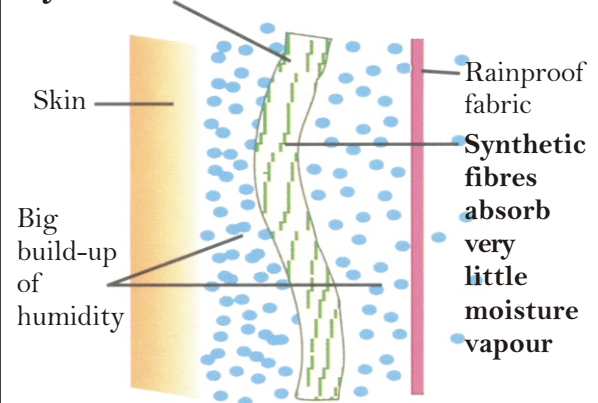
Graph 2: Sportwool™ slows the rate of increase of moisture vapour during exercise.

low as 0.01°C per second, with more rapid changes achieving a stronger sensory response, i.e. a greater awareness of the change. During physical activity, moisture levels in the clothing microclimate rise and fall, often quite rapidly. The greater the buffering effect, the less wearers are conscious of change and thus their perceived comfort level is improved.

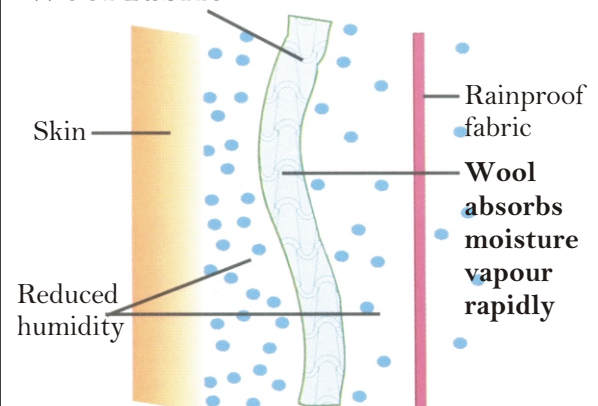
Because wool has a greater capacity than any other fibre to store moisture vapour, it is unique among apparel fibres in its ability to exert control over the humidity of the air around it. The accompanying graph shows how the wool inner face of a Sportwool garment slows the rate of moisture vapour increase in the clothing microclimate relative to an equivalent polyester product. This data was obtained from the skin microclimate of athletes exercising in a climate chamber. The effect of Sportwool next to the skin is a significantly reduced awareness of moisture discomfort.

Wool's Hygroscopicity

Synthetic Fibre



Wool Fabric



Wool is hygroscopic which means it can easily absorb water vapour. This property counteracts the build-up of clammy, humid conditions within clothing.