Water in Wool

Wool can be regarded as an active fibre. It is able to absorb and desorb moisture vapour as conditions around it change. This process is a form of equilibrium reaction.

The amount of moisture held in the fibre is the result of a physico-chemical balance between the relative humidity at the fibre surface, the temperature and the amount of water already in the fibre. If either the humidity or temperature changes, the fibre moisture content quickly re-adjusts to a new equilibrium level.

Water vapour molecules absorbed by wool attach to specific chemical sites within the structure, losing some of their energy as heat. Much of this energy comes from the effective condensation of the mobile water vapour but some results from the weak chemical bonding of water molecules to these sites. When this process is reversed, energy is taken from the fibre to convert the bound water back into a mobile state. Thus moisture absorption by wool as humidity rises increases the fibre temperature and moisture release following a decrease in humidity lowers it.

The amount of heat involved is quite significant. A kilogram of dry wool placed in an atmosphere of air saturated with moisture releases about the same amount of heat as that given off by an electric blanket running for eight hours!

A good demonstration of this is to take a loose handful of wool (it can be fibre, yarn or fabric) that has been oven dried and allowed to cool under dry conditions. When lightly sprayed with water from an atomiser the heat released is enough to cause the temperature of the wool to rise by as much as 10-12°C.

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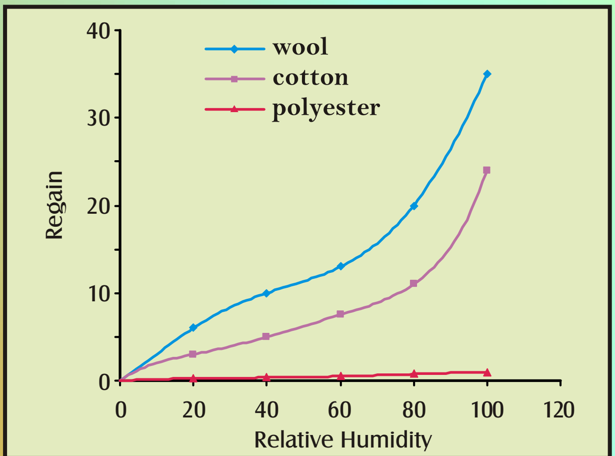
Because wool has such a large capacity to absorb water vapour compared to other apparel fibres it has a unique ability to interact with these changes in ways that make conditions at the skin feel more favourable to the wearer. (See graph 1 - Regain to relative humidity relations for wool, cotton and polyeater). Such changes can occur in the environment outside the clothing, or in the internal clothing microclimate. There are large differences between the climate conditions normally experienced in winter and summer, and between clothing microclimate conditions during rest and activity. Wool is able to adjust to these conditions, providing benefits such as warmth when moving outdoors in cold, damp climates, and cooling in warm, humid climates.

Water vapour diffused through the skin or evaporated from the skin surface passes through clothing to the environment because there is a decrease in the concentration of moisture in the air from inside to outside. An increase in sweating increases the humidity in the clothing and causes wool to take up some of the moisture released in order to adjust to a higher equilibrium level. This uptake of additional moisture vapour contributes to an apparent increase in the rate of moisture lost from within the air adjacent to the skin, which is why materials that differ in their ability to absorb moisture vapour feel to wearers as though they 'breathe' differently. Wool's reputation as a fibre that breathes particularly well is due to the fact that its high moisture vapour capacity enables it to respond more effectively in such situations.



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

Wool is comfortable to sit on for long periods because it buffers the microclimate around the back and buttocks. Moisture released by those parts of the body in contact with a chair or lounge furniture cannot readily escape to the surroundings, and can lead to feeling of clamminess. Regardless of whether it is used as the upholstery material or the trouser or skirt fabric sandwiched between the body and the upholstery, wool buffers the rise in moisture, reducing the likelihood of discomfort.