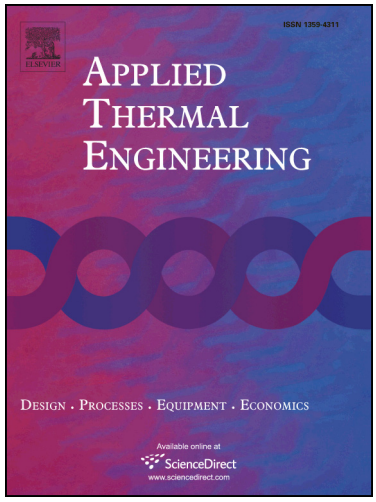


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# Effects of clothing and fibres properties on the heat and mass transport, for different body heat/sweat releases

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## Abstract

Clothing plays a key role in the capacity of the body to adapt to the surrounding thermal environments. Thus, it is critically important to have a solid understanding of the effects of clothing and fibres properties on the body exchange rates. To this end, a detailed transfer model was implemented to analyse the effect of several textiles characteristics (outer surface emissivity, tortuosity, and fraction of fibre) and fibre properties (affinity with water, coefficient of water diffusion in the fibres, thermal conductivity, density, and specific heat), on the heat and mass transfer through multilayer clothing, for different intensities of heat/sweat release. The temperature and humidity predictions were validated with experimental data obtained during measurements of textile evaporative resistance.

The results obtained for the multilayer clothing during an energy-demanding activity (i.e. metabolic heat production of 300 $W \cdot m^{-2}$ and sweating of 240 $g \cdot m^{-3} \cdot h^{-1}$) show that a decrease in the emissivity of the outer surface (0.9 - 0.1), and an increase in the coefficient of water diffusion in the fibres of the inner layer ($4x10^{-16}$ - $4x10^{-11}$), induce an increase in the maximum skin temperature (of 4.5 °C and 6.8 °C, respectively). Moreover, the water trapped inside clothing is significantly increased by augmenting the fraction of