Experimental investigation of the human convective boundary layer in a quiescent indoor environment

This study aims to characterize human convective boundary layer (CBL) in a quiescent indoor environment. The study has two objectives: first, to characterize the velocity field around the thermal manikin under two ambient temperatures and body postures; and secondly, the influence of clothing insulation/design, chair design, table positioning and seated body inclination on airflow characteristics in the breathing zone of a sitting manikin is examined. The increase of the ambient temperature from 20 to 26°C widens the CBL flow in front of the sitting manikin but do not influence the shape of the CBL in front of the standing manikin. The same temperature increase causes the reduction of the CBL mean peak velocity from 0.24 to 0.16m/s in front of the sitting manikin. Dressing the nude manikin with thin-tight clothing ensemble reduces the peak velocity in the breathing zone from 0.205m/s by 17%, and by 40% for thick-loose ensemble. Removing the wig increases the peak velocity from 0.17 to 0.187m/s. Clothing and chair design have a minor influence on the velocity profile beyond 5cm distance from the body. Closing the gap between the table and the manikin reduces the peak velocity from 0.17 to 0.111m/s. Manikin leaned backwards induces the peak velocity of 0.185m/s, which is 45% above the case when manikin is leaned forward. PIV measurements complemented with Pseudo color visualization (PCV) technique provide a good synergy between quantitative and qualitative airflow characteristics and can be adequately employed for the CBL investigation. © 2014 Elsevier Ltd.