Improved performance of displacement ventilation by a pipe-embedded window

The air distribution in displacement ventilation (DV) mainly depends on the heat sources in the room. The solar radiation and cold window are strong heat source or heat sink in summer and winter. A pipe-embedded window (PEW) has been developed to address the heat gain/loss through the window. In this study, the performance of the system based on DV and radiant ceiling was compared with that based on DV and PEW. A room with two workstations and two thermal manikins was adopted in the experiment. The impact of human bioeffluents and passive contaminant sources were studied. The results show that the warm window and floor in summer and cold window in winter damaged the normal air distribution of DV. The vertical temperature gradient was weakened and the ventilation effectiveness was close to that of mixing ventilation. The normalized contamination concentration was almost 1 in both workstations in different conditions. On the contrary, the PEW was able to keep the nature of DV and eliminate the negative effect from window. The bioeffluents and heat was efficiently removed by the DV flow. The exhaust air temperature in PEW system was higher in summer and lower in winter compared with radiant ceiling system.

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