Wearable Personal Exhaust Ventilation, WPEV: Improved Indoor Air Quality and Reduced Exposure to Air Exhaled from a Sick Doctor - DTU Orbit (08/11/2017)

Wearable Personal Exhaust Ventilation, WPEV: Improved Indoor Air Quality and Reduced Exposure to Air Exhaled from a Sick Doctor

Exposure reduction to exhaled air from a sick doctor wearing a personal exhaust unit incorporated in a headset-microphone was studied. Experiments were performed in a full-scale test room furnished as a double-bed hospital room with overhead ventilation at 3, 6, and 12 air changes per hour. Room air temperature was 22 ◦ C. A breathing thermal manikin with a body size and shape similar to the body of an average Scandinavian woman was used to mimic a “sick” doctor. The manikin was equipped with artificial lungs with a realistic breathing cycle (2.5-sec inhalation, 2.5-sec exhalation, and 1-sec pause) and a tidal flow rate of 6 L/min. A second thermal manikin and heated dummy were used to resemble lying patients. Exhaled air by the doctor was mixed with tracer gas to mimic pathogens. The wearable personal exhaust unit was positioned frontally by the mouth of the doctor at three distances: 0.02, 0.04, and 0.06 m. It was operated at 0.25 or 0.50 L/s under mixing background ventilation at three air changes per hour. The effect of the wearable exhaust unit geometry by modifying the exhaust surface, as well as the posture of the doctor, standing or seated, was also studied. The use of the wearable personal exhaust resulted in cleaner air in the room compared to mixing alone at 12 air changes per hour, reducing the exposure of the two patients. The nozzle geometry and posture of the doctor affected the indoor exposure to exhaled air. The high potential to capture exhaled air makes the device efficient against airborne pathogens in densely occupied spaces.

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