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Lattice Boltzmann investigation of contaminant removal efficiency in a ventilated chamber

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ABSTRACT

The objectives of many researchers in building ventilation are to analyse contaminant removal and ensure comfort in buildings. To achieve this, improving indoor air quality and thermal comfort is essential to prevent health problems and reduce energy consumption in these environments. In this perspective, our research aims to numerically evaluate the efficiency of the removal of pollutants in a room where the ventilation occurs through the bottom of an active wall, while the exit is located at the upper part of the right wall. In the middle of the lower wall, the chamber is divided by a porous matrix with a dimensionless height of 0.6. The numerical simulations were done with Fortran code using the lattice Boltzmann method with multiple relaxation time (LB-MRT). The results demonstrate that for a dimensionless time value less than 50, the pollutant removal efficiency virtually reaches its maximum value and is twice as high for low Reynolds values as for high Reynolds values, regardless of Rayleigh and Darcy values.

Keywords: Air quality; Displacement efficiency; LB-MRT method; Porous separation; Ventilated cavity

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