

Objectif : Air intérieur, ventilation, climatisation et propagation du Covid-19

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Google Scholar, Lens et WoS

Kim, S., Baughman, N., Badawy, M., Armstrong, M., Wayne, K., Vogel, E., *et al.*

[EGFET-based detection of airborne E. coli using a recirculating wetted wall cyclone collection.](#)

Sensors and Actuators B: Chemical, Vol. **449**, (2026)

We developed a high-volume bioaerosol collection and analysis prototype device to detect low concentrations of airborne E. Coli in 50 minutes. Potential applications of this system include integration into a building's heating, ventilation, and air conditioning system for indoor detection and identification of viral, bacterial, and fungal biological threats. A scaled-down version has potential surveillance use by the military for defense against biological weapons. Our device integrates an array of technologies including (1) the collection of airborne biological particles using a wetted wall cyclone at up to 1200 liters of air per minute, (2) microfluidic particle filtration and concentration, and (3) the extended-gate field-effect transistor (EGFET), which detects both viable and non-viable cells, as the biosensor for target pathogens. The 50-minute operation includes a 12-minute collection phase (8-minutes without recirculation, 3 minutes with recirculation, and 1 minute of residual collection without aerosol input) followed by an 8-minute concentration and a 30-minute detection phase. Using aerosolized particles containing target Escherichia coli, we detected concentrations as low as 7.6 colony-forming units (CFU) per liter of air with a sensor surface potential shift of 165 ± 73 mV.

Sepehri, B., Sharifi, A.

[Lessons from COVID-19 for enhanced urban resilience against Mpox and future pandemics.](#)

Cities, Vol. **168**, (2026)

Cities may face new pandemic threats due to the highly interconnected nature of urban areas, the encroachment on natural resources driven by rapid urbanization, and the adverse impacts of climate change on public health. Recent experiences with COVID-19 have yielded valuable lessons in urban planning, design, and management. By employing Methodi Ordinatio, this short communication critically examines key insights from the COVID-19 response and their potential application to Mpox and future pandemics and infectious diseases, identifying opportunities and lessons for urban areas to enhance their pandemic preparedness and resilience. Due to the heterogeneity of urban spaces, lessons were analyzed based on various urban typologies. This led to an understanding of the critical points in generalized policies, such as proximity-based planning and mixed-use development, and the need to propose more flexible strategies for less focused urban typologies in low-income areas and informal settlements. Findings provide specific recommendations related to urban planning, design, and management, emphasizing the importance of building on characteristics such as adaptability, diversity, flexibility, modularity, decentralization, inclusivity, multi-functionality, and redundancy to enhance urban resilience. Ultimately, by proposing a framework of key interventions and measures, this short communication provides insights that cities can apply to enhance their resilience to future pandemics.

Wang, T., Yao, J., Han, W., Lu, Y., Chen, Z., Shi, F., *et al.*

[Numerical modelling of the through-draught induced by traveling trains in subways and its impact on airborne droplet transmission in compartments.](#)

Process Safety and Environmental Protection, Vol. **204**, (2025)

Due to the enclosed structure and high passenger density, subway carriages are strongly affected by the through-draught induced by train speed variations, which significantly influence droplet dispersion. While previous studies have primarily focused on static conditions, the transmission mechanisms of cough droplets under dynamic operations remain insufficiently explored. This study develops a numerical model based on a non-inertial reference frame to simulate droplet distribution in a traveling train. The momentum source term is introduced to construct a non-inertial frame and the through-draught (TD) simulation is achieved through velocity distribution and pressure boundaries. The model is validated against full-scale field measurements, showing mean absolute errors of 0.10 m/s for peak velocity, 0.13 m/s for average velocity and 0.20°C for temperature. The numerical results show that TD increases the maximum horizontal dispersion of droplets by 6.72 times and prolong the clearance time by 87 % compared to static conditions. Droplets released from the front of the carriage disperse 1.58 times farther than those from the center, while the middle section achieves a 90 % removal rate and 50 % faster. These findings clarify the coupling between transient airflow and droplet dynamics, providing theoretical support for ventilation optimization and infection risk mitigation in transit environments.

Mirzajani, A., Babazadeh Asbagh, G., Rezazadeh Movahhed, S., Hamed, M. A., Jafari, M.

Robust particle Swarm-Optimized sliding mode control for enhanced air curtains: A comparative study on pollutant control.

Building and Environment, Vol. **288**, (2026)

Air curtains are widely used to separate indoor and outdoor environments by generating high-velocity air barriers that reduce pollutant infiltration, improve thermal efficiency, and enhance indoor air condition. However, their performance under dynamic disturbances remains a challenge, particularly in controlling pollutant dispersion such as CO₂. In this study, a series of CFD simulations were conducted to investigate the effectiveness of the air curtain system in controlling the dispersion of CO₂ within the enclosed space. The numerical simulations are conducted using the 2D steady-state Reynolds-Averaged Navier–Stokes (RANS) equations in conjunction with the k– ω Shear Stress Transport (SST) turbulence model. An advanced Sliding Mode Control (SMC) structure optimized by Particle Swarm Optimization (PSO) to enhance the air curtain pollutant containment capability is proposed. The PSO algorithm automates the tuning of SMC sliding surface parameters and control law coefficients, improving robustness against external perturbations. For comparison PID, standard SMC, and SMC optimized with a Genetic Algorithm (GA-SMC) are also implemented. Results demonstrate that the proposed PSO-SMC method outperforms PID, conventional SMC, and GA-SMC achieving faster convergence of the sliding surface, significantly lower CO₂ mass fraction leakage, improved stability under critical pressure fluctuations, and reduced control effort leading to enhanced energy efficiency. The PSO-SMC approach exhibits proper adaptability to dynamic conditions, making it a promising solution for industrial and commercial applications requiring reliable pollutant containment. This work highlights the potential of metaheuristic-optimized control systems in fluid boundary management and provides a framework for further advancements in intelligent HVAC and ventilation technologies.

Pan, X., Zhang, Y., Wang, X., Xiong, Y., Tian, Z., Yang, B., *et al.*

A study on an innovative dynamic ventilation strategy for reducing the exposure risks of passengers.

Thermal Science and Engineering Progress, Vol. **68**, (2025)

In light of the increasing expectations for air quality from passengers, the current ventilation system needs to be improved to create a safer and healthier cabin environment. Therefore, this study proposes an innovative ventilation system that periodically swings the air supply angle in the aircraft cabin to reduce the exposure risk of passengers. Numerical simulation was used to study the impact of the dynamic ventilation

strategy on contaminant diffusion in the seven-row full-scale cabin. By comparison and analysis, the differences in flow field characteristics between the new ventilation system and the traditional sidewall ventilation system were investigated. Furthermore, the exposure risk of passengers and the distribution of contaminant concentrations under both systems were discussed. The results show that the new system can generate dynamic small-scale circulations. By enhancing the airflow mixing, the new system achieves more uniform distributions of both airflow velocity and temperature in the cabin. In addition, it promotes the quick dilution of contaminants and decreases the average exposure index by up to 35% compared with the traditional sidewall ventilation system.
