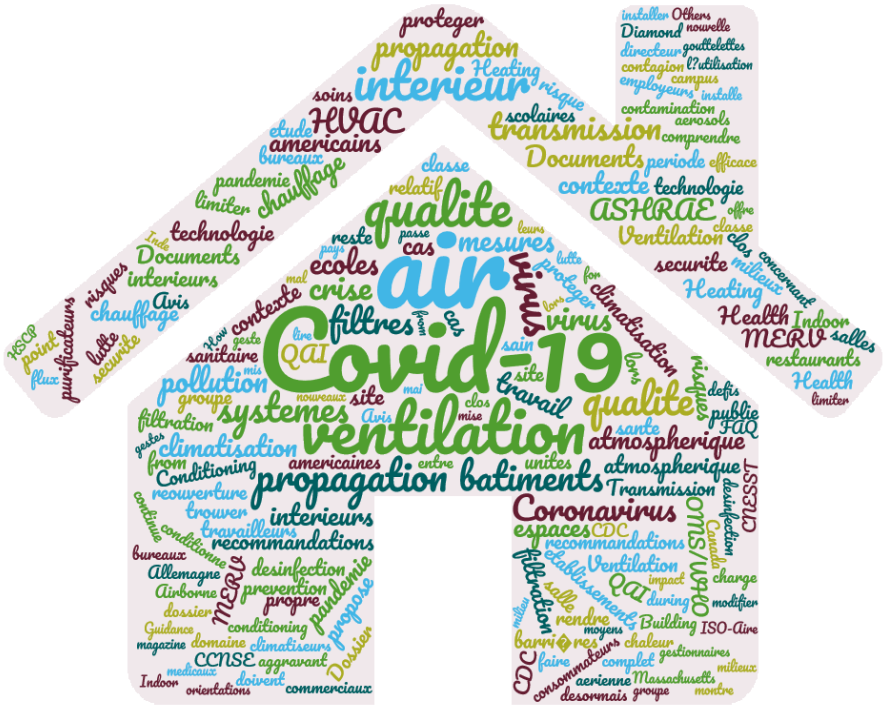

Bulletin de veille AéroCovid
N°113 - 09/04/2025

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

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS. Les éléments issus de cette veille sont founis sans garantie d'exhaustivité.

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Zong, J., Chang, Y., Hu, Y., Ai, Z.

Aerosol dispersion and energy consumption in a mechanically heated and cooled multi-chair dental office with windows routinely opened.

Physics of Fluids, Vol. **37** n°(4), (2025)

Natural ventilation via open windows is a common practice widely applied to dilute aerosols in dental offices for all year around in China, which, however, would modifies air distribution and leads to extra energy consumption for cooling and heating. This study intends to evaluate aerosol removal efficiency and energy consumption in a multi-chair dental office with both mechanical ventilation (MV) and natural ventilation (NV), namely, mixed-mode ventilation (MMV). It numerically investigates the effect of ventilation mode and environmental condition on indoor aerosol distribution and fallow time (FT) duration, as well as energy consumption. The results show that introducing fresh air via open windows in such a mechanically ventilated space results in enhanced airflow mixing and particle dispersion. Compared to six air changes per hour (ACH) MV mode, MMV mode with less than 4 ACH NV does not ensure a reduction in suspended particle count indoors. When NV rate reaches 6 ACH, all compartments show an average reduction of 64.6% in particle counts. However, energy consumption for MMV mode with 6 ACH NV is 3.5 times higher during heating seasons and 2.2 times higher during cooling seasons compared to 6 ACH MV mode. Compared to MV mode with recommended FT of 18–21 min between appointments, MMV mode with 4–6 ACH NV has the required FT of 14–16 min. This study is intended to provide references for clinic managers to balance air quality improvements with energy consumption, thereby achieving a sustainable indoor environment and optimizing operational costs in multi-chair dental offices.

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Park, C., Jang, J., Jang, J.

Airborne Influenza Virus Surveillance Platform Using Paper-Based Immunosensors and a Growth-Based Virus Aerosol Concentrator.

Environmental Science & Technology, Vol. **59** n°(13), (2025), 6502-6511 p.

The measurement of respiratory viruses in indoor air is critical for effectively preventing the spread of diseases. This is typically accomplished by counting the nucleic acids or plaques of air-sampled viruses. Herein, we present a growth-based airborne virus surveillance (G-AVS) platform based on paper-based electrochemical immunosensors for targeting hemagglutinin (HA) and nucleoprotein (NP), and water-condensation air sampling for the quantitative measurement of airborne influenza viruses. The measurements, compared with RT-qPCR, demonstrated consistency between the two. In the measurements of airborne influenza viruses conducted in an elementary school using G-AVS, 23% (4/17) of indoor air samples were positive, with concentrations ranging from 1.7 × 104 to 1.6 × 106 gene copies/m3, while losses in the HA relative to NP were 48–75% at a relative humidity of 27.0–36.8% and 60 min air sampling, similar to infectivities reported in the literature. This platform has the potential for rapid and cost-effective airborne virus measurement.

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Zhang, B., Wang, J., Shangguan, L., Rezgui, Y., Ghoroghi, A., Cao, X.*, et al.*

Analysis of HVAC sensor characteristics for operation and maintenance of the indoor environment: A case research on public building HVAC.

Building Simulation, (2025)

Sensors are a crucial component in heating, ventilation, and air conditioning (HVAC) control systems, and the quality of them plays an important role in control accuracy. In the research of fault detection and control optimization, improving sensor data quality has inspiring potential in application. It has been largely limited to the application of signal processing methods in research focus, whereas a detailed analysis of the characteristics of signals from various sensors of the HVAC system has not been conducted. Therefore, this study analyzes the time-frequency domain characteristics of control sensors within HVAC systems through integrating the structural design and control logic of such systems. Additionally, the research examines the correlations between control sensors in HVAC systems. Based on statistical principles and the energy-mass dynamic laws of the equipment, this paper defines first-class (I) correlated sensors and second-class (II) correlated sensors. To sum up, the main contribution of this paper is conducting a fundamental study on the characteristics of control sensors within HVAC systems, providing theoretical reference for future research on HVAC system fault diagnosis and control optimization.

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Cheng, Z., Qin, H., Lei, N., Aganovic, A., Jiang, X.

An analysis of the application potential of protected zone ventilation in hospitals based on experiments and simulations.

Building and Environment, Vol. **278**, (2025)

This study explored hospital indoor air environments using experiments and simulations, with a specific focus on assessing the performance of the protected occupied zone ventilation (POV) system across various function rooms. Optimize the parameters of the POV system by simulating the supply air velocity, temperature, and angle. Field measurements of POV system protection efficiency were conducted in the chamber. The results indicated that the efficiency of the POV system was influenced by supply air temperature, velocity, manikins' thermal plume. Surprisingly, manikin position was not the primary factor affecting efficiency; instead, exhaust location significantly impacted air quality in the protected manikin's breathing zone and placing the exhaust in the polluted zone was found to enhance the effectiveness of the POV system in maintaining air quality. When the supply air velocity was 2 m/s, the protection efficiency exceeded 50 % in all cases. When all the exhausts were open and the patient manikin was close to the exhaust in the polluted zone, the protection efficiency exceeded 60 %. Moreover, even under high supply air velocity, the draught did not exceed the standard. Compared to total volume air distribution (TVAD) systems, the POV system effectively segregates polluted and protected zones, achieving isolation, while demonstrating a relatively low air exchange rate, highlighting its energy-saving potential. Finally, we observed that the indoor layout could impact the isolation effect. Therefore, we carefully noted variations in the setting of air supply parameters across different rooms to ensure the effective and customized application of POV systems in hospitals.

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Tangestani, M., Jafari, A. J., Kermani, M., Kalantary, R. R., Arfaeinia, H.

Application of Monte Carlo simulation and quantitative microbial risk approach to investigate seasonal variation of airborne particulate matter and bioaerosols in medical waste management department and wastewater treatment plant of Iranian hospitals.

Results in Chemistry, Vol. **15**, (2025)

This study addresses a significant knowledge gap by conducting a thorough analysis of pollutants in hospital environments and utilizing advanced risk assessment models to evaluate their health impacts on workers for the first time. The study aimed to assess the concentration of particulate matter (PM1–2.5, PM0.5–1, PM0.25–0.5, and PM<0.25) and bioaerosols (bacteria and fungi) in the air around waste disposal departments and wastewater treatment plants of selected hospitals in Bushehr city, Iran, during different seasons. A probabilistic risk assessment using Monte Carlo simulation and the Disability-Adjusted Life Years (DALYs) model was employed to evaluate the health risks of PM and bioaerosols on workers. The

study collected 32 PM samples and 132 bioaerosol samples using a four-stage impactor and a single-stage Anderson sampler, respectively. The results showed that the highest concentration of PM was found in PM1–2.5, measuring 119.4 μg/m3, while bacteria and fungi concentrations were 617 and 756 CFU/m3, respectively. Additionally, larger PM sizes were more prevalent, and bacterial levels exceeded those of fungi in the wards. Waste disposal sections in hospitals exhibited higher pollution levels of PM, bacteria, and fungi compared to wastewater treatment plants, especially during summer. Bioaerosol levels exceeded existing standards in the surrounding air of these departments Risk values surpassed acceptable thresholds, indicating significant health concerns. Sensitivity analysis revealed that concentration (C) and exposure duration (ED) parameters had the most significant impact on worker health assessment.

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Zu, S., Yin, H., Li, Z., Li, A.

Comparative study on aerosol fate of mixed ventilation and attachment ventilation in a dental clinic.

Energy and Built Environment, (2025)

Dental clinics have become hotspots for potential virus transmission due to the nature of their procedures. This study introduces a wall-based attachment ventilation (AV) model to investigate aerosol diffusion and the impact of ventilation control within dental clinics, utilizing both experimental and simulation methodologies. A full-scale laboratory has been established for the experimental validation of numerical simulations based on Computational Fluid Dynamics (CFD). The findings highlight that the AV mode, particularly when the air outlet is situated in the upper region, exhibits superior aerosol removal compared to the lower outlet configuration. Additionally, the research identified a critical point in aerosol reduction related to the air change rate per hour (ACH), which falls between 5 and 8 h−1 based on this study. Compared to mixed ventilation (MV), the AV system demonstrated approximately 10% higher escape rate, 10% lower deposition rate, and 3% higher suspension rate. These findings provide valuable insights for reducing infection risks among healthcare workers in dental clinics.

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Liu, J., Zhang, Y., Zheng, X., Qian, H.

Developing and optimizing air curtains for reducing bacteria-carrying particles in operating rooms: A numerical simulation study.

Journal of Building Engineering, Vol. **104**, (2025)

Frequent entry of surgical staff into operating rooms (ORs) during procedures can introduce bacteria-carrying particles (BCPs) through doorway airflow. Air curtains may provide a dynamic solution by creating a protective barrier, but their efficiency across various conditions remains underexplored. This study employs numerical simulations to analyze pressure variations and particle dispersion during door opening, surgical staff entry, and door closing under three air curtain discharge velocities. Results demonstrate that activating the air curtain enhances and sustains the pressure difference between both sides of the sliding door. The air curtain establishes a protective barrier that minimizes air exchange through the doorway when the door is open and effectively blocks the infiltration of contaminated air carried by the wake flow of personnel entering the operating room. Results show while discharge velocities of 2 m/s are insufficient to prevent contamination and 6 m/s cause excessive turbulence, a velocity of 4 m/s reduces BCP infiltration by 71.8 % and decreases residual BCPs by 61.8 % after door closure. Additionally, turbulent kinetic energy (TKE) analysis confirms that 4 m/s maintains a favorable balance between airflow stability and contamination control. These findings provide actionable recommendations for improving OR cleanliness, advancing the safety of surgical environments.

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Yoshinaga, T., Ando, Y., Sato, Y., Kishida, T., Kitajima, M.

Development of COPMAN-Air method for high-sensitivity detection of SARS-CoV-2 in air.

Scientific Reports, Vol. **15** n°(1), (2025)

Several studies have successfully detected SARS-CoV-2 in air samples. However, most of these studies focused on validating the air collection method, and there was no report on the development of a virus detection method. In this study, to detect viruses in air samples with greater sensitively than conventional detection methods, we utilized COPMAN, a highly sensitive virus detection method originally used for wastewater samples. We applied COPMAN to air samples, thereby developing COPMAN-Air. Briefly, this method efficiently detects the extremely low levels of viral RNA in air samples via three reaction steps: RT, preamplification, and qPCR, as it is performed with COPMAN. We evaluated COPMAN-Air using samples from a fever clinic for COVID-19 patients. COPMAN-Air demonstrated a higher detection rate of viral RNA compared with conventional methods, detecting the virus in 22 out of 23 samples (95.7%) vs. 14 out of 23 samples (60.9%). Additionally, a positive correlation (r = 0.70) was detected between the amount of viral RNA detected by COPMAN-Air and the number of confirmed COVID-19 cases, suggesting that COPMAN-Air could estimate the number of SARS-CoV-2-positive individuals in a given space based on the quantitative values of SARS-CoV-2 RNA in air samples. Surveillance systems for airborne pathogens using COPMAN-Air are expected to be valuable for estimating the number of infected individuals and for guiding the implementation of public health measures.

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Meng, H., Ji, J., Xie, H., Jia, H., Qian, Y., Li, J.*, et al.*

Experimental study on the purification performance of sterilization-Trombe walls with and without fins in the heating season.

Building and Environment, Vol. **277**, (2025)

Indoor bioaerosol in winter will lead to frequent respiratory diseases, influenza and other diseases, and thermal sterilization technology is an important sterilization technology. The combination of thermal sterilization technology and Trombe wall for indoor heating can realize the thermal sterilization of indoor air in winter at the same time, which is of great significance for indoor comfort and safety. However, there is still a lack of actual research reports to study this aspect, so this paper sets up the experimental platform of traditional Trombe wall system (TSTW) and finned Trombe wall system (FSTW), and studies the effect of the two systems on indoor bacteria in winter. The change of indoor bacterial concentration with time under different temperature conditions was studied, and the inactivation effect of the two systems was analyzed and compared. The results show that: in both systems, the single inactivation rate of bacteria increased with the increase of temperature. At 75 °C, the single inactivation rates of K. pneumoniae and Escherichia coli in TSTW and FSTW systems were 0.47 and 0.78, 0.71 and 0.87, respectively. For TSTW and FSTW systems, at low temperature of 45 °C, the indoor bacterial concentration of FSTW system decreases faster than that of TSTW system; however, at high temperature, because TSTW system has a larger amount of heat exchange air, the indoor bacterial concentration of TSTW system decreases faster than that of FSTW system.

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Mandal, D. K., Bose, S., Biswas, N., Manna, N. K., Santra, S., Cuce, E.*, et al.*

Hybrid solar Chimneys: Enhancing thermal comfort and Alleviating indoor air pollutants − A comprehensive review.

Solar Energy, Vol. **293**, (2025)

Indoor air pollution (IP) remains underrecognized compared to outdoor pollution, despite extensive research on environmental contamination and outdoor air quality. Individuals of all age groups spend the majority of their time indoors—often over 90%—placing them at continuous risk of exposure to indoor pollutants and potential harm to both individual and public health. In this context, hybrid solar chimney (SC) systems have emerged as a promising strategy to enhance thermal comfort and mitigate indoor pollution levels. These systems employ thermal buoyancy for natural ventilation, thus improving indoor comfort and indoor air quality (IQ). Researchers have investigated several modifications to hybrid systems, such as

integrating Photovoltaic cells (PV), Phase Change Materials (PCMs), evaporative cooling, and Earth-air heat exchangers (EAHE), to improve their efficiency, these studies have primarily focused on the thermal comfort benefits. However, a notable gap remains in addressing indoor pollutants. In response, this review examines the potential of integrating a photocatalytic reactor into hybrid solar chimneys to target airborne contaminants while maintaining desirable indoor temperatures. The findings underscore the need for future advancements in hybrid Solar Chimney technology, particularly in optimizing multi-technology integration, enhancing photocatalytic materials, and establishing standardized performance metrics to evaluate both thermal comfort and air quality. Lastly, the review highlights the challenges facing these systems and proposes directions for future investigation.

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Yun, H., Seo, J. H., Kim, Y. G., Yang, J.

Impact of scented candle use on indoor air quality and airborne microbiome.

Scientific Reports, Vol. **15** n°(1), (2025)

Indoor air quality has become a growing concern worldwide due to its significant impact on human health, particularly in residential environments where people spend most of their time. Many studies have examined particulate matter (PM) in indoor air and indoor bioaerosols. However, there is a significant lack of research on airborne micro-sized bacteria (m-AB) and nano-sized bacterial extracellular vesicles (n-ABE), particularly those produced by common household activities, such as burning scented candles. This study investigates changes in PM concentrations and indoor microbiome composition resulting from candle use. Air samples were collected from three locations in residential homes: at the candle-lit spot (CL), 3 m away (3m_CL), and 6 m away (6m_CL). PM10 concentrations peaked at 1.52 times the baseline at the source after 5 min of burning, while PM2.5 and PM1 remained elevated at 3m_CL and 6m_CL over time. Before burning, dominant m-AB genera included Phyllobacterium and Pseudomonas, while post-burning, Phyllobacterium myrsinacearum in n-ABE significantly increased, marking its first detection in indoor air. This suggests that existing airborne bacteria may undergo growth or apoptosis due to combustion byproducts. These findings highlight the importance of improving ventilation in indoor spaces to minimize health risks from prolonged exposure to airborne particles and bacterial vesicles.

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Nishimura, H., Katsumi, M., Suzuki, T., Maruyama, T., Sakata, S.

Inactivation of Airborne Influenza Viruses by Transient Heating for Sub-Second—One-Pass Analyses Using a Fan Heater Simulator—.

Earozoru Kenkyu, Vol. **40** n°(1), (2025), 28-35 p.

Airborne influenza viruses were exposed to transient high temperatures to explore their vulnerability to such heating. A hot-air heater simulator with a high-temperature heat source was created, and aerosols containing the influenza virus were passed at various wind velocities through a passage heated to a set temperature. Viruses were collected at the exit of the corridor using a gelatine membrane filter and titrated to estimate the extent to which viruses decreased during passage: the aerosol was exposed to a high temperature environment (80, 100, 130, 150, and 180°C) for a short time (0.12, 0.25, and 0.36 s), resulting in about three-log decrease in the recovery of active viruses at 180°C at 0.25 s compared to the unheated condition of 20°C; at 150°C, there was about a two-log reduction at a retention time of 0.36 s; but the reduction was within one order of magnitude at ≤130°C. The number of viral genes recovered on the gelatine membrane decreased slightly compared to the active viruses. Thus, significant viral inactivation occurred by sub-second exposures at these high temperatures, indicating the minimum line of the temperature-duration combinations for efficient inactivation.

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Izbassarov, D., Auvinen, M., Kuula, J., Hellsten, A., Karppinen, A.

Modeling Dispersion by Indoor Turbulence with LES.

39th International Technical Meeting on Air Pollution Modeling and its Application, Chapel Hill, North Carolina, USA, May 22-26, 2023.

In the present work, the PALM-LES model is employed to study different indoor dispersion problems utilizing a dental treatment room as a test space. With high-resolution modeling, the structured LES solver is applied to different indoor configurations with varying ventilation conditions and room geometries. The aim is to investigate the role of enhanced mixing in indoor dispersion problems. The findings demonstrate that improved mixing lowers overall concentration levels and dilutes local concentration peaks indoors. These positive impacts can be achieved by moderate means, for example by employing a simple table fan.

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Martínez-Espinosa, E., Vicente, W., Salinas-Vázquez, M., Ramírez-Cruz, J.

Numerical study of the effect of flow patterns on contaminant removal in a hospital ward with symmetrical and asymmetrical inlet port arrangements.

Science of The Total Environment, Vol. **979**, (2025)

The effect of flow patterns on contaminant removal in a hospital ward is studied numerically using the Reynolds Averaged Navier-Stokes (RANS) approach. Transient simulations are performed for three air changes and four ventilation systems. The contaminant is represented by a tracer gas (contaminant air) to study the airflow patterns, contaminant concentration, and contaminant removal in the hospital ward. The simulation is validated through two experimental studies using different ventilation systems, yielding a satisfactory agreement between the predictions and the experimental data. Numerical results indicate that flow patterns have a significant impact on the concentration and removal of contaminants, influenced by the building's geometry and the location of injection ports. In symmetrical arrangements of injection ports, the contamination concentration tends to be non-uniform in the x-z directions. The contaminant removal efficiency is the lowest (0.9322–0.9877) due to jet interference and the formation of dead zones by recirculation regions. In the asymmetrical arrangement of injection ports, the formation of recirculation zones in critical areas is inhibited, resulting in a more uniform contaminant concentration compared to other cases. The contaminant removal efficiency for the nine inlet ports presents the best performance (0.9944–0.99995), as jet interference is minimized and dead zones are eliminated. Furthermore, the overall concentration is <0.55 % for 9 ACH and 0.0048 % for 16 ACH in 1200 s. However, implementing more inlet ports (13) than in Case 3 affects the contaminant removal efficiency (0.9745–0.9991) due to jet interference. Therefore, according to the building geometry, a correct number of inlet ports and an appropriate distribution are essential in contaminant removal.

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Liu, S., Xu, L., Chen, B., Deng, Z., Du, C., Li, P.*, et al.*

Optimized design of a reinforced exhaust at low velocity (RELV) system for efficient viral aerosol removal in elevators.

Building Simulation, (2025)

Elevators, as an enclosed and often crowded space, pose a high risk of airborne infections due to ineffective ventilation. To mitigate this issue, this study introduces a reinforced exhaust at low velocity (RELV) system, specifically designed to enhance aerosol removal efficiency in elevators. The performance of the RELV system was assessed through computational fluid dynamics (CFD) simulations, employing the Renormalization Group (RNG) k–ε turbulence model to simulate airflow and the Lagrangian method to track particle motion. The RELV system was benchmarked against three conventional ventilation strategies: mixed ventilation (MV), displacement ventilation (DV), and local exhaust (Exhaust). Results demonstrated that the RELV system, optimized at a momentum ratio of 0.2, achieved a remarkable 72.9% aerosol removal efficiency within 120 s, significantly outperforming the 16.1% removal efficiency of the MV system under Scenario I, where the patient was located at the elevator’s center. Furthermore, the viral aerosol concentration in the breathing zone was reduced from 2.03×10−2 mg/cm3 in the MV system to 1.02×10−3 mg/cm3 in the RELV system. The RELV system features simple design and compatibility with existing

ventilation systems, offering an effective solution to improve air quality in elevators and other enclosed environments. Additionally, this study provides a velocity decay curve for low-velocity jets in the RELV system. This curve offers valuable insights for designing ventilation systems in similar settings.

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Batra, V. B., Kirtania, J., Tiwari, S., Kumar, P., Kumar, A., Chakraborty, S.

Role of Antimicrobial Air Purifier in Reducing the Microbial Load in the Critical Care Unit in Oncology Center: An Intervention Study.

Indian J Crit Care Med, Vol. **29** n°(4), (2025), 327-332 p.

Introduction: High quality and effective ventilation system operation plays a major role in maintaining indoor air quality in critical care unit (CCU). Aim of this study was to detect the role of antimicrobial-air-purifier in reducing the colony counts of microbes in air and high surface. Methods: This prospective study was conducted in CCU over a period of 18 months from November 2022 to May 2024 after approval from Hospital Ethics Committee. Microbial load was tested in CCU in the presence of and absence of purifier and air/high touch surface sampling was done by using settle-plate method on consecutive days in two phases (with/without purifier). Microorganism culture and identification was done using VITEK-2, and colony counting was performed using Omeliansky formula. Results: The comparison of microbial load in the CCUs between two phases revealed significant difference in the air and surface on days 1, 7, 14, 30, and 60 ($p < 0.0001$). Among gram-positive cocci (GPC), the most common isolate identified was coagulase-negative Staphylococcus species [35 (92.10%)], followed by Micrococcus luteus [5 (13.15%)] and Staphylococcus aureus [1 (2.63%)]. All GPC were resistant to methicillin and erythromycin while 1 (5%) strain was resistant to vancomycin, teicoplanin, and linezolid. Among gram-negative bacilli (GNB), the most common isolate was Acinetobacter species [8/23 (34.78%)], followed by P. species [5 (21.74%)]. About 19−23 (85−100%) GNB strains were resistant to third-generation cephalosporins and beta-lactam and beta-lactamase inhibitors. About 9−15 (42.3−67.64%) were resistant to tigecycline and carbapenems. Decreased bloodstream infections/catheter-associated urinary tract infections (CAUTI) rate of 3.49−2.92/3.97−1.95/1,000 patient-days was observed in CCU, while the device utilization ratio was same. Conclusion: Antimicrobial air purifier showed an effective role in decreasing the central line-associated blood stream infections and CAUTI rates in CCU.

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Vejanand, S. R., Janushevskis, A., Vaicis, I.

Selection of Appropriate Estimation Criteria in Flow Simulation Study for Predicting Cooling Efficiency of Ventilated Protective Clothing.

Latvian Journal of Physics and Technical Sciences, Vol. **62** n°(2), (2025), 17-29 p.

A Computational Fluid Dynamics (CFD) is utilised in various research and engineering areas across multiple fields and industries. The research field of ventilation and indoor air science has experienced a significant surge in scientific articles focused on the utilisation of CFD. With the solution of increasingly complicated ventilation problems, CFD validation and verification are more important than ever. The present study focuses on the crucial task of selecting suitable criteria in a flow simulation analysis aimed at predicting the cooling efficiency of ventilated protective clothing. This study examines three different cases of a simplified elliptical model of the human body with a protective jacket comprising 11, 48, and 105 ventilation elements. SolidWorks Flow Simulation is used to simulate all three models individually to calculate values of eight different criteria. It is assumed that increasing the number of ventilation units would result in an enhancement of cooling efficiency. However, it is crucial to understand how the values of various criteria change in flow simulation studies under different situations, and which criteria are crucial for the analysis. The criteria values for three cases are recorded and compared. The analysis results indicate a gradual increase in values of heat transfer rate, pressure and temperature differences as the number of ventilation units increases. However, certain parameter values like flow pressure difference do not provide sufficient information to predict efficiency of the system, whereas a parameter like average temperature

shows low sensitivity. The study suggests that the heat transfer rate and heat flux are the most appropriate criterion to be examined in such a situation. This is due to the fact that an increased heat transfer rate from the body signifies a more effective cooling mechanism.

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Liu, F., Ma, Q., Zhang, J., Wang, J., Govindan, D., Zhao, M.*, et al.*

Self-Cleaning Microwave-Responsive MXene-Coated Filtration System for Enhanced Airborne Virus Disinfection.

ACS Applied Materials & Interfaces, (2025)

The COVID-19 pandemic has highlighted the urgent demand for advanced air disinfection technologies. Traditional air filters primarily capture large airborne particles but are ineffective against submicrometer aerosols. This study introduces a microwave-enabled catalytic air filtration system using Ti3C2Tx MXene-coated polypropylene filters to enhance air disinfection. With only 0.05 mg·cm–2 of MXene coating, the filter surface temperature rapidly reached 104 °C within 3 s under 125 W microwave irradiation. Such surface heating led to a significantly higher log removal value (LRV) (1.86 ± 0.47) of the MS2 bacteriophage in the synthetic bioaerosol with an initial concentration of 105 PFU·mL–1, compared to 0.24–0.38 achieved by the pristine filter or the MXene-coated filter without microwave irradiation. Additionally, the filter surface exhibited promising self-cleaning behavior, as indicated by the stable viral inactivation and removal efficiency even in high-humidity environments. This innovative air filtration technology shows promising potential for preventing airborne pathogen transmission and protecting public health across diverse environmental conditions.

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Chattarika, U., Ninnart, R., Chatchai, C., Ketsophon, P., Prayuth, P., Kou, Y.

A Study of Improving the Respiratory Intensive Care Unit (RCU) to be Appropriated for COVID-19 Situations.

ICIC Express Letters Part B: Applications, Vol. **15** n°(04), (2024)

This work presents a way to improve Respiratory Intensive Care Unit (RCU) to be appropriated for COVID-19 situations. The objectives of the study are to collect information, analyze the impacts, and study the design standards for improvement. The design standards are based on the guidelines of Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), American Society of Heating, Refrigerating and AirConditioning Engineers (ASHRAE), The Engineering Institute of Thailand Under H.M. The King's Patronage (EIT), and the relevant research articles. The medical personnel, engineers, and related agencies are involved in the planning and standardization process. Then analyze the area of Respiratory Intensive Care Unit, which needs to clearly divide the working area between medical staff and patients. After the improvement , the application of isolation room innovation was used to reduce the dangerous area and minimize the infection rate among medical staff. It also reduces excessive energy consumption.

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Olivas, A. C., Yee, J.-J.

Towards the use of data-driven methods for indoor airflow field reconstruction: A systematic review.

Journal of Building Engineering, Vol. **106**, (2025)

Indoor airflow field reconstruction is vital for ensuring a safe and healthy environment for indoor occupants as people spend more than 90 % of their time indoors. This requires understanding indoor airflow dynamics, which is crucial for efficient and effective heating, ventilation, and air conditioning. This review highlights the emergence, applications, advantages, and limitations of data-driven methods within the

context of indoor airflow field reconstruction. Findings show that traditional methods such as computational fluid dynamics, zonal, and multizone modelling remain trusted for indoor airflow field reconstruction. However, in 2019, the pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) led to the urgent exploration of data-driven methods (DDMs) to address the concerns of high computational cost and time. This gave rise to new challenges, such as the need for large training datasets and addressing the black-box nature of data-driven methods, which can affect user trust and the adaptability of these methods to other domains. Furthermore, while adoption of DDMs grows, there is still a lack of standardized evaluation frameworks, given their largely empirical nature. Future research can investigate DDMs towards enhancing the robustness, scalability, and interpretability of data-driven methods for indoor airflow field reconstruction.

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Minarti, M., Minata, F., Irzanita, I., Putri, R. N., Novianti, L.

Variasi spasial risiko tuberkulosis di sumatera selatan, indonesia 2016-2023.

PREPOTIF : JURNAL KESEHATAN MASYARAKAT, Vol. **9** n°(1), (2025), 803 - 810 p. (en indonésien)

Le sud de Sumatra est l'une des trois provinces d'Indonésie où l'incidence de la tuberculose est la plus faible, mais l'incidence de la tuberculose a connu une tendance à la hausse entre 2016 et 2023. L'objectif de l'étude était de déterminer des stratégies importantes pour réduire la transmission de la tuberculose et la charge de morbidité. Des analyses descriptives ont été menées sur les données de routine de la tuberculose entre 2016 et 2023 à partir du site officiel du Bureau central des statistiques, couvrant tous les types de patients atteints de tuberculose. Le nombre total de cas, le ratio d'incidence (RI) ont été calculés pour chaque district de la ville au cours de la période. La distribution de l'IR a été représentée sur des cartes et des graphiques à barres. Il en résulte que le nombre de cas de tuberculose dans le sud de Sumatra s'élève à 23 256 cas sur 8743522 cas. La ville de Palembang s'est classée au premier rang avec 7379 cas. Conclusion : Le risque de tuberculose varie dans le sud de Sumatra en 2016-2023, avec un risque plus élevé dans la ville de Palembang et dans plusieurs districts urbains de Sumatra Sud à forte densité de population.

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