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[Control of air environment in sustainable society]

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Engineering of architecture and urban environment

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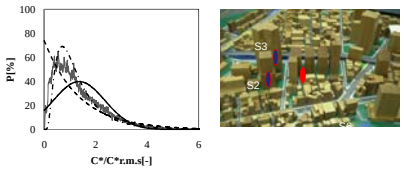
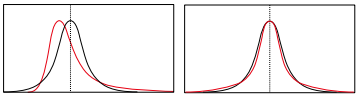
Countermeasures Against the Danger of Unpredictable and Emergent Urban Air Pollution

Compared to the chronicle air pollution, terror attack with bio chemical material or accidental leakage of flammable gas have different types of danger.
As for the unique and original problem of them, we point out the fluctuation of concentration. In these emergent situations, the operation of first responders might be decided with information of fluctuation of concentration.

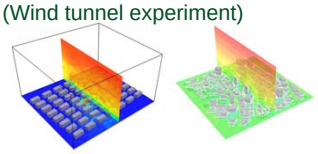
The aim of our research is to contribute to provide these information without time consuming. We focus on the transport of higher order moments, which derive the indicator of histogram of concentrations. The equation of them are analyzed numerically and possibility of modeling is now being attempted.



○Histogram of concentration
(Wind tunnel experiment)



○Inclination and wideness
Skewness and kurtosis are the indicators of shapes of histogram



○Numerical simulation

$$\frac{\partial\langle c^n\rangle}{\partial t} = -\langle u_j\rangle\frac{\partial\langle c^n\rangle}{\partial x_j} - \frac{\partial\langle u_j' c^n\rangle}{\partial x_j} - n\langle c^{n-1}u_j'\rangle\frac{\partial\langle c\rangle}{\partial x_j} + n\langle c^{n-1}\rangle\frac{\partial}{\partial x_j}\langle u_j' c'\rangle + n\left\langle c^{n-1}\frac{\partial}{\partial x_j}\left(\Gamma\frac{\partial c'}{\partial x_j}\right)\right\rangle$$

○Transport of higher（n-th）order moments
possibility of predicting the properties

Germicidal effect of microwave radiation on microbial contamination of evaporative humidifier in HAVC system

Humidifiers have been used not only to maintain a comfortable indoor environment but also to prevent respiratory symptoms from worsening due to extremely low humidity. The microbes grown on the humidifier element surface can then become airborne and be transported throughout the entire building's air-conditioning systems.

In this study, microwave irradiation was tested as a possible means to disinfect evaporative humidifiers in air-conditioning systems.

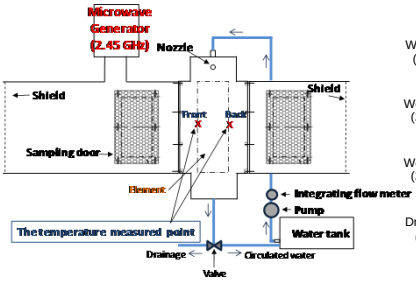


Fig.1 . Schematic drawing of an evaporative humidifier

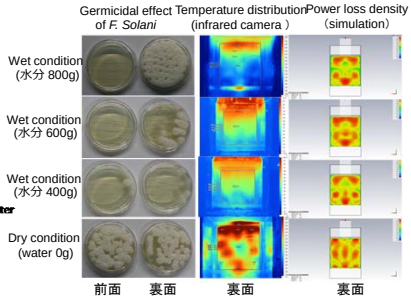


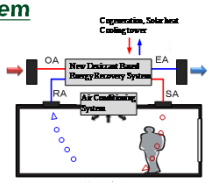
Fig.2 . Germicidal effect of an evaporative humidifier elements

Development of batch type desiccant air-conditioning system using cogenerated hot water

The central thrust of this study is to develop new desiccant-based energy recovery system useful for humidity control intergraded design and analysis as the dedicated outdoor air system.

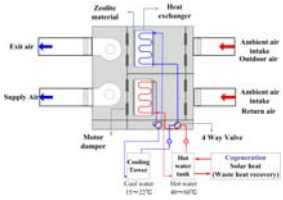
The proposed system is using recovery energy, hot water from co-generator and cool water from cooling tower. A cooling dehumidification mode is flow cool water to the air-water heat exchanger, the process air have occupied cooling and dehumidification by directly-cooled adsorption for absorbent material. A heating humidification mode is flow hot water to the air-water heat exchanger, the process air have occupied heating and humidification by directly-heated desorption for absorbent material.

○The point of the new compact desiccant-based energy recovery system



- To Reduce Energy Consumptions
- Reuse Unutilized Energy
- To Maintain Comfortable Indoor Environment

○Schematic diagram of the new compact desiccant-based energy recovery system



○ Expected effect

- Energy Saving in Buildings
- Improvement of Indoor Environment
- Non-condensation Indoor and HVAC
- Compact system
- Reuse Unutilized Energy