

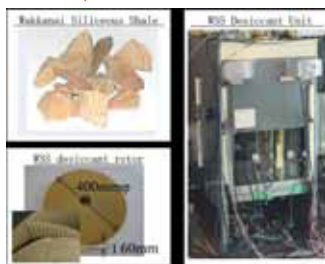
# Building Environment Laboratory

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Key words	Indoor air quality, indoor climate, desiccant ventilation system (dehumidification), sleep, thermoregulation, thermal comfort, energy saving, productivity, foliage, renovation

We conduct research on methods to achieve healthy and comfortable residential environments with a minimum burden on the natural environment. Current research themes include (1) indoor air pollution and ventilation systems; (2) sleep and thermal environments; (3) thermal comfort and productivity; (4) housing renovation and healthy effects for elderly people.

## Theme 1 ► Development of Desiccant Ventilation System Using Natural Mesoporous Material

A highly efficient air-conditioning system for residential use is necessary to develop because energy consumption is increasing more and more in both the residential and commercial sectors. In Asian countries, with high temperatures and humid climates, dehumidification requires a large amount of energy to sustain a satisfactory level of thermal comfort. The desiccant ventilation system is expected to reduce energy consumption for the dehumidification process. We are focusing on a natural mesoporous material called Wakkanai Siliceous Shale (WSS) as a desiccant material. Our research aims to develop a new desiccant system using WSS. Currently, in order to evaluate energy saving performance, a demonstration test of a prototype WSS desiccant unit has started.



Pictures of WSS desiccant rotor and ventilation unit

## Theme 2 ► The Effects of Thermal Environment on Human Sleep and Thermoregulation

Sleep is one of the most important behaviors for human health in the indoor environment. In order to investigate sleep quality and thermoregulation in an actual living environment, field surveys are performed to reveal the sleep quality and subjective sensations of the occupants as along with the surrounding air temperature, humidity, and air velocity in the bedroom. In a climatic chamber we set environmental conditions and measure EEG, ECG, or thermoregulatory responses such as skin temperature and sweat loss of the human subjects in order to investigate the effects of environmental factors on the human body during the sleep period. We consider the correlations between thermal factors and human responses in order to research a thermally comfortable environment for sleeping people. Further researches on elderly sleep quality and seasonal environmental effects on sleep are studied in residential houses and nursing homes.

## Theme 3 ► The Effect of Foliage on Physiological & Psychological Responses and Productivity

Foliage plants such as benjamin and pothos seem to have a variety of beneficial ("green amenity") effects, including purification by removing chemical compounds from indoor air, recovery from fatigue, alleviation of stress, and an increase in productivity. The subject experiments were performed to investigate EEG, ECG, salivary amylase, subjective sensations, and productivity in a space including foliage plants in the experimental room. Moreover, further investigations were carried out to analyze office workers' productivity in actual offices.



Experiment on the effect of foliage plants on the office workers' productivity

## Theme 4 ► The Housing Retrofit and its Health Effects on Human Occupants

Old houses without sufficient insulation material need to be renovated. We measured the blood pressure of the elderly occupants as well as thermal environments in the houses and compared them before and after renovation. The indoor air temperature increased with the addition of insulation material and improved air tightness in the older structures. Such an increase in indoor air temperature resulted in a good outcome by lowering the blood pressure of the elderly occupants.