Development of an Autonomous Humidity Controlling Material with Meso Pores

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Japan is located at the northern east end of Asian monsoon area, so it is very sultry in summer. In traditional Japanese houses, problems related to humidity had been naturally prevented. This is the reason why the houses are open to the outside and made of the moisture breathing natural materials such as woods, papers and soils.

In recent years, energy consumption at public welfare is growing because of wishing an amenity life by people whereas the consumption at industries is saved because of much effort by enterprises. Under such circumstances, current houses are highly airtight and energy saving. But the indoor air tends to be very wet or dry on account of using artificial materials which cannot breath moisture. Furthermore problems of allergic mold/tick or dew condensation sometimes arise in the houses. And the release and build-up of formaldehyde and other injurious volatile organic compounds (VOCs) from them has led to new health-related problems, now well known as the "Sick House Syndrome".

To solve these problems, the authors have developed a humidity control building material using natural soils.

ECOCARAT was prepared by using allophone and other clay materials and fired at around 900°C. Fig.1 showed moisture adsorption isotherm of ECOCARAT and wallpaper. Thoughwallpaper did not adsorb moisture, ECOCARAT adsorbed much moisture more than 60% moisture pressure and amount of moisture adsorption was about 500g/m^2 under increasing the partial pressure of humidity in air from 50 to 90%. In contrast, moisture adsorbed on ECOCARAT desorbed easily with decreasing moisture pressure.

Fig.2 showed change in relative humidity with and without ECOCARAT in desiccators. Without ECOCARAT, relative humidity in desiccators increased and reached dew point. Even though
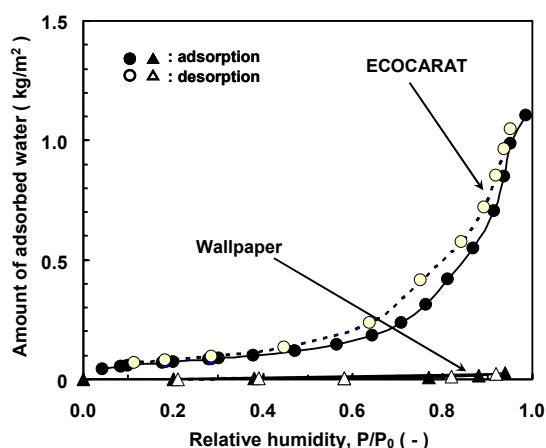

Fig.1 Adsorption-desorption behavior as a function of relative humidity, P/P$_0$ at 25°C.

putting ECOCARAT in the desiccators, relative humidity was kept the range 60 to 70%RH. When humidity in desiccators rose, the pores adsorbed extra moisture. Conversely, when the humidity went lower, the pores released the moisture they had adsorbed. Thus, ECOCARAT had the function of preventing the room becoming excessively humid or dry so as to maintain a comfortable humidity range (40% to 70%) which was gentle to the skin and throat. In terms of moisture adsorption / release performance, ECOCARAT was more than 15 times better than vinyl wallpaper.
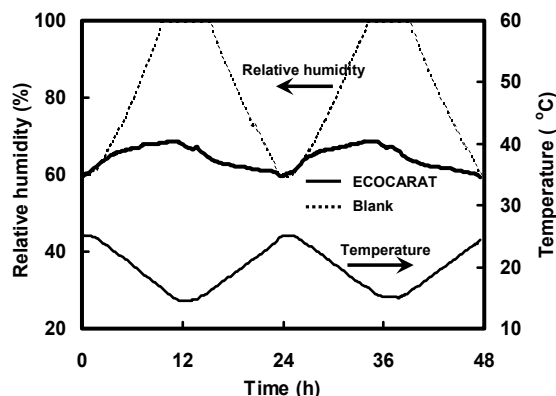

Fig.2　Change in relative humidity in closed vessel.

Biographical Sketch

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Study :　　　Development of vitrification behavior of porcelain bodies for building construction, meso-porous material for humidity control of indoor air and functional surface of ceramics for building construction.

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