Abstract

This research investigates the reduction of cooling load of an air conditioning system by using the solid desiccant, which contains silicon dioxide compound (SO_2), having porous structure and high moisture absorption ability. Since the typical air conditioning system in the hot-humid climate consumes more energy to reduce the latent heat (moisture) than the sensible heat (temperature), applying desiccant to the air conditioning system is one method to help reduce electricity consumption. The solid desiccants used in this study are the natural desiccants called dry act and eco dry and the artificial desiccant called silica gel. The experiments include three parts: 1) the test of adsorption ability in various arrangements of desiccant beds in the testing boxes with the dimensions of 35x40x40 cm^3, 35x40x40 cm^3, 50x40x40 cm^3 and 40x60x40 cm^3. All testing boxes are supplied with the average air velocity of 0.5 - 0.6 m/s at the inlets, and are tested in conditions with high and low relative humidity, 2) the test of regeneration ability of the desiccant beds using solar energy in a solar dryer, and 3) application of the experimental results from 1) and 2) with the air conditioning system to compare the electricity consumption between the cases with and without installation of desiccant bed.

The first experimental results show that, the eco dry bed, with a dimension of 20x30 cm^2 and with the arrangement perpendicular to the direction of the airflow, absorbs the highest amount of moisture. In the conditions of low and high relative humidity, the bed absorbed 9.37% and 6.62% or 41.66 gram and 28.59 gram of moisture, respectively. During the first ten minutes of the experiments the average value of air temperature raises by 1 - 1.5^{o}C and the average value of relative humidity and air velocity drop by 9 - 12% and 0.2 - 0.3 m/s, respectively. The second experiment reveals that silica gel in bed C and D, with the dimension of 20x30 cm^2, shows the highest regeneration rate. The mass differences are 18.35 gram and 24.31 gram, accounting for 5.71% and 7.45% of regeneration, respectively. The third experimental results show that, by applying the silica gel and the eco dry to the air conditioning system, the electricity consumption are 10.6 kWh and 11.2 kWh, respectively. This is accounted for 5 - 10%

less than the electricity consumption in the air conditioning system without desiccant bed. The research verifies that the application of desiccant bed with the air conditioning system can significantly reduce the electricity consumption and can be applied to the residential buildings.