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Performance Investigation of Silica Gel Fluidized Bed

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Abstract : Poor ventilation and high carbon dioxide (CO2) concentrations lead to the formation of sick buildings. This problem cannot simply be resolved by introducing fresh air from outdoor environments because this creates extra loads on indoor air-conditioning systems. Desiccants are widely used in air conditioning systems in tropical and subtropical regions with high humidity to reduce the latent heat load from fresh air. Desiccants are usually used as a packed-bed type, which is low cost, to combine with air-conditioning systems. Nevertheless, the pressure drop of a packed bed is too high, and the heat of adsorption caused by the adsorption process lets the temperature of the outlet air increase, bringing about an extra heat load, so the high pressure drop and the increased temperature of the outlet air are energy consumption sources needing to be resolved. For this reason, the gas-solid fluidised beds that have high heat and mass transfer rates, uniform properties and low pressure drops are very suitable for use in air-conditioning systems.This study experimentally investigates the performance of silica gel fluidized bed device which applying to an air conditioning system. In the experiments, commercial silica gel particles were filled in the two beds and to form a fixed packed bed and a fluidized bed. The results indicated that compared to the fixed packed bed device, the total adsorption and desorption by amounts of fluidized bed for 40 minutes increased 20.6% and 19.9% respectively when the bed height was 10 cm and superficial velocity was set to 2 m/s. In addition, under this condition, the pressure drop and outlet air temperature raise were reduced by 36.0% and 30.0%. Given the above results, application of the silica gel fluidized bed to air conditioning systems has great energy-saving potential.

Keywords : fluidized bed, packed bed, silica gel, adsorption, desorption, pressure drop
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