Explore energy saving operation strategy: Indoor VOCs removal performance of silica gel rotor in clean-air heat pump system at low regeneration air temperature

Clean air heat pump (CAHP) is a new technology that combines air cleaning with hygro-thermal control of ventilation air, which is competitive to vapor compression cooling technology from both energy and indoor air quality perspectives. In CAHP, a regenerative silica gel rotor is used for both moisture control and air cleaning, and a heat pump is used for providing thermal energy to regenerate the rotor. If the CAHP is applied in the mild climate area, the desired thermal conditions of ventilated air will be achieved without operating at high regeneration air temperature to save energy, however, whether air cleaning performance of the CAHP can be guaranteed is unknown. Therefore, this study experimentally investigated the air cleaning performance of the CAHP when it was regenerated by air at different low air temperatures. Five typical indoor pollutants-formaldehyde, acetone, ethanol, toluene and 1,2-dichloroethane were adopted as indoor pollutants. The results showed that air cleaning efficiency of the CAHP was normally decreased by 5%~15% when regeneration air temperature was decreased by 10 °C. The air cleaning efficiency for all the pollutants could still maintain 50% when the regeneration air temperature dropped to 40 °C with low air humidity.