

Numerical simulation of a two-bed solar-driven adsorption chiller in a tropical climate

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Abstrak

Cooling systems in tropical countries consume a large part of energy usage in a building, especially in a tropical climate, which places a high demand on cooling systems throughout the year. This paper presents a simulation of a two-bed silica gel-water adsorption chiller, utilizing solar energy based in the tropical climate of Indonesia. The adsorption chiller is being mathematically modelled and calculated numerically using MATLAB®. The simulation is used to show the performance of the chiller during the working hours, based on maximum and minimum inputs of solar irradiation in Indonesia. Furthermore, mass recovery and heat recovery is also applied in the adsorption cycle in order to increase the cooling capacity. The adsorption chiller is based on the most recent chiller developed by Shanghai Jiao Tong University (SJTU). The simulation results generally demonstrated the running characteristics of the chiller under a range of different values of solar radiation. Furthermore, the simulation results in detail showed that during the maximum value of irradiation, the average value of COP can reach 0.26, while during the minimum value of irradiation the COP is 0.15. At the same time, the cooling capacity is also varied which can reach up to the maximum value of 37.8 kW, whereas in the minimum range of irradiation values, the cooling capacity dropped to 5.3 kW.