Abstract

This study aimed at analyzing different operation strategies to improve the performance of a new type adsorption chiller employing a novel composite adsorbent, silica gel impregnated with lithium chloride, paired with methanol as the adsorbate. The chiller's experimental test results showed an average Specific Cooling Power (SCP) and Coefficient of Performance (COP) of 286 W/kg and 0.48, respectively. This was when the average hot water inlet temperature, cooling water inlet temperature, and chilled water inlet temperature were 83°C, 26°C and 15°C, respectively. In addition, the corresponding mass flow rates were 0.22, 0.39 and 0.09 kg/s, respectively. Despite the fact that the average SCP and COP, were rather satisfactory, analysis of experimental results conducted with different cycle times, inlet hot water temperatures, and hot water flow rates showed that a much better performance could be achieved. Experimental results indicated the following: (1) the COP increased while the SCP decreased with increased cycle time, (2) both the COP and the SCP increased with increase in heat and mass recovery time to an optimal time then started to decrease as heat and mass recovery time increased beyond the optimal time, (3) both the cooling power and COP generally increased with increase in inlet hot water temperature at a relatively higher value from 60°C to about 90°C beyond which the incremental value started diminishing, and, (4) increase in mass flow rates produced higher cooling power with decreased COP while decrease in mass flow rates of hot water produced lower cooling power with increased COP. This paper therefore recommends an adsorption/desorption time, heat and mass recovery time, inlet hot water temperature, and hot water mass flow rate of 780 s, 60 s, 83°C, and 0.22 kg/s as appropriate to give the best chiller performance for refrigeration.