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Investigation of carbon based adsorbents for the development of thermally-driven adsorption cooling systems

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Adsorption cooling systems are considered as energy efficient and sustainable technologies from the prospective of environmental safety and thermal energy utilization. These systems possess zero potentials of ozone depletion and global warming. In adsorption cooling processes, knowledge of adsorbent-refrigerant pairs (e.g. adsorption equilibrium, kinetics and heat) is important. The system performance is directly related to interactions between the adsorbent and refrigerant. Thus, overall thermodynamic performance of the system can be improved accordingly. In this study, numerous carbon based adsorbents are explored in detail with different types of refrigerants (e.g. ethanol, methanol, CO2, R134A etc.). in order to select the optimum adsorbent-refrigerant pair. The analyses in the study are based on the experimental data of various adsorbent-refrigerant pairs available in the literature. Various adsorption isotherms models including: Dubinin-Astakhov, Tóth, Freundlich etc. present adsorption equilibrium data. Consequently, overall system analyses have been conducted by means of pressure-temperature-adsorption equilibrium (P-T-W) diagram. The P-T-W diagram is also drawn for the ideal cycle analysis in order to explain the performance of adsorption cooling systems. The coefficient of performance of the system has been calculated accordingly for the studied adsorbent-refrigerant pairs.
Keyword: adsorption cooling; activated carbon; refrigerant; optimization

Authors: Mr SHABIR, Faizan (Bahauddin Zakariya University, Multan); Dr SULTAN, Muhammad (Bahauddin Zakariya University, Multan); Dr SHAMSHIRI, Redmond (Adaptive Agro-Tech Research Group International, 948 Via Verde, Del Rey oaks, California. 93955. USA); Prof. KHAN, Zahid M (Bahauddin Zakariya University, Multan)

Presenter: Mr SHABIR, Faizan (Bahauddin Zakariya University, Multan)

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