



STUDY ON ENGINE WASTE-HEAT RECOVERY FOR AUTOMOBILE AIR-CONDITIONING

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ABSTRACT

More than half of the heat generated in internal combustion engines (ICEs) is wasted into the surrounding environment. Effective recovery of such heat from automobiles is a key approach to mitigate energy and to sustainable technology. This study investigates its possible use for automobile indoor air conditioning (AIAC) from the viewpoint of adsorption heat pump systems. The study explores the fundamentals and application of adsorption heat pumps for automobile air-conditioning. As the regeneration temperature is the success key for adsorption heat pumps, therefore, this study investigates optimum adsorbent-refrigerant pair which could be employed for recovery of the engine waste heat efficiently. The studied class of adsorbent-refrigerant pairs are (i) silica gel-water (ii) zeolite-water and (iii) PS II-water. Moreover, the study insights the maximum cooling potential associated to former classes of adsorbent-refrigerant pair for AIAC. The study experimentally investigates the adsorption isotherms of locally available silica gel and compare it with other adsorbent-refrigerant pair studied in literature. Steady state ideal cycle analysis is performed to determine the suitable adsorbent-refrigerant pair for AIAC. The study finds all the three studied adsorbent-refrigerant pair are effectively regenerated (55-80°C) from engine waste heat. However, zeolite-water pair is suitable adsorbent-refrigerant pair having cooling potential of 501.5kJ/kg followed by polymer-water pair and silica gel-water pairs.

Keywords: *Engine Waste Heat Recovery, Automobile Air-Conditioning, Adsorption Cooling, Adsorbent-Refrigerant Pairs.*