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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 [1], [2]. Effective recovery of such heat from automobiles is a key approach to mitigate energy and to sustainable technology [3]–[5]. This study investigates its possible use for automobile air conditioning (AAC) 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-adsorbate pair which could be employed for recovery of the engine waste heat efficiently. The studied class of adsorbent-adsorbate pairs are (i) silica gel-water (ii) activated carbon-ammonia/methanol, (iii) zeolite-water and (iv) MOF-water. Moreover, the study insights the maximum cooling potential of associated to former classes of adsorbent-adsorbate pair for AAC. The study finds that the CPO-27(Ni)-water and zeolite-water could produce high cooling potential as compared to silica gel-water pair. However, they are regenerated at temperature ≥150℃ that is not available in small vehicles. Whereas, the activated carbon-ammonia pair have regeneration temperature ≤100℃ and have a supreme cooling potential but not suitable from the viewpoint of sustainable technology. The study concluded that silica gel-water pair is economically and environmentally effective having regeneration temperature ranges between 70 – 90℃ with cooling potential of 2kW.

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

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