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Development of Vapor Absorption Refrigeration System for Mini-Bus Car's Air Conditioning: A Two-Fluid Model

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Abstract : This research explores the implementation of a vapor absorption refrigeration system (VARS) in mini-bus cars to enhance air conditioning efficiency. The conventional vapor compression refrigeration system (VCRS) in vehicles relies on mechanical work from the engine, leading to increased fuel consumption. The proposed VARS aims to utilize waste heat and exhaust gas from the internal combustion engine to cool the mini-bus cabin, thereby reducing fuel consumption and atmospheric pollution. The project involves two models: Model 1, a two-fluid vapor absorption system (VAS), and Model 2, a three-fluid VAS. Model 1 uses ammonia (NH_3) and water (H_2O) as refrigerants, where water absorbs ammonia rapidly, producing a cooling effect. The absorption cycle operates on the principle that absorbing ammonia in water decreases vapor pressure. The ammonia-water solution undergoes cycles of desorption, condensation, expansion, and absorption, facilitated by a generator, condenser, expansion valve, and absorber. The objectives of this research include reducing atmospheric pollution, minimizing air conditioning maintenance costs, lowering capital costs, enhancing fuel economy, and eliminating the need for a compressor. The comparison between vapor absorption and compression systems reveals advantages such as smoother operation, fewer moving parts, and the ability to work at lower evaporator pressures without affecting the Coefficient of Performance (COP). The proposed VARS demonstrates potential benefits for mini-bus air conditioning systems, providing a sustainable and energy-efficient alternative. By utilizing waste heat and exhaust gas, this system contributes to environmental preservation while addressing economic considerations for vehicle owners. Further research and development in this area could lead to the widespread adoption of vapor absorption technology in automotive air conditioning systems.

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