Construction of a Self-regulating Thermoelectric Air-Cooling System

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Abstract

The most common method of refrigeration, a vapor compression air cooling system (VCACS), has adverse effects on both human health and the

environment, including refrigerant poisoning, ozone layer depletion, and other severe consequences. This project attempts to provide an alternative method of refrigeration that can compete with the VCACS and offer a more sustainable solution. The thermoelectric air-cooling system (TACS) is one such alternative, which operates without the use of gases. In this project, we compare the TACS to the VCACS. The thermoelectric air cooler is constructed using a Peltier module as the primary component, which is placed on a heat pump to remove hot air and enable the device to reach optimal temperatures. While the temperature of the thermoelectric cooler drops at equal rate similar to that of a VCACS, it ceases moving after reaching a specific temperature. During the experiment, it was observed that the TAC can reach a mean temperature of 29.70 ℃ which is close to that of the VCAC which is 29.35 ℃. It means the TAC has equal cooling rate just as the VCAC (i.e., 0.053 ℃/min). Also, in terms of power consumption, compared to the VCAC, the TAC consumes about 62.04 W of power which makes it more energy efficient than the VCAC. Overall, the thermoelectric air cooler offers a promising alternative to the traditional VCACS method of refrigeration, without the negative influence on the environment and human health.

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