

Zephyreco: Energy-Free Air Cooler

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ABSTRACT

The consequences of climate change, fast urbanization, and the widespread use of heat- generating cooling devices have made Pakistan more vulnerable to extreme heatwaves. Conventional cooling techniques, like refrigerant-based air cooling systems, provide short- term respite, but they are not only too expensive for the majority of people because of their low incomes, high electricity bills but they also use a lot of energy. This study examines the experimental potential of air-cooler to lower the temperature of ambient air. In dry conditions, evaporative coolers could lower the room temperature by 8–12°C. When the humidity was moderate, the cooling efficiency dropped to 5-8°C, whereas 2-5°C temperature drop was observed at high humidity level. As the growing demand for a sustainable alternative to solid waste management, this product contains more effective approach for the reuse of polyethylene terephthalate (PET) bottle. It is completely non-toxic in order to promote environmental health and to make environment clean and safe.

Keywords: Climate Change, Polyethyleneterephthalate, Air-Cooler, Humidity.

INTRODUCTION

The high energy consumption, dependence on refrigerants, and environmental damage of traditional air conditioning systems are being questioned as global temperatures rise as a result of climate change and the growing need for cooling systems. Conventional air conditioners are good at chilling, but because of their negative effects on the environment— such as their high energy consumption and greenhouse gas emissions— alternative, more sustainable cooling options are being sought after. The evaporative air cooler, a technique that uses natural processes to chill air with little effect on the environment, is one such option. By passing warm air across a moistened cooling pad, water evaporation causes the water to evaporate, chilling the incoming air. This is how an evaporative air cooler operates. In contrast to traditional air conditioners, which use refrigeration cycles based on compressors.

OBJECTIVE

Eco air cooler systems aim to combat climate change by providing a cost-effective, efficient, and ecologically friendly means of cooling homes and workplaces.

METHODOLOGY

- Evaporative cooling is the fundamental idea behind this air cooler.
- In this process temperature of the air is lowered by passing heated air through wet materials, which causes the water to evaporate.
- By using PET waste bottles as a cooling medium and air passage ways, the air cooler constructed from them improves this natural process.

RESULT

Temperature Drop (°C)	Low Humidity	Medium Humidity	High Humidity
	8-12	5-8	2-5



CONCLUSION

- The cooler uses low-power fans and the natural method of evaporative cooling, which saves a lot of energy and electricity compared to typical air conditioning systems.
- Making an eco-friendly air cooler out of PET bottles encourages plastic recycling, which lowers plastic waste and helps protect the environment.
- The cooler functions best in hot, dry conditions where the incoming air temperature can be considerably lowered by natural evaporation.
- The technology uses water effectively and is easily recyclable or replaceable, which lessens the total impact on water resources.
- In future, evaporative cooling efficiency will be increased by using moisture-retaining materials, this will enhance water retention and quicken the evaporation process in high humid condition.

REFERENCES

1. Feng, Y-C. A "Clean Energy Generation System Also a Free Air Cooler". *Energy Procedia*, 118, (2017), 72-78.
2. Zhang, Y, Zhiyuan W, and Mingshan Z. "Free cooling technologies for data centers: energy saving mechanism and applications". *Energy Procedia* 143 (2017), 410-415.
3. Xu, S, Hua Z, and Zilong W. "Thermal management and energy consumption in air, liquid, and free cooling systems for data centers: A review". *Energies* 16.3, (2023), 1279.
4. Silva-Llanca, L, *et al.* "Improving energy and water consumption of a data center via air free-cooling economization: The effect weather on its performance". *Energy Conversion and Management* 292 (2023), 117344.
5. Kumar, Dn M, *et al.* "Advanced modeling and energy-saving- oriented assessment of control strategies for air-cooled chillers in space cooling applications". *Energy Conversion and Management* 291. (2023), 117258.