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Theoretical and Experimental Study for Solar Powered Atmospheric Water Generation Using Peltier's Device.

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ABSTRACT

Potable water shortages are one of today's world's most critical problems. While water covers more than two-thirds (about 71%) of the earth's surface, works suitable for everyday usage are still scarce (only about 2.75 percent). Countries with long coastlines and island states that do not have adequate freshwater facilities, such as rivers and wetlands, face the acute water scarcity crisis. This paper conducts an experimental and theoretical analysis for an atmospheric water generation system. The unit is based on the thermoelectric cooling theory, with solar energy as the system's power source. The experimental work is conducted at Basra Region, located in southern of Iraq, between August and September 2019 and March 2020. Different climatic conditions test the experimental system on different days. Maximum water production is 3.4 L/day from all test days for various hours of service when relative humidity varies from (45-95 percent), and temperature ranges from 17C to 45C. Results indicate that water production rate increases with increasing humidity, temperatures, and hours of service and model area

1. Introduction

Countries primarily face severe water scarcity issues with long coastlines and island states that do not have adequate freshwater facilities, such as rivers and ponds. As a result, most of these countries satisfy their water needs by desalinizing seawater, which is expensive. There is also an immediate need to find new ways to produce water to fulfill its water protection needs. The purpose of this research is to solve this problem. The relative humidity (RH) is very high in coastal areas (about 70% - 80 %). The air in coastal regions can also meet people's water needs with a dehumidifier device. Also, the sun's rays are very high all year round in these regions. This can be used to supply the energy needed for the dehumidification device. It is also possible to extract usable water from the air by using solar energy. [1],[2].

The research aims to create a model that can be used to meet water requirements. The form will condense the water present in the atmosphere and then purify it so that it is suitable for human use. During the atmospheric water generator design, requirements were identified to ensure that the research effectively fulfilled its intended purpose.

1- The possibility of using water - the water produced by design must comply with the World Health Organization (WHO) drinking water quality standards.
2- The simplicity of use - the design should be operable by persons with limited technical experience.
3- Safety - the design should not pose a danger to users at any time during regular operation.
4- Flexibility in the energy source - The design should use various energy sources, including (but not limited to) solar, wind, and conventional power grids.
5- Maximizing efficiency - the design should increase the water produced per unit of energy.
6- Reducing the cost - the design should reduce the cost of producing one water unit each Capital cost and production cost. [1],[2].