

Critical Review of Using Humidified Air for Potable Water Production

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Abstract

The necessity of this day and age is to solve the problem of water shortage. Although a desalination procedure and other sustainable techniques for solving this challenge are in the works, they are still in the early stages. As a result, using atmospheric dew water as a solution to this problem is an alternative method. Atmospheric dew water offers enormous potential for use in the development of drinkable water. To a significant extent, this source remains unexplored. As a result, the goal of this effort is to extract drinkable water from atmospheric dew water. An experimental setup was created that included a compressor, condenser, expansion valve, and evaporator to collect water. This water is collected on a daily basis for a 7-month period, and the yield and cleanliness of the water are tested experimentally. The monthly average water yield is estimated on a daily basis, and cost analysis for the generation of every litre of water is done. The results of this investigation indicated that water was generated at a rate of 20 litres per day on average, with an average cost of INR 14.12 /- per litre, which is less than a dollar. This technology has shown to be a consistent and lasting solution to the massive problem of water shortage in humidified geographical places.

Keywords: *Broadband, Microstrip Antenna, Reflection coefficient, Stub Matching*

INTRODUCTION

The world's population is rapidly expanding; it is now 7.7 billion and will soon reach 9.7 billion [1]. The use of resources to improve one's level of living is expanding in tandem with the dramatic growth in population. Water shortage has recently been an issue.

Growing as a result of increased consumption and population growth, Mesfin et al. [2] discovered that about 4 billion people will suffer from water scarcity at least once a year, and half a billion people will suffer all year [3]. These statistics demonstrate the importance of freshwater. Despite this, 73%

The planet is surrounded by water, but it is unable to satisfy the demand due to the existence of dissolved salts. [4]. To address the issue of water shortage, saltwater desalination, rainwater collecting, and atmospheric water vapour processing, among other things, can be employed [5].

Seawater desalination processes are expensive and may be out of reach for underdeveloped or developing nations, whereas rainwater collecting is climate dependant and requires more land for installation and upkeep. In comparison to the other two technologies, the

atmospheric water vapour processing approach now totally relies on humid air and may be deployed at a minimal cost. Because of these characteristics, the atmospheric dew water generator (ADWG) has become a popular method for addressing water scarcity issues. The ADWG is most suited for coastal locations where humid air is abundant, with an estimated amount of $12.9 \times 10^{12} \text{ m}^3$ of renewable water. According to the literature, the ADWG approach is a reliable method for harvesting water from the atmosphere [4].

Wei He et al. [5] extracted water from air vapour using thermoelectric coolers. Two models were developed for this purpose and tested experimentally at various flow rates. The results showed that water yield rises with higher humidity and flow rate, with a total water yield of 43.4 percent at 90 percent humidity air and 30 m³/h flow rate. Bahram Asiabanpour and colleagues [6]

When the cost of water created by an atmospheric water generator (ADWG) is compared to the cost of ordinary bottled water, the ADWG technology is found to be more cost-effective. Another advantage of the ADWG system is that it may capture moisture from the air using solar

energy via photovoltaics or solar thermal. Based on the preceding arguments, it is evident that adopting the ADWG is a feasible and cost-effective strategy to fight the water shortage. As a result, in this project, a potable atmosphere water generator was conceived and built to extract water from humid air or atmospheric dew. In technique and outcomes, the complete experimental approach including computations is presented.

MATERIALS AND METHOD

The atmospheric dew water generator (ADWG) unit is designed and

manufactured on the campus of the Department of Mechanical Engineering, Raghu Engineering College, Visakhapatnam, India, which is located at 17°59'41.6"N 83°24'52.9"E and has an elevation of 24 m above sea level.

Figure 1 shows the location of the campus in relation to Bheemili Beach, which is 21.3 kilometres away. The average wind velocity at this location is 9.4 mph on normal days, and the experiment was carried out under various climatic circumstances from October 2019 to April 2020 to collect the water.



Fig.1:-Location site of the experimental set up

The ADWG unit comprises a hermetically sealed reciprocating compressor with a horsepower rating of 1/3, a condenser, and an evaporator. The unit's total measurements are 55 cm x 55 cm length and 30 cm x 30 cm width. Figure 2a depicts a schematic picture of the experimental setup, whereas Figure 2b depicts a photographic image of the unit. In the current experiment, R-22 is employed as a coolant, and a forced draught fan is added to cool the condenser. A hygrometer is used to measure humidity.

With a 1.5 V battery, monitor humidity levels (10% to 99.9% relative humidity) and dry bulb temperature (DBT) from -10°C to 50°C.

A 25-litre storage tank is installed on the machine to collect the water created throughout the operation. Along with these instruments, accessories such as thermocouples, hygrometers, and psychrometers are attached to the equipment at various locations for calculating purposes.

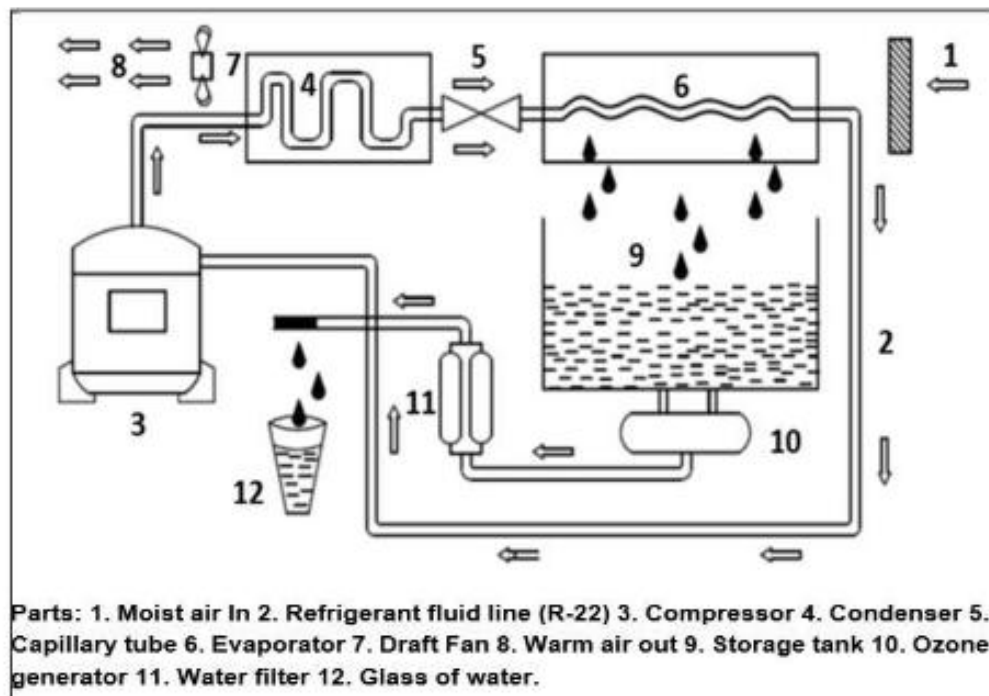


Fig.2(a): Schematic representation of the experimental setup



Fig.2(b): Illustration of the experimental setup

METHODOLOGY