DESIGN AND ANALYSIS OF WATER GENERATOR FROM ATOMSPHERIC AIR

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Abstract: Water desperately needs alternative "water cultivation" methods and producing water from air is one of the most viable and sound solution presented as the world's fresh water needs increase daily . This technology has ability to meet and fill the growing demand for economical, safe, great tasting drinking water in a clean drinking water is to health and wellness for people everywhere. We have designed and developed a system for removing clean drinking water from air using a traditional power grid. Use a traditional power grid to generate electricity; use electricity to cool air (or increase pressure) resulting in condensation of water ; capture water vapour from air that condenses into water to obtain 99% pure and safe drinking water from the moisture in the air . Implementation of process using most efficient and cost effective method is also an important concern in the project.

Keywords - Air conditioner system, compressor, condenser, cooling coil, fan motor and container.

1.INTRODUCTION

This thesis is a part of the development of an AWG, for this purpose the project group will initially investigate the suitability of the vapour compression cycle, where the extraction will be obtained on the evaporator. An AWG is a device that generates clean drinking water by utilizing the natural presence of water vapour in the air. This thesis will hopefully result in information that will be used as a basic data for decision-making. Since most of the evaporators on the market today are designed merely to cool the air passing through them, much effort will be made to design an evaporator that not only lower the temperature but also condensate some of the water vapour included in the air and to collect the condensed water if this technology is assessed to be liable. There can also be other technologies that can be more suitable for this application. The main purpose is to investigate which technology is the most suitable one in order to extract water. Other possible solutions for this problem will be presented, explained and discussed. The purpose is to find and develop a technology applicable for water extraction.

2. OBJECTIVES

In fact there are many products that are available in the market which use this technology. But on prior research and going through the product development page of various companies we found that the devices which use this technology are very bulky and heavy. They are not portable and since they use a compressor they have heavy electricity demand and are not eco-friendly.

Also these devices produce a lot of noise and require periodic maintenance. Since we wanted to make a portable device hence we thought of using some other method to achieve our goal.

In their design report “Water generator water from air using liquid desiccant method” Niewenhuis and others have tried to incorporate liquid desiccant method for dehumidification. After they created a prototype and put it into testing they found that water output from the device was very dismal. Hence we decided not to use this method of dehumidification for our prototype.

3 .PROBLEM DEFINITION

This project aims to solve this problem. In the coastal areas the relative humidity is quite high (around 70-80%). So, the air in coastal areas can be used to meet the water needs of people by using a dehumidifier unit.

Manufacturing requires huge volumes of processed water since the industry involves many procedures such as cooling, boiling, rinsing and washing.
Further the solar installation is quite high in these areas round the year. This can be used to provide necessary power to the dehumidifier unit.
Thus drinking water can be obtained from the atmosphere by harnessing solar energy. Such a device is called Atmospheric Water Generator.

India also needs to work forward in this direction in order to address this issue. Even though it has a very large coastline but still people face water scarcity

4. WORKING PRINCIPLE

This project is designed on the basis of refrigeration principle, which states that is a process in which work is done to move heat from one location to another. The work of heat transport is traditionally driven by mechanical work, but can also be driven by heat, magnetism, electricity, laser, or other means. All the circuit are designed, and then connections are made as per the diagram as shown below, by using the copper tube of diameter 5 mm and capillary tube of diameter 0.5 mm to the necessary connections. Afterwards creating the vacuum in the component by using vacuum creator. Then refrigerant gas is filled to compressor by using nozzle. Then made supply electric power into the system. The compressor will compress the refrigerant which is filled in system and in converts low pressure vapour into high pressure vapour .

Then it moves from the compressor to condenser to condense the gas stream and made it to high pressure liquid then passes to expansion valve i.e. capillary tube. Then the expansion valve will control the flow of air stream which is in the form of high pressure liquid to the evaporator cabin, in the form of low pressure liquid. Therefore due to temperature difference between refrigerant and atmospheric moisture the ice is formed on the surface of evaporator. The heating coil is fixed to this cabin. Then evaporated refrigerant in the form of vapour with low pressure is again circulated to the compressor through copper tube. This process is continued for 1.5 hrs. Then formed ice on the evaporator is defrost to water by using heating coil. Then it is collected by water collector

5. COMPONENT DESCRIPTION

- Compressor
- Condenser
- Evaporator
- Expansion valve
- Solenoid valve
- Capillary tube
- Cooling coil

- Sensor
- Radial fan .

6. DELIMITATION

Because this thesis is a part of a development project handling a substantial amount of information concerning various technological and non technological topics delimitations have been made in order to uphold the relevancy of the report. The most crucial being that this report only touches one function (the main one) in the product, the extraction of water. All other functions related to the product will be ignored. During the project several technical concepts have been presented and pursued to different extends but due to limitations in the length of the thesis as well as the technical scope only the main concepts will be presented. Except of the technical aspects of the project several non technical activities have been performed. Some of which have been design related activities and market studies. These aspects of the project will not be discussed. Furthermore the information in this thesis has been limited to the technical aspects. Total Dissolved Solids (often abbreviated TDS) is an expression for the combined content of all inorganic and organic substances contained in a liquid.

7. CALCULATION

At DBT=26 Degree C & RH=60% we get dew point temperature = 17.64^{o}C By taking references from Research papers,
Extraction efficiency=40%
Water extracted =20L
Specific humidity= 0.012 kg of water/kg of dry air.
It depicts that 1 kg of dry air contains 0.012 kg of water & considering 40% extraction efficiency from 1 kg of dry air 0.0048 kg of water is extracted
Cp(air)=1.005 kJ/kg K
Heat absorbed by refrigerant = heat rejected by air + latent heat of water
=m(air)Cp.dT+ m(water)L
= 0.48466 + 0.52
= 1.0078 kW
Refrigeration effect = 1.0078 kW
Assumptions made
Temp of condenser = 55^{o}C
Outlet to compressor = 60^{o}C
Inlet to compressor = 15^{o}C
Evaporator temperature = 2oC From P-h chart, h1 = 410 kJ/kg h2 = 430 kJ/kg h3 = h4 = 280 kJ/kg i] Heat absorbed during evaporation stage = m(r)[h1-h4] ii] mass flow of refrigerant 1.0078=m(r)[410-280] m(r)=0.007752 kg/sec Compressor work = m(r)[h2-h1]
= 0.155 kW/hr

•Heat rejected in condenser = m(r)[h2-h3] = 1.162 kW

• Power required by compressor = 0.155 kW

• Total hours per month used = 30 x 24

• Total units consumed = 30 x 24 x 0.155 = 111.6 kWh

• As per MSEDCL; cost per unit = 6.25 Rs

• To run compressor for a month = 111.6 x 6.25 = 697.5 Rs

• It will cost around Rs 23.33 per day

• Rs 23.33 for 20 L of water

• For 1 L of water, it costs around Rs 1.16

8. CONCLUSION

From this work we have concluded that the humidity in air can be changed to water for drinking and for useful purpose. This product is useful in areas were humidity is high but lack of water facilities and water availability. So proper usage of this product can bring down the death, that happening in some countries without water availability.

9. REFERENCE

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