

Atmospheric Water Absorption Kit

Jain Varghese^{1*}, Stephy Akkara², Jarin T¹

¹Department of Electrical and Electronics Engineering, Jyothi Engineering College, Cheruthuruthy, India.

²Department of Electronics and Instrumentation Engineering, Karpagam College of Engineering, Coimbatore, India

*Corresponding author email: jainvarghese2018@gmail.com, Tel.: +917994039969

ABSTRACT

As the water scarcity is becoming a serious problem, it's our duty to use each drop of water with care. Everyone knows that the atmosphere is rich in humidity. Thus the humidity rise, it will cause a dangerous problem of rise in temperature of that particular place. Both the problems can be avoided by the water absorption from atmosphere. For this we are using biomimicing with desert beetle, cactus, and lotus for effective water absorption without electricity. Usually in railway stations, we can see lots of people are using water filters for drinking waters. The water coming out from these electrical filters are chilled water. This chillness is not required for the people as its making tough to drink. Besides such chillness of water is not good for human health .in such a case we are wasting some amount of energy on chilling water. While considering a water filter unit in in public place like railway station the wastage of energy will be really high as people are using it more for getting drinking water.in this paper we are explaining the possibility of using this waste energy to collect atmospheric water by using a particular container which is a result of biomimicing. This method will help to reduce the over humidity present in the surrounding atmosphere. The prime important factor of this method is that we are collecting atmospheric water as energy input.

Keywords-biomimicing, chilling water, electrical filters, humidity, water absorption

1. INTRODUCTION

Water filtration is the procedure of eradicating unwanted chemical components, suspended solids in addition to form toxic gases from water. The aim is to create a novel water filter for a definite utility for the human being. Mostly water is sterilized for human intake (drinking water), but water wastage may also be considered for a diversity of other resolves, indulging the necessities of medical, pharmacological, chemical as well as industrial applications. Reusing of water could diminish the wastage of water as well as reducing the electricity usage used for filtering [1-3].

Rendering to a 2007 World Health Organization (WHO) report, 1.1 billion people want safe drinking water for their existence; 88% of the 4 billion yearly issues of diarrheal disease are endorsed to insecure water also insufficient hygiene, whereas 1.8 million people pass away due to diarrheal sickness every year [4, 5]. There are several methods vibrantly used for the water filtering purpose i.e., from homely approach to industrial level. Nature is the best way to learn things hence we are approached the technique of biomimicing. Nature handle things very beautiful manner so that it will benefit for everyone.so by using the technique of biomimicing this proposed method is eco-friendly.

This proposed method is a new design to existing filter unit, so it can collect water from atmosphere without using any other energy by biomimicing principle and also try to reduce room temperature by putting an attempt of absorbing the atmospheric water (thus reducing the humidity). For this we are introducing the proposed method Atmospheric Water Absorption Kit (AWAK).

2. LITERATURE REVIEW

In order to create an effective design, the actual need of the customer is of absolute importance. If these needs are not taken into consideration, it is possible to create a design that has no use for the people it is intended to help. With this in mind, when creating a design, the focus was placed on creating a purification system capable of reusing water with the limited resources that are available in India. That is, we were tasked with making a filtration setup that accepted the polluted water as an input and yielded clean water as the output. It was essential to create a re-filtration system that solved the water problems India faces in a way that it would also be feasible for those living there to utilize, purchase, and maintain. The problem that needed to be solved in India was how to reuse their water, which had very specific and unique problems with it, as well as

more common contaminants. Here is an explored alternate existing solution to this problem of filtering water, such as a wastewater treatment plant that is so prevalent in most developed nations [1, 6]. These ideas were considered at first in order to find different solutions that are either feasible or effective in addressing the problem. From there, it was possible to determine what was or was not a viable option through viewing the available resources necessary to maintain and operate whatever system that would be implemented. Moreover, a new perspective was gained through generating purposefully bad ideas. At a glance this may seem pointless, but it allows outside-the-box thinking to figure out what is truly outside the realm of possibility and what would just require some creativity and critical thinking.

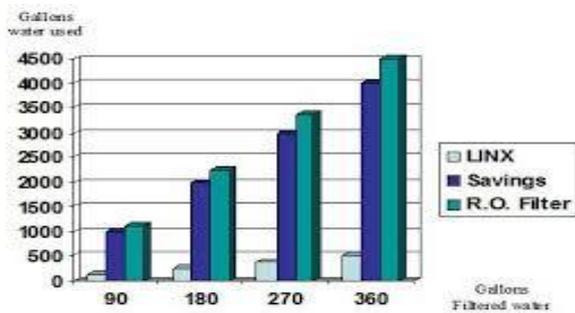


Fig. 1 Graphical representation of water consumption using filters

2.1 Water filter unit in Railway station

The railway station is a place where lots of people commuting to and fro. Indian railway is the second largest transportation network. It's a public place. The basic need for every commutates in normal railway station providing is drinking water, toilets etc.as we all know drinking water is the most prominent need of the living being. Considering this point of view the Indian government and central railway board provide water filter units in each and every railway stations.

The water coming out of these filters are usually chilled water. This is because the filter unit is electrical and chilling unit is also provide along with it. But the fact is that this much chillness of water is not good for health. The most disadvantage of this system is wastage of energy in the form of chillness of water. Most commonly multitudes fill this chilled water from the system in water bottles without having directly from the filtering order to reduce the coldness of water. This unnecessary chilling of water is the main disadvantage of this type of water filter units place in railway stations by government.

The proposed work 'AWAK' will help to overcome this wastage of energy of chilled by using it to absorb water from atmosphere providing a hand to solution from scarcity.

2.2 Atmospheric water absorption unit in America (AKVO)

There are plentiful source of water is the Earth's atmosphere. When atmospheric humidity condenses, it forms as rain. AKVO atmospheric water generators use a similar process known as the air-to-water technology. Air-to-water technology is the procedure of converting water vapour in the air (humidity) to water. Akvo repeats this natural process of condensation by put on the dew point, which consents it to make clean drinking water uninterruptedly. Atmospheric Water Generators are moisture in addition to temperature-driven Appliances. This will worth the Appliance's capability to produce water to be contingent completely on the range of humidity plus atmospheric temperature [7].

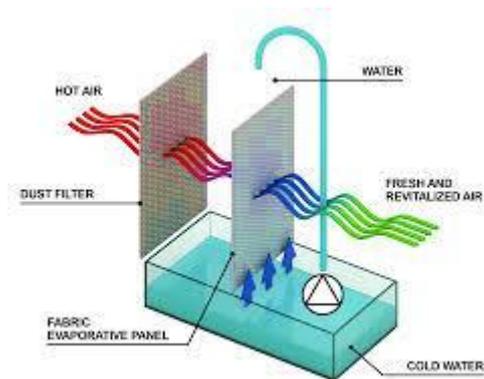


Fig. 2 Working of AKVO

The air comprise of lots of water, dust in addition to it has micro particles. In Akvo atmospheric water generation is done through a influential biological filtration method which intakes a large amount of air .The obtained output is in the form of water is pure, fresh also drinking water [7].

2.2 Water tank

Water tanks are castoff to deliver storing of water. It's abundantly custom in drinking water, cultivation, fire conquest, both for plants besides livestock, chemical engineering, food preparation as well as many other uses. Water tank parameters include the general design of the tank, and choice of construction materials, linings. Earthen pots also function as water storages. Water tanks are a well-organized way to benefit emerging countries to store clean water.

Considering the existing case into notice, the need is to store the chilled water in such manner the project objective is to improve the tank contact area of the surface of the tank with atmosphere. Consider a simple water tank in railway station. The outer surface is only getting exposed to sunlight. But in the case of AWAK the U shaped tank is designed so that its contact area is large and closer to the atmosphere. This possible process is biomimicing.

Here in the proposed method lotus plant and designed tank in a U shape in addition to that the cactus plant for surface projection like thrones which helped us to improve the contact area. The surface of the tank is made with small bindings imitating desert beetle. All these helped u to improve the water absorption in the surface of the tank, which is not possible in normal water storing tank. While go through all these products we are able to find certain types of limitations in much area which have to be modified for its effective performance.

3. PROPOSED METHODOLOGY

There were lots of problems and limitations for the existing systems. It needs certain modifications in order to achieve the objective. The combination of filter unit, surface improvement and water storing tank must be in such a manner so that the water absorption take place in an efficient manner in addition to reducing the wastage of energies. Hence the proposed idea AWAK in order to achieve the objective overcoming existed system problem.

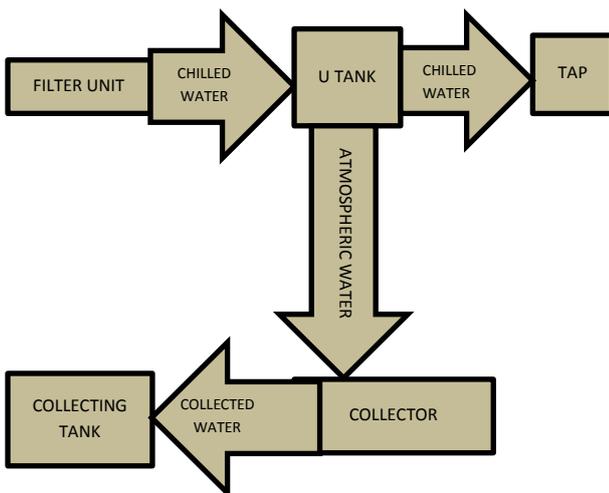


Fig. 3 Block diagram of proposed system

It simply uses the wasted energy in water and stroke in the form of chillness for absorbing water from the atmosphere. The Figure 3 depicts the block diagram of

the proposed system. The main principle behind the proposed work is Capillary rise, Archimedes principle, Biomimicing.

3.1 Capillary rise

With the help of an external force the water flow through an arrow line tube or space is called capillary rise or capillary action. Figure 4 emphasis the working of capillary action in two different ways based on the spacing between the tube and any material. The capillary action can be done in different materials such as paper, plastic, carbon fiber, thin brush and even in a cell. These all materials are belonging to the category of porous. The main factor behind this capillary action due to the intermolecular force between the surrounding solid surfaces and liquid. The diameter of the tube plays a vital role in capillary action. If the diameter of the tube is adequately small, formerly the combination of surface tension as well as adhesive forces among the liquid besides vessel wall act to drive the liquid [8].

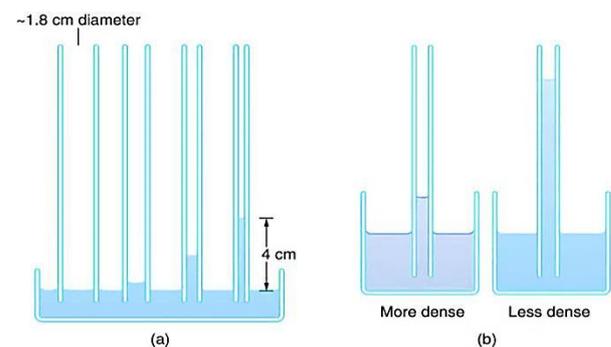


Fig. 4 Capillary action

3.2 Archimedes principle

Archimedes' principle states that the uphill buoyant force that is applied on an object wrapped up in a fluid by completely or moderately sunken and thus it is equivalent to the weightiness of the fluid that the object relocates besides it performs in the rising path at the centre of mass of the moved fluid. Archimedes' principle is a law of physics fundamental to fluid mechanics. In this fig 5 Archimedes principle is pictorially represented and easy to understand the theorem [9].

3.3 Biomimicing

Biomimicry is process of imitating different system or models or elements in the nature to solve the complex problems that's not, much easy to rectify. Due to natural selection or over wide range of geological time evolution the living organisms are evolved well obtained structures, materials and composition (Fig 6).

Nowadays in biomimicing new technologies are implementing by biological solution at extreme cases (macro and nanoscales). Humans have looked at nature for answers to problems throughout our existence [10]. Figure 6 clearly depicts the example of biomimicing inspired from nature and used in another sector. Currently self-healing abilities, environmental exposure tolerance and resistance, hydrophobicity, self-assembly, and harnessing solar energy (engineering problems) were solved by this natural process.

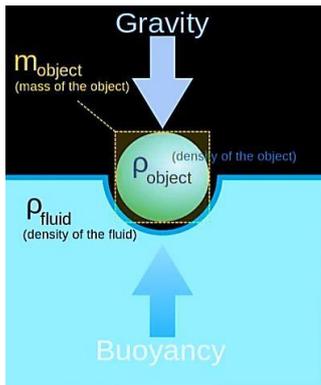


Fig. 5 Archimedes principle

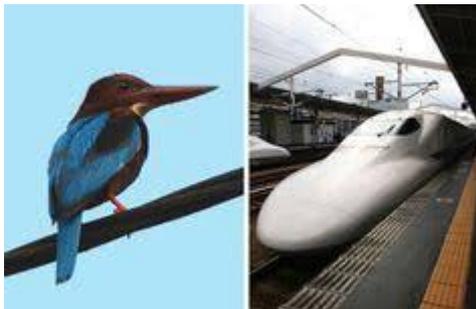


Fig. 6 Example of biomimicing

3.4 Working of AWAK

The water from the filter unit is passed to the U shaped cup like tank which merely match to the surface of the lotus leaf. The container of chilled water will have water drops absorbed on the surface due to the humidity around it. This water is collected in the hemispherical tank is tank taken to the filter again or it can be directly used. Specially created surface of the U shaped tank make the water absorption more effective-shape tank is more or less resembles to the lotus petals. The tank is made of U-shaped (Fig 8) because it can provide more surface area than that of other tanks. Its surface is smoothed for effective collection of water. The thrones provided on the surface of the tank will improve the surface area and also will help in condensation process (Fig 7). There are special small openings which drop of water pass through the surface in controlled

time and also help to collect from the surface of the tank. For this purpose we are using single drop valve. It's actually a specially designed mini valve which works one of the principles in capillary rise, Archimedes principle (Fig 9). The surface is specifically made so that water drops will able to flow easily. For this utility, surface is made with a water contact angle between the surface and water is greater than 80 degree.

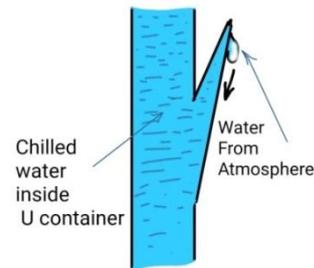


Fig. 7 Throne like structure in U tank

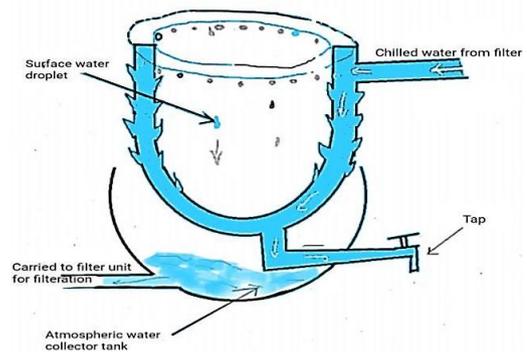


Fig. 8 Important parts of AWAK

The important parts of the U-shaped tank is the single drop valve.it is a special type of valve made for special purpose of collection of absorbed water on tank surface and also to initiate the water drops to flow downward to the collector tank.

- The single drop valve is designed to get only a single water droplet out.Actually this valve is now at a conceptual level. This can also be called in the name of angular valve because it order for the proper working of the valve and also is should be place in an angle of 45 degree.
- Thus the ball move and hit the pupil closing the hole when water level goes above the value, which prevents the escape of water outside. But a small drop of water will escape due to water reached in front of ball before it closing through the mini channel.

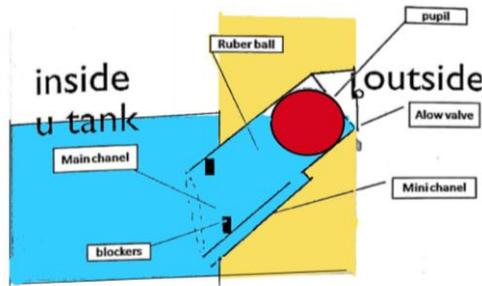


Fig. 9 Internal part of AWAK

- When the drop becomes the desired size, allow valve will open and the water droplets are allowed to flow through the surface of the tank (Fig 9).
- In U-shape tank the water from filter is filled. This tank is designed so that it can have a maximum surface area of contact to atmosphere. The water gets absorbed on the surface of this tank which will flow down through the surface of the tank to collector tank. There is throne like structure in order to increase the surface area. The SD valve is placed on the top of this tank.
- The water absorbed on the surface of the tank is collected by the collector tank. it can either pass water to filter again and use for drinking purpose or else it can collect into another tank as per the design and necessity of the project.

4. CONCLUSION

As the scarcity of water stays big problem this proposed work AWAK is relevant. It is taking the atmospheric water, thus the humidity gets reduced by decreasing the temperature. The water absorbing device is now available which works in the mode of electricity and thus wastes the energy. But in this case of AWAK saves the electricity and reuses the wasted energy in an efficient manner. The absorbed water gets diluted in pure water and then it is filtered by the unit. There is no any problem by taking the atmospheric water. This is a simple design modification and the cost is less when it is compared to the large scale production. The simulation of the proposed work is published in sketchfab [11]. Thus AWAK is 100% environmental friendly (sustainable).

ACKNOWLEDGEMENTS

The simulation of this proposed method is uploaded in sketchfab. Simulation on Atmospheric water absorption kit (AWAK): [online]. Updated: 15/10/2018. [Viewed 2 January 2019]

<https://sketchfab.com/models/445ee91f006b44e8bae1a4bc6743a6b7>

REFERENCES

- [1] Turbidity Lenntech water treatment and purification Holdings (retrieved 3/3-2011) <http://www.lenntech.com/turbidity.html>
- [2] T. Wakatsuki, H. Esumi, S. Omura, High performance and N & P-removable on-site domestic waste water treatment system by multi-soil-layering method, *Water Science and Technology*, 27, 1993, 31-40.
- [3] Water and Health-Cholera's grim warning Understanding Global Issues, Greenemeier L (2008), Water filtration system in a straw Scientific American 25 February 2008, Nature America Inc., New York NY (retrieved 15/10-2010) <http://www.scientificamerican.com/article.cfm?id=water-filtration-system>
- [4] WHO/UNICEF Joint monitoring report 2010: Progress on sanitation and drinking water-fast facts WHO (retrieved 15/10-2010) http://www.who.int/water_sanitation_health/monitoring/fast_facts/en/index.html
- [5] Sonune Amit, Rupali Ghate, Developments in wastewater treatment methods, *Desalination*, 167, 2004, 55-63.
- [6] Huesemann, H. Michael, A. Joyce Huesemann, Technofix: Why Technology Won't Save Us or the Environment, Chapter 13, The Design of Environmentally Sustainable and Appropriate Technologies, *New Society Publishers, Gabriola Island, British Columbia, Canada*, 2011.
- [7] Souter, Philip F., et al., Evaluation of a new water treatment for point-of-use household applications to remove microorganisms and arsenic from drinking water, *Journal of Water and Health* 1(2), 2003, 73-84.
- [9] Capillary Action – Liquid, Water, Force, and Surface – JRank Articles. Science.jrank.org. Retrieved 2013-06-18.
- [8] R. Mark Wilson, Archimedes' principle gets updated., *Physics Today*, 65(9), 2012.
- [9] Julian F.V Vincent, Olga A Bogatyreva, Nikolaj R Bogatyrev, Adrian Bowyer, Anja-Karina Pahl, Biomimetics: its practice and theory, *Journal of the Royal Society Interface* 3(9), 2006, 471-482.
- [10] Sketchfab. Simulation on Atmospheric water absorption kit (AWAK): [online]. Updated: 15/10/2018. [Viewed 2 January 2019] <https://sketchfab.com/models/445ee91f006b44e8bae1a4bc6743a6b7>