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Renewable and Rechargeable Powered Air Purifier and Humidifier: A Review

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ABSTRACT

The increase in urbanization and industrialization has led to an increase in air pollution which has resulted in a reasonable percentage of mortality rate in the world. A humidifier is a device that adds moisture to the air and filters it to make it clean and safe for use. This device will always make the air within the enclosure clean and safe for inhaling and at the same time makes the environment healthy. The installation of solar Photovoltaic (PV) based or rechargeable humidifiers will make the environment healthier as the devices will always be at work steadily to prevent some of the airborne diseases. The inclusion of solar and rechargeable air purifiers and humidifiers in our respective environments will reduce the indoor pollution impacts such as allergies, asthma, Sinus and Congestion and improves the healthiness of the user.

Keywords: Air, Humidifier, Purifier, Renewable, solar PV.

INTRODUCTION

Humidifiers are devices that add moisture to the air to prevent dryness that can irritate many parts of the body. Humidifiers can be particularly effective for treating skin dryness, nose, throat, and lips. They can also ease some symptoms caused by the flu or common cold. An air purifier or air cleaner is a device that improves indoor air quality by removing contaminants in the air. An air purifier is commonly used for those who are asthmatics and those who are allergic to un-purified air. Air purifiers are manufactured as either small stand-alone or larger units that can be affixed to an air handler unit (AHU) or an HVAC unit found in hospitals and industries. Air purifiers may also be used in industry to remove impurities from air before processing. Pressure swing absorbers or other adsorption techniques were also used as a means of keeping the air clean

and safe for processing. Humidification is a process in which seawater is brought into contact with air to increase the air's moisture content. Water diffuses into the air as vapour and increases the air's humidity. The force driving humidification is the difference in concentration between the water-air interface and the water vapour in the air. This concentration difference depends on the vapour pressure at the gas-liquid interface and the partial pressure of water vapour in the air. Various devices can be used as humidifiers, such as packing-filled towers, spray towers, bubble columns, and wetted-wall towers [1]. The heterogeneity of the rooms in temperature and humidity is a significant factor that must be regulated in an industrial operation. Healthy air has three main components to it. It has to be fresh, clean and have the right moisture content. Human beings are prone to humidity

INOSR Scientific Research 9(3):56-63,2023. because the human body uses evaporative cooking as the primary mechanism for getting rid of the system [2]. In [2], the researcher designed an automatic humidity controller prototype that can help control the level of humidity to lower a room's humidity or to balance the temperature. The designed devices after

detecting the room's humidity will either humidify or dehumidify the room depending on the degree of the room's sanity. Figure 1 is the prototype of the Automatic Room Humidifier and Dehumidifier Controller using Arduino Uno.



Figure 1 is the actual design of the system where the DIY dehumidifier is situated on the left side. The research study used silica gel, fans and acrylic was used to enclose the system. The main design in the middle was designed to show the humidity value and program for sensing room humidity. This study designed a device that controls the humidity of the room using humidity sensors DHT, Arduino Uno and LCD that automatically display the data. The developer programmed a system that will control the humidity of a room to normalize it by turning on devices like dehumidifiers and humidifiers [3]-[6].

The researcher in [7], critically reviewed the Solar humidification-dehumidification desalination systems. A considerable amount of energy was consumed during desalination and humidification processes. The majority of currently running desalination plants throughout the world rely on fossil fuels as the energy source. However, most of the regions, facing higher levels of freshwater demand, simultaneously receive high values of solar energy. Solar is used as a source

Solar desalination technologies are classified into direct and indirect categories. When solar radiation is directly

absorbed by the input feed water of the desalination plant, the plant is considered to be of direct type whereas indirect type occurs when solar energy is either absorbed by solar thermal collectors and then transferred to the saline water. or transformed into electricity and then used for running the plant. In both cases, solar energy could be used for running a heat engine as a power source for the plant as illustrated in Figure 2. This showed that solar energy can be used as an alternative source of energy to ensure that the room humidity and temperature are kept constant. The 21st fabrication and maximum power point optimization is required for steady power supply to the system which enhances efficiency and durability [8][9][10]. The researchers in [11][12] developed techniques by which solar Photovoltaic can be optimized for effective power efficiency Enhancement. The latest solar panel fabrications enhance efficient power delivery without so much physical tracking. The fabrication methods in [13][14][15] made use of the most recent fabrication techniques which use organicprocessing methods inorganic in fabricating perovskite solar cells.

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Figure 2: Classification of solar power-driven desalination technologies [7]

In [16], the researcher experimentally investigated the thermal design of the humidification dehumidification desalination system. Humidification dehumidification (HDH) is a promising small-scale technology for seawater desalination and has widespread application in drinking and industrial water treatment systems. This review demonstrated the significance of a novel parameter known as the 'modified heat capacity rate ratio' (HCR) in the thermal of HDH svstems design and in simultaneous heat and mass exchange (HME) devices. HCR is of particular importance in developing a fundamental understanding of the concept of thermodynamic balancing. Therefore, based on these experiments, the recently developed theories behind the design of HDH systems with or without mass extraction and injection are validated [16]. in [17] reported The author the development of a new active humidifier for dry eyes. The system consists of modules

Humidifier Purification Systems are designed such filters are (1) True HEPA Filter:

Several purification systems are designed to purify the air intake in a stuffy and less concentrated/insufficient oxygen environment. The device always helps in purifying the air within the environment and also makes the air intake safe and good for inhaling. Filter components of humidifier that are used to clean and make the airworthy for inhaling. Examples of

for sensing, mist generation and a main control unit. Furthermore, once the humidifier is activated, it increases the relative humidity level of the confined environment by +30% within four minutes. The use of renewable energies for а desalination appears nowadays as reasonable and technically attractive option for the emerging and stressing energy and water problems. For lowdensity population areas worldwide, there are lack of fresh water as well as electrical power grid connections [5][18][19][20]. Therefore, cheap fresh water may be produced from brackish, sea and ocean water by using solar panels, wind turbines and other emerging renewable energy technologies to reduce the carbon footprint of commercial desalination processes [21]. Furthermore, The HDH system has some advantages for smallscale decentralized water production which include simpler brine pre-treatment and disposal requirements and simplified operation and maintenance [1] [22].

Originally designed for the US Army, HEPA

filters remove 99.97% of airborne particles 0.3 microns. It also eliminates mould

spores, bacteria, viruses, pollen, and more.

Figure 3 is a typical diagram of the system.

(2) **Pre-Filter:** Removes large dust particles

and pet dander. (3) Activated Carbon

Filter: Gets rid of smoke and VOC odours.

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Figure 3: APH230C Air Purifier

- 1. Central Humidifier: This type of humidifier is installed in the heating room to release water vapour into the room at an adjustable rate.
- 2. Ultrasonic Humidifier: They have a water reserve that uses high-speed vibrations to release the water vapour into the air. They are known as "cool mist" humidifiers because the water is never heated and can be a good choice for children.
- **Types of Humidifier** 3. Impeller Humidifier: This releases cool air into the system using a rotating disk.

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- 4. Evaporator humidifier: This uses a fan to dispense mixed air into the system through a wet filter.
- 5. Steam Vaporizer: This uses electricity to create steam that blows into the air. The air is cooled first, so the air coming out feels rather cool. But, they are still known as "warm mist" humidifiers

Benefits of Humidifier Prevent Colds and Flus

Increasing the humidity level of air to 43 percent or more can decrease the ability of certain airborne viruses which can cause infection such as influenza. If indoor humidity levels are less than 23%, influenza's infectivity rate-also known as its ability to infect others via respiratory

air droplets-is between 70% and 77%. If indoor humidity is kept above 43%, the infectivity rate is much lower, between 14% and 22%. By running a humidifier in your home, you can prevent the further spread of the flu and colds.

it hard to blow or cough. Increasing air

moisture can make it easier to expel the

skin

Improve Skin

In general, dry air is really bad for your moisturizing your skin, making it feel skin. Dry air pulls moisture from the skin, smooth, and bringing back its "glow." In a making it feel itchy and irritated. It can hospital setting, simply increasing humidity from 32% to 43% with a also reduce your skin's moisture, making it dry, dull, and cracking. Humidifiers can humidifier in the winter has been shown counter this effect by increasing moisture relieve drv itchy to and in the air to help avoid discomfort, symptoms among staff.

Help with Sinus and Congestion

Humidifiers can also help loosen congestion and clear the vocal cords by moistening the nasal passage. When you get sick, the cells lining your respiratory

tract generate more mucus. When the mucus dries, it can become sticky, making

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INOSR Scientific Research 9(3):56-63.2023. mucus when coughing or blowing your nose by preventing it from drying. Additionally, if you frequently experience

A sore throat is a common problem that can occur in the upper respiratory tract, with dry air being the main culprit. If the dry winter air is causing your throat to get painful and scratchy, rehydrating the

Dry air often triggers upper respiratory tract contraction, which causes a cough. Using a humidifier will not only reduce the

Reduce Allergies

Breathing higher-humidity air is one way to relieve the discomfort and symptoms of allergies. Symptoms of allergies include nasal congestion, irritation, and inflammation of the nasal cavity. Reducing inflammation of these tissues can provide quick relief for allergy sufferers. With increased humidity, moistened nasal

Asthma is a condition that occurs by the contraction of smooth muscle in the upper respiratory tract due to the effect of allergens such as dirt, dust, pollen, spores, and more. A humidifier will adsorb these asthmatic triggers and relieve the upper

Dry air can make it uncomfortable to sleep, causing some people to experience insomnia or sleep deprivation due to lack of moisture in the air. A humidifier will improve humidity and the quality of your sleep. Humidifiers are often added to CPAP (continuous positive airway pressure

Humidifier benefits are not only useful for humans; moist air can also be good for your houseplants. Plants need water from their soil and the air to survive and thrive. Dry air can leave house plants shrivelled up, while a humidifier can add the needed

The air quality in a home can be significantly improved bv using а humidifier. Moist air is healthier for you. Doctors recommend using humidifiers to improve indoor air quality as part of their treatment for respiratory illnesses and allergies. Airborne contaminants in dry air can make breathing harder, make you sick more often, and cause you to stay sick

sinusitis or any problem related to your sinuses due to dry air, a humidifier can help reduce symptoms.

Soothe a Sore Throat

mucous membrane with a humidifier can help. Setting a humidifier in your bedroom while you sleep to moisten the air can be an effective way to get rid of sore throats.

Relieve Cough

ability of airborne disease infection but also help relieve your cough by soothing your upper respiratory muscles.

tissues can blow out irritants and allergens from your nasal cavity, reducing allergy symptoms. However, too much humidity can cause dust mites and mould to spread. Therefore, people with these indoor allergies should clean their humidifiers regularly and monitor humidity levels so they don't exceed 50%.

Prevent Asthma

respiratory tract, which reduces asthma. Humidifiers also help to relieve asthma by soothing the tissues in the nose and throat and relieving dry and itchy throat, runny nose, coughing, nose bleeds, and sinus congestion.

Improve Sleep Quality

treatment) machines used on sleep apnea patients. Because CPAP machines blow dry air up your nose, increasing congestion, using heated humidification on sleep apnea patients helped reduce symptoms of a stuffy nose and improve sleep quality.

Beneficial for House Plants

moisture to their air. Indoor plants also contribute to good air quality because they produce more oxygen for us. The more oxygen you breathe in, the better for your body.

Improve Air Quality

longer. Increased moisture alleviates dry skin and eves, chapped lips, cracked furniture, warped floors, window sills, and peeling paint. Humidifiers can also increase the efficiency of furnaces in the winter because moist air feels warmer than dry air at the same temperature. Finally, portable humidifiers work great, but they can be a lot of maintenance. You must

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INOSR Scientific Research 9(3):56-63,2023. remember to clean them every week as well as purchase distilled or demineralized water. Also, you have to be careful that **Fin**

From the extensive review done, it was observed that humidifier has a lot of benefits as outlined above. The secret to

This paper reviewed twenty-three papers hell on renewable energy such as solar and imp humidifier. This showed that humidifier one powered by renewable sources of energy is by the best. Humidifier is an essential device rev that every home needs to have because of nee their numerous advantages such as pow reducing allergies, preventing asthma, unh **REFERENCES**

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you are not adding too much moisture to the air because it can encourage the growth of organisms including dust mites [23].

Findings

good health is a humidifier backed up with solar energy as an alternative source of energy supply.

CONCLUSION

helping with Sinus and Congestion, and improving sleep and air quality which is one of the major things that were needed by a living thing for healthy life. This review paper recommends that every home needs to have a humidifier and purifier powered by solar to reduce sickness and unhealthy life.

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