

Design & Fabrication of Air Purifier & Humidifier with Water as a Filtering Medium

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Abstract – We tend to think of air pollution as something that happens outside but that's not always the case. Even inside your home, there are things like dust mites and dirt trodden in from outdoors to worry about. Indoor air pollution from sources like this can irritate your lungs and contribute to allergies and asthma. The trouble is, if you use an ordinary vacuum cleaner, you might simply be "rearranging the dirt": your cleaner will trap some of the dust inside the bag or cyclone filter but let the rest pass straight back into the room

Indoor air quality has been major public concern recently. Several health effects are related to these problems. Findings from several study shown MVAC systems were the main contributor for IAQ problem. Good practice of maintenance and servicing are important to maintain MVAC system especially filters. Good air filtration for MVAC system is needed to make sure adequate air received by the occupants. This paper illustrates recent study of air filtration for MVAC system especially for several industries that used MVAC system in their premises. This paper also proposed air filtration study to make sure better air quality. Several Act and Regulation that related to Safety and Health were identified to create the framework for this proposes study. Air filtration technique will be used in this preliminary study will set up a guideline to create safe and clean indoor spaces for workers and occupants.

Air pollution has crossed all bounds in 2021. WHO estimates that around 7 million people die every year from exposure to polluted air; the spread of air pollution is so high that about 91% of the world population is exposed to air pollution? Well, this also means that the air you breathe in your house is polluted. To counter this issue, we here develop a mini air purifier with that does not use expensive filters but rather uses water as an air filter. Also, it acts as an air humidifier and can be used as oil diffuser too which helps you relax and also kills certain bacteria and viruses present in the air.

The mini-Air Purifier brings up the following key aspects

- A Low-Cost Purifier
- No Expensive Filters Just Water
- Quiet Operation
- Easy Maintenance
- Also acts as a Humidifier
- Low Power Consumption
- Easy To Use
- Can be used as an Oil Diffuser

The system makes use of 2 x high power low noise centrifugal fans that are used to suck in air through a protection mesh. The pulled air is then passed through a water tank situated at the bottom of the purifier. The air passed through water gets auto purified as water traps dust, fungi, bacteria etc. in the water. The

resulting air rising through the water is a high humidity cool air. Also added essential oils to the system allow for humidifying the area/room with essential oils which are researched to kill certain types of bacteria fungi in air and help humans relax. Also, some essential oils are researched to provide various health benefits when inhaled.

I -INTRODUCTION

Poor indoor air quality is commonly found in homes in larger cities, and is the result of a growing industrialization that pollutes the air we breathe with contaminants like industrial dust, smog and other particles from traffic. The solution from a user perspective is to use an air purifier that clean the air from these particles inside the user's home. An air purifier can also be used to ease annoyance for people suffer from allergies. However, most air purifiers on the market today are made with one-time use filters that eventually end up in landfill, and incur a regular cost for the consumers. This master thesis concerns the design and development of the next generation of air purifiers for indoor use. The project has been conducted with a human centered design process and an eco-design approach. The development of this project contains several different methods commonly used in a design process, which have been used in order to achieve a result that is trustworthy and in line with user needs.

An air purifier or air cleaner is a device which removes contaminants from the air in a room to improve indoor air quality. These devices are commonly marketed as being beneficial to allergy sufferers and asthmatics, and at reducing or eliminating second-hand tobacco smoke. The commercially graded air purifiers are manufactured as either small stand-alone units or larger units that can be affixed to an air handler unit (AHU) or to an HVAC unit found in the medical, industrial, and commercial industries. Air purifiers may also be used in industry to remove impurities from air before processing. Pressure swing absorbs or other adsorption techniques are typically used for this. HUMIDIFIER: A humidifier is a device, primarily an electrical appliance that increases humidity (moisture) in a single room or an entire building. In the home, point-of-use humidifiers are commonly used to humidify a single room, while whole-house or furnace humidifiers, which connect to a

home's HVAC system, provide humidity to the entire house. Medical ventilators often include humidifiers for increased patient comfort. Large humidifiers are used in commercial, institutional, or industrial contexts, often as part of a larger HVAC system. Low humidity may occur in hot, dry desert climates, or indoors in artificially heated spaces. In winter, especially when cold outside air is heated indoors, the humidity may drop to as low as 10–20%. This low humidity can cause adverse health effects, by drying out mucous membranes such as the lining of the nose and throat, lead to a snoring problem, and can cause respiratory distress. The low humidity also can affect wooden furniture, causing shrinkage and loose joints or cracking of pieces. Books, papers, and artworks may shrink or warp and become People spend more than 90% of their time indoor. Therefore, indoor air quality (IAQ) has become public concern. Mechanical ventilation and air conditioning (MVAC) system were used for climate control in certain area of buildings. This automated system for climate control also important to provide comfortable and safe working environment (Li, Wall, & Platt, 2010).

MVAC system usually consists of several part and equipment to deliver air to the occupants. Meanwhile, ventilation was used to exchange the air in the enclosed spaces. Mechanical ventilation and natural ventilation are the common type of ventilation method used in commercial buildings. Air filtration o significant role in order to create clean indoor air (Sublett et al., 2010). Air filter also one of the important equipment in order to prevent MVAC equipment such as air handling unit (AHU) and duct become dirty, thus ensure good air quality (Hyttinen M. et al., 2007; Lin & Chen, 2014).

Several health problems were also associated with poor IAQ and can cause people eye incitement, asthma, allergic dermatitis, pneumonia, and even death (DOSH, 2010; Sekhar & Goh, 2011). Air-filtration and air-cleaning systems can remove a variety of contaminants from a building's airborne environment (Azimi & Stephens, 2013; Moritz, Peters, Nipko, & Rden, 2001). Air filter also will be used as sampling mechanism to evaluate contaminant that are exists in certain MVAC system (Noris, Siegel, & Kinney, 2011). The main concern to installed filter in MVAC system is because:

- To maintain of a clean environment for the comfort of the occupant

- To protect of the décor of occupied spaces by removing the staining portion of airborne dust
- To protect of the mechanical parts of the HVAC system
- To reduce particulates that potentially harmful to the occupants
- To remove odors

The effect of dust in HVAC system commonly depending on the size of dust particles. Usually, bigger dust will be stuck to the MVAC system and components (E.Mull, 1998). Thus, good air filtration is needed to protect MVAC system and to have better air quality for the occupants (Bluyssen, P.M et al., 2003).

II - METHODOLOGY

Urbanization increased population density in cities and consequently leads to severe indoor air pollution. As a result of these trends, the issue of sustainable and healthy indoor environment has received increasing attention. Various air filtration techniques have been adopted to optimize indoor air quality. Air filtration technique can remove air pollutants and effectively alleviate the deterioration of indoor air quality. This paper presents a comprehensive review on the synergistic effect of different air purification technologies, air filtration theory, materials and standards. It evaluated different air filtration technologies by considering factors such as air quality improvement, filtering performance, energy and economic behavior, thermal comfort and acoustic impact. Current research development of air filtration technologies along with their advantages, limitations and challenges are discussed. This paper aims to drive the future of air filtration technology research and development in achieving sustainable and healthy building ventilation

III -CONCLUSION

The outcome of this project is a next generation air purifier with a new filter innovation. The new filter makes it possible to have a smaller housing compared with competitors but still having high performance. This means that it does not take up as much space and is easier for the user to move around from place to place inside the apartment; it is also equipped with a handle. The 360o Air is also easier to fit in more places in a home because its design does not restrict its position as much as competitors. That is, it has been given a round

shape and has therefore no defined backside that needs to be placed towards a wall. The uniform round shape allows more varieties of how it can be positioned in a home. The filter is cleanable and does not need to be changed. The filter also has a low pressure drop which results in less generated noise and lower energy consumption. All these advantages that is the outcome of the new filter innovation makes this a product that stands out from competitors and makes it easy to sell for sellers and should generate revenue for the brand owners. The air purifier is a product that solves the problem of bad indoor air quality. It is a problem that most of all have its effect on large cities and where the population is dense. Many cannot afford an air purifier and many have problem to cover the expenses of buying new filters. The 360o Air is a more socially sustainable than most competitors because it is cheaper in long term which results in more people being able to buy an air purifier that might be vital for their health. Even if the brand owners, manufacturers and sellers would not earn money from people regularly buying new filters, the 360o Air should still be economically sustainable because of the new filter innovation and its benefits that would attract more buyers. The fact that the 360o Air uses less material than competitors will most likely also result in cheaper manufacturing. As mentioned before, the air purifier developed in this project is also more environmentally sustainable than competitors in the existing market.

The lack of ventilation in homes has spurred the demand for air purifiers. They decrease indoor air pollution levels, but their filters have a threshold. Some filters are effective for two to three months, while others can work for a longer period of time. Keep checking the air filter indicator so you change filters at the right time, and continue to enjoy a clean indoor environment

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