

DESIGN, ANALYSIS & FABRICATION OF AIR PURIFIER AND HUMIDIFIER USING WATER AS A FILTER

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Abstract : We have developed a small air purifier that employs water as an air filter instead of pricy filters. It also functions as an oil diffuser and air humidifier, which helps you unwind and eliminates some bacteria and viruses in the atmosphere. Two high-power, low-noise centrifugal fans are employed by the system to draw air through a protective mesh. After that, the air is drawn in and run through a water tank at the purifier's base. Water collects dust, fungi, germs, and other particles, which causes the air it passes through to become naturally cleaned. Cool air with a high humidity level rises through the water as a result. Additionally, the system's additional essential oils enable the area or room to be humidified with essential oils, which have been shown in studies to help people relax and kill specific types of germs and fungi in the air. Additionally, studies have shown that inhaling some essential oils might have a variety of health benefits

Key words: Low-Cost Purifier, No Expensive Filters, Quiet Operation, Easy Maintenance, Also acts as a Humidifier, Low Power Consumption, Easy To Use, Can be used as an Oil Diffuser

1.INTRODUCTION

Extreme air pollution is a problem that many nations and major cities face nowadays. The air around cities is polluted by vehicles, factories, and the usage of non-renewable energy sources. This is a serious issue in China and India, where over a billion people live in contaminated cities. Air purifiers are the answer that people use to filter the indoor air in polluted locations. Most people who live in areas with bad air quality have this gadget in their homes and offices. Usually, the purpose of an air purifier is to draw air into the house through a fan located inside the appliance. Clean air is released when the air is passed through a filter medium of some kind that captures the particles causing pollution. Nevertheless, the majority of air purifiers available today use so-called HEPA filters, which need to be changed frequently and use a lot of energy. Given that pricing is one of the most significant considerations for clients when purchasing an air purifier, this solution is somewhat expensive and may not be appropriate for everyone.

2.SYSTEM COMPONENTS

This system consists of various components which are as follows:

1. Air Blower Pump or centrifugal pump.
2. Air Suction pump.
3. Pipe, Pipe Fitting.
4. Protective three mess filter.
5. Mounts and Joints.
6. Base Frame.
7. UV light.
8. Water Tank.
9. Pipe Fittings.
10. Nozzle.
11. Pipe Connector.
12. Transformer/Adapter.

3. METHODOLOGY

Fabrication is a significant industry that creates structures by cutting, forming, and assembling materials. Although many fabrication businesses employ diverse methodologies, the majority depend on three fundamental procedures: chopping, shaping, and assembly.

Slicing Cutting is the first step in the fabrication process. In order to create a new metal structure or product, the metal fabrication firm will cut one or more pieces of raw metal during this process. But cutting any kind of metal, be it iron, steel, aluminum, or any other common metal, calls for specialized equipment. While some metal production businesses employ numerical control (CNC) equipment with lasers or water jets, others use torches. When it's done, the business will have neat, precisely proportioned metal sheets or parts to operate with.

Bending Metal fabrication companies must bend raw metal after cutting it. Once more, there are various methods for bending metal after it has been cut. Certain enterprises that fabricate metal sheets or sections use hammers to shape them into the required shape. Hammering can be performed manually or mechanically (power hammering). However, a lot of

metal fabrication businesses have only started bending metal with press brakes. When activated, this massive industrial equipment automatically presses metal parts and sheets into a predetermined shape. In essence, it forces the metal into the required shape by clamping it between a punch die. Putting Together Assembling is the last and third step in the metal production process. As the name implies, this procedure entails putting the metal sheet or parts together to create the intended final result. Welding is the usual method of assembly, however there may be additional procedures involved. Metal fabrication businesses, for instance, can apply glue, screws, or other fasteners in addition to welding to crimp seams.

4. Working

The following are the working procedures:

- Air Intake: Through an air intake vent, the air purifier first draws in contaminated air from the surrounding area.
- Air Blower: By rapidly rotating its blades, it generates air flow throughout the system.
- Water Tank: A clean water-filled water tank serves as the filter media for the air purifier.
- Pipe: The water tank and the air blower are connected by means of the pipe.
- Water Filtration: The water in the tank is in contact with the contaminated air as it is drawn through the pipe.
- Water Evaporation: The water filter element of the air purifier permits water evaporation in addition to air filtering.
- Case Fan: Following the water filter's passage, the cleaned

5. Mathematical Model

a. Energy consumption: Energy consumption equation can be written as given in Eq. (1) taken from literature [1]

Energy consumption of device expressed kilowatt hours (kWh) which can be multiplied by the applicable energy rate to calculate the cost. Important aspect in this regard is the volume of air passing through the device, the average resistance, operating hour and efficiency of the fan

$$E(\text{kWh}) = (q \cdot \Delta p \cdot t) / (\eta \cdot 1000) \quad \dots (1)$$

Where, E represents energy consumption(kWh) , q represents air flow volume(m^3/s), Δp represents average resistance of the filter, t represents operating hours (h), η represents efficiency of fan

b. Mass conservation equation: Mass conservation equation can be written as given in Eq.(2) taken from literature[1]

If the outdoor particulates get into the room via air leakages of windows and doors. The seams of windows and doors can be regarded as low efficient filters. It is supposed there is no indoor source. The mass conservation equation is,

$$V \frac{dc}{dt} = Q \cdot C \cdot P - K \cdot V \cdot c - Q' \cdot c \quad \dots (2)$$

Where, V represents room volume, m^3 , c represents concentration of particulate matters in the room, ug/m^3 , t represents is time, h, Q represents air leakage rate, m^3/h , C represents outdoor concentration of particulate matters , P represents penetration coefficient of the seams ,K represents sedimentation coefficient, h-,CADR represents clean air delivery rate for particulate matters of air cleaners

C. Area : Equation for area can be written as given in Eq.(3) taken from literature[3]

For area the suitable area is associated with C, so in different outdoor atmospheric environment we should have different λ to calculate the suitable area

$$A = (c \cdot \text{CADR}) / (H[\text{ACH}(C-P) - K]) = \lambda \cdot \text{CADR} \quad \dots (3)$$

Where, ACH represents Air change, h^{-1} , A represents room area, m^2

d. Time required passing all air of room through blower = $t = V/v'$

e. Time for filtration with water = $T = t/\eta_w$

.... (V represents velocity ($v = 2\pi N/60$) , v' = Volumetric Flow Rate , N = RPM of fan, η_w represents filtration efficiency of water which is 40%)

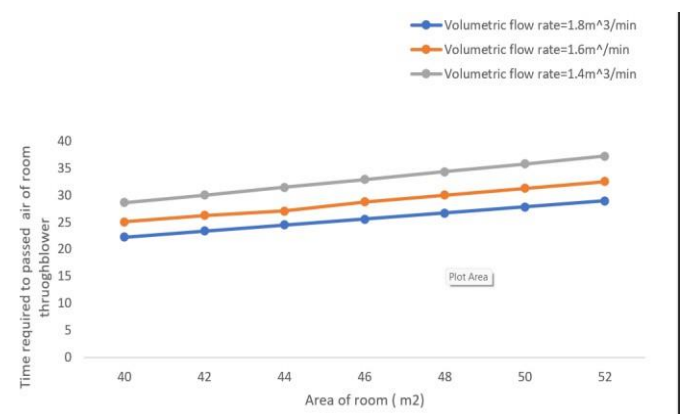


Fig 1. Time required to passed air of room through blower

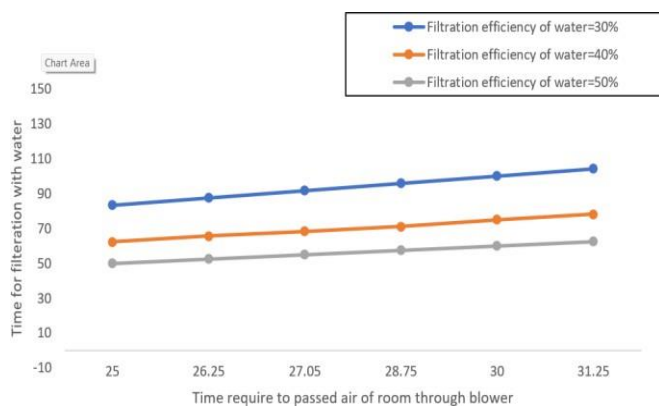


Fig 2. Time For Filtration Efficiency With Water

pollution. While air purifiers are gaining traction, consumer hesitation due to cost and lack of immediate results persists. However, as awareness grows, demand for advanced technologies like Plasma Cluster Ion Technology is expected to rise. Clarifying performance indicators and focusing on comprehensive solutions will drive the air purifier market forward.

8.FINAL MODEL:

6. Solidworks model

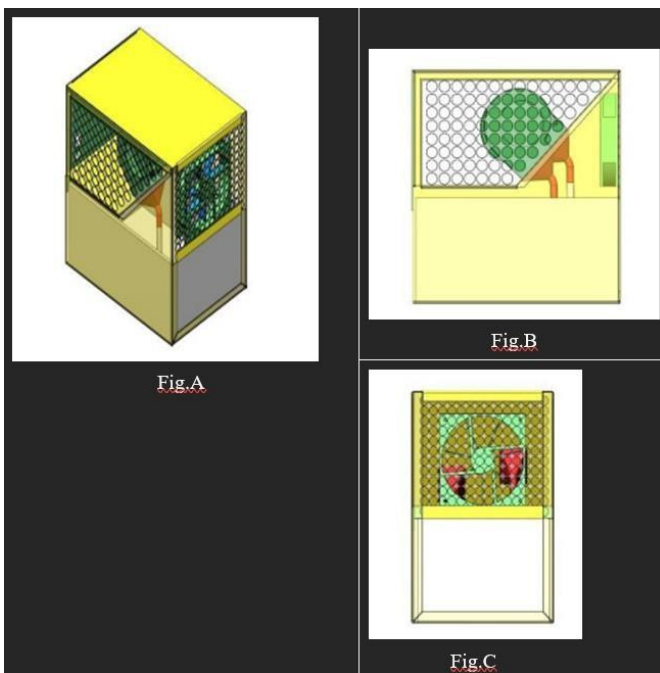


Fig A. represents isometric view
 B. represents side view
 Fig C. represents front view

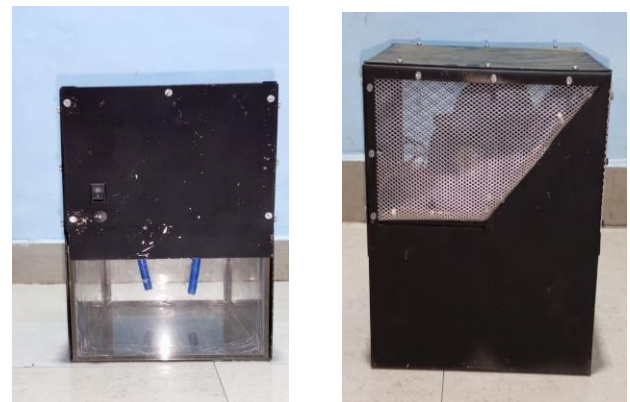


Fig 3. Final Model(Side View)



Fig 4. Final Model(Front View)

8.CONCLUSIONS

Create a small air purifier that uses water as an air filter rather than pricy filters. It can also be used as an oil diffuser and air humidifier, which helps you unwind while also eliminating some bacteria and viruses from the air.

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.

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