VIVA-TECH INTERNATIONAL JOURNAL FOR RESEARCH AND INNOVATION
ANNUAL RESEARCH JOURNAL
ISSN(ONLINE): 2581-7280

DESIGN AND FABRICATION OF CATCH AND KILL AIR FILTER

Chetan Bandekar[1], Ganesh Bhojane[2], Tejas Choudhary[3], Sahil Dalvi[4]
[1](Department of Mechanical, Viva Institute of Technology, India)
[2](Department of Mechanical, Viva Institute of Technology, India)
[3](Department of Mechanical, Viva Institute of Technology, India)
[4](Department of Mechanical, Viva Institute of Technology, India)

Abstract : *Airborne transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) via air-conditioning systems poses a significant threat for the continued escalation of the current coronavirus disease (COVID-19) pandemic. Considering that SARS-CoV-2 cannot tolerate temperature above70^{0}C, here we are designing and fabricating efficient filter based on heated nickel (Ni) foam to catch and kill SARS-coV-2. The virus can remain in the air for about three hours, a filter can kill the virus almost instantly. According to the study, published in journal Materials today Physics, 99.8 percent of aerosolized SARS-CoV-2 was caught and killed by single pass through a novel Ni- Foam-based filter when heated up to 200^{0}C. In addition, the same filter was also used to catch and kill 99.9 percent of Bacillus anthracis, an airborne spore. This study paves the way for preventing transmission of SARS-CoV-2 and other highly infectious airborne agents in closed environments. Air filters are common enough daily items, familiar to anyone who has ever used an air conditioner on a hot summer's day, but scientist clarified that a common air filter cannot kill the SARS-CoV-2 as well as other highly infectious airborne viruses. Hence This project is about designing and fabricating the catch and kill air filter to help essential workers are at elevated risk of exposure mainly at schools, health care facility, hospitals etc. by providing them safety. This project will help people to buy air filters with lower cost and highest safety during this pandemic.*

Keywords – *Covid-19 pandemic, Electrostatic Precipitator, Infectious airborne Virus, Nickel Foam.*

I. INTRODUCTION

This paper discusses the design and fabrication of catch and kill air filter. Now-a-days, people are more concern about airborne health issues. Perhaps the greatest challenges remain indoors, when tiny droplets can stay alive for hours in air. This restricts people from going on work to going restaurants. Scientist clarified that common air filter cannot kill the SARS-CoV-2 as well as other highly infectious airborne viruses. Therefore, it is necessary to provide an efficient and affordable light weight air filter. As per demand and requirements Nickel foam- based air filter have additional advantages due its large porous surface, which is perfect for trapping he virus during the passing of air through it.

The air filter we designed will be compactable and highly efficient as compared to other commercial filters. It will provide maximum safety.

II. LITERATURE REVIEW

Centre for Disease Control (CDC) MAY 2020[1], they published an investigation which traced an early outbreak of COVID-19 back to a restaurant in Guangzhou, China, and concluded that the air conditioning system of the building enabled the micro-droplet, or aerosol, transmission of the virus between table groups thus we thought of choosing a foam material

University of Houston College of Medicine JUNE 2020[2]: virus-trapping air filter that can kill the coronavirus instantly using extremely high temperatures, and can be installed in existing cooling and heating systems thus this helped us to choose a better material which must conduct heat properly with also a good conductor of electricity

Beijing Key Laboratory of Indoor Air Quality Evaluation and Control, Beijing 100084, China JULY 2020[3]. "the virus can stay up to 4 hours in close rooms", which means different rooms require different filters as the virus can stay at a place so we thought of making an air filter less costly and compact in size.

III. PROBLEM DEFINATION

3.1 Problem Statement

During this pandemic Most of the front workers are risking their lives while working at healthcare facility, hospitals etc. in turn risking their families so it's too important to provide them safety. Hence the purpose of our project is to create a compact, cost-effective and portable which can kill most of airborne viruses at a single pass.

3.2 Objective

a) Making compact filter design.
b) Eliminating most of airborne virus.
c) Affordable price of filter for everyone.
d) Long life filter.

IV.PROPOSED METHODOLOGY

We studied few research papers on Design and fabrication of catch and kill air filter, we try to improve results by considering above result then we come to following methodology.

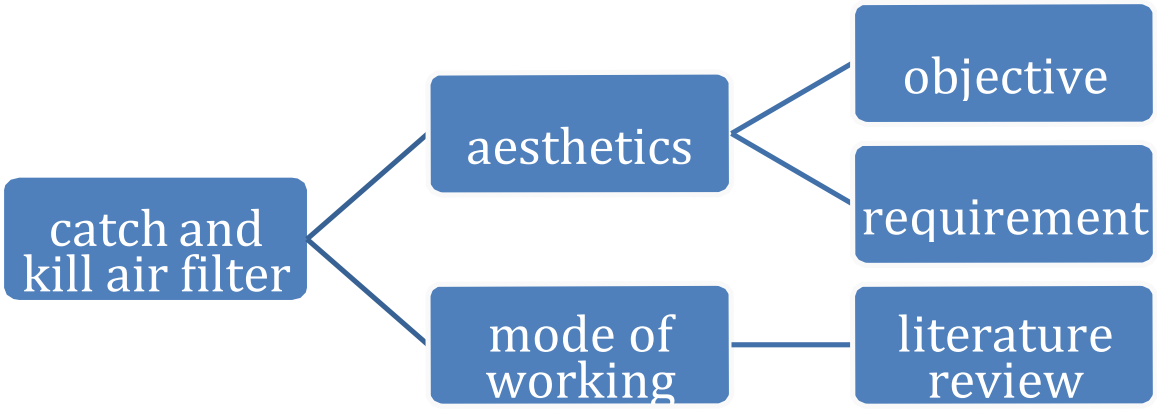

Fig.4.1: process chart

4.1 Objective and Requirements

We try to build a compact and light weight air filter, which will consume less electricity and work more efficiently. Also, it must kill most of air borne virus. The overall cost must be low.

4.2 Aesthetics

Design must look descent and should have cool colour theme on it.

4.3 Working

a) Dirty air of closed space is first travels through pre-filter, where dust particles of large size get trapped. Pre-filter prevents damage of electrostatic precipitator from large dust particles.
b) Air from pre-filter flows towards the electrostatic precipitator. An electrostatic precipitator consists of nickel foam filter at higher temperature to kill the harmful viruses such as SARS-CoV-2 and airborne viruses (which causes lungs problems) in a single pass.
c) The temperature of nickel foam filter can be raised up to 250^0C by increasing the resistance of wire present in-between the folded nickel foam.

d) For next stage of purification air carbon fibre is used to remove the dust particles as well as other unwanted tiny particles from the air.
e) At last, for proper flow of air fan is provided to give clean free air.

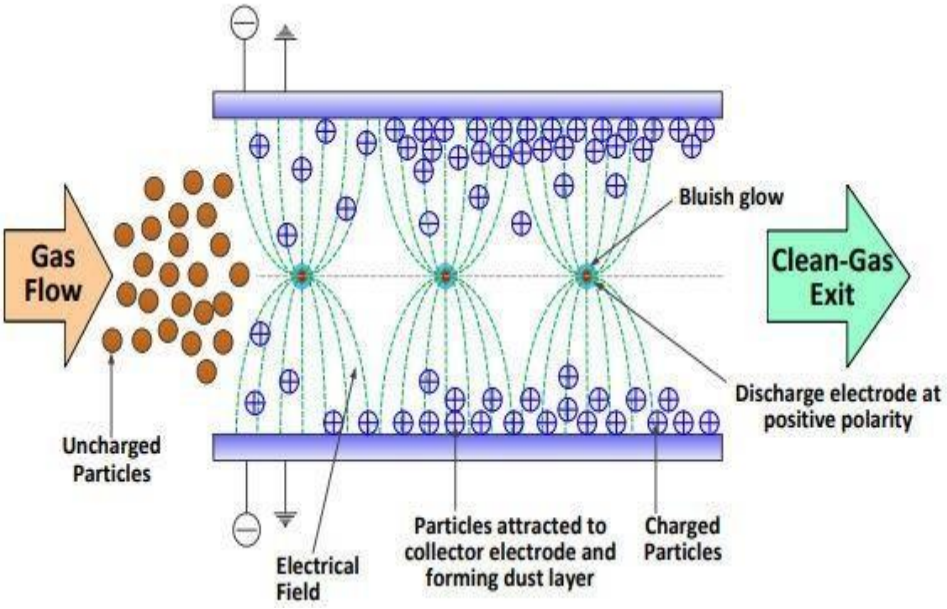

Fig.4.2: working of electrostatic precipitator.

4.4 Design of Model

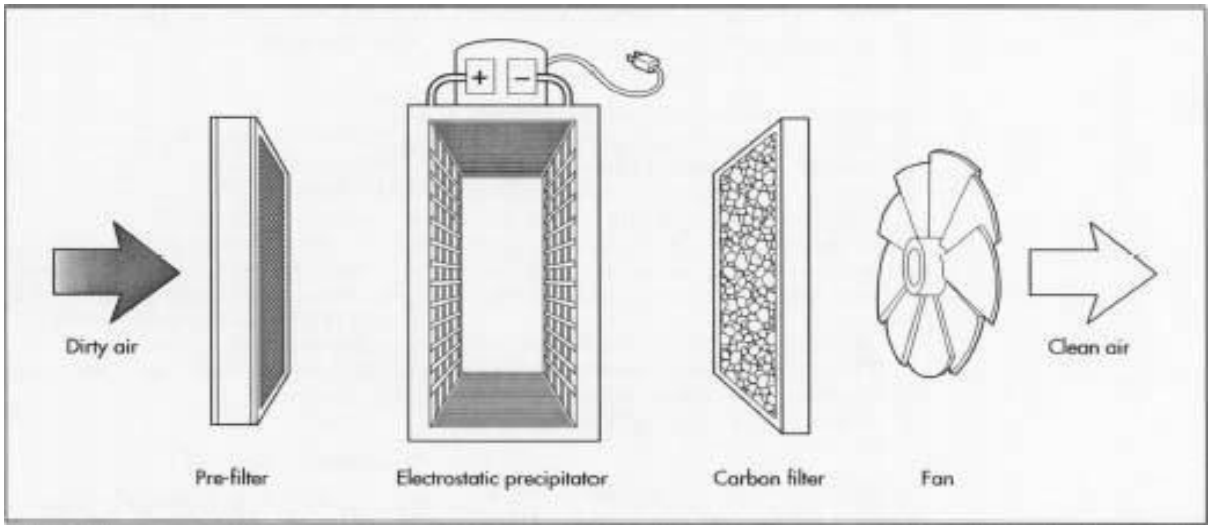

Fig.4.3: design of air filter.

V.CONCLUSION

By using the catch and kill air filter we can purify air in closed space and provide safety to people. we are expecting results while using catch and kill air filter are listed below:

1. Purify air in single pass through air filter.
2. Eliminate most of airborne viruses.
3. Provide efficient and cost effective air filter.

REFERENCES

Journal Papers:

[1] R. C. Spencer, *Bacillus anthracis, J. Clin. Pathol*, 182-187 (2003)
[2] K. Chan et al., *The effects of temperature and relative humidity on viability of SARS coronavirus, Adv. In virology,10.1155/2071/734690.* (2011)
[3] N. Van Doremalen et al., *Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1, N. Engl. J. Med 382*, pp.1564-1567 (2020).
[4] C. Wang, P. W. Horby, F.G. Hayden, G. F. Gao, *A novel coronavirus outbreak of global health concern, vol. 395*, pp. 470-473 (2020).
[5] M. Yadav, *Understanding the epidemiology of COVID-19, Evr. J. Biol. Res 10*, pp. 105-117 (2020).
[6] P. Azoulay, B. Jones, *Beat COVID-19 through innovation, science, vol.368*, pp. 553 (2020).

.

Books:

[7] K. R. Parker, *Applied electrostatic precipitation* (springer science and business media, 2012).

Chapters in Books:

[8] Kenneth R. Parker, Electrostatic precipitation, in *Particle technology and applications*, (281, CRS press, 2017).