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Removal of Air Pollutants by Using Activated Charcoal Briquette

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Abstract - Volatile Organic Compound (VOC) is one of the most common air pollutants emitted from industries like Chemical, Petrochemical industries, as well as when plastics are burned. It is very harmful to our environment which affects climate change, the life cycle of plants and the health of all living beings. So, it is necessary to control its emission for improvement of air qualities which is beneficial to the indoor environment. The objective of the study is to review the performance of activated carbon-based air filters. Activated carbon is preferred due to its high micro pores volume and adsorption kinetics. Researchers have studied the removal efficiency of activated carbon using various methods under various conditions. Activated briquettes chemically or thermally can be used for removal of air pollutants. It is observed from this study that activated carbon-based techniques are effective for removal of VOCs andenhancing the air quality.

***Key Words*:** Activated carbon briquette, HEPA Filters air filters trap.

1. INTRODUCTION

Activated carbons are extremely versatile adsorbents and have major industrial significance. They have high specific porosity and hence enhanced surface area. Thus, activated carbons are used in wide range of applications concerned particularly with the removal of species by adsorption from the liquid or gas phase. Activated carbons can be considered to be composed of non-graphitic, non-graphite carbons with a highly ordered micro structure. Air pollution and climate change were recognized as the top environmental global threats to human health in 2019 by the world health organization. We focus this review on respiratory health, knowing that minimizing air pollutants by activated carbon briquette.

2. Purpose of the Project:

This project is to provide Carbon air filters which are most commonly used to remove gases. They are designed to filter gases through a bed of activated carbon (also called activated charcoal) and are usually used to combat volatile organic compounds (VOCs) released from common household products. They are also often used to remove odors from the air, such as the smell of tobacco smoke.

3. HISTORY:

Materials used Activated carbon Exhaust fan Acrylic sheets. The acrylic sheets were cut according to required dimensions so as to prepare the boxes. Two boxes were placed one over the other between which exhaust fan was placed. A hole was made on the box present at the bottom so that emission can be passed into the closed boxes with the help of pipe connected and extended externally. Activated briquette were placed vertically against the emission so that the pollutant traps into this activated carbon and only the purified or clean air passes through the filter and the pure air moves towards the exhaust fan and the readings were noted down from the both boxes before keeping activated briquette and after placing the briquette respectively. These readings were taken with the help of PUC testing machine.

4. OBJECTIVE:

- To find effective methodology/technique to treat hazardous pollutants.
- To possibly develop new market/areas of application for newly prepared activated carbon in India andother neighboring countries.
- To find the cost effective naturally available adsorbent.
- To find the hazardous free and re-useful adsorbent.
- To build up a smart pollutant free city.

5. PROBLEM DEFINITION:

Ambient air pollution poses grave, multi-faceted risks to India's prospects for achieving its development goals: More air pollution leads to rapid increase in public health expenditure, diminished labour productivity, and reduced agricultural yields. Air quality in India has deteriorated significantly over the past two decades today air pollution is the second largest risk factor contributing to the country's disease burden.

Pollution prevention or control is needed to preserve precious environmental resources and to improve the environmental quality so that preserved resources can be utilized for benefit of mankind and the improvement of health and wellbeing of the people.

The commonly used adsorption process, activated briquettes is an effective adsorbent because it is highly porous material and provides a large surface area to which contaminants may adsorb.

Powdered activated carbon

Powdered, micron-sized activated carbon particles are milled from millimetre granular activated carbon and exhibit faster kinetics and a greater capacity for contaminant removal, when compared to carbons with largerparticle sizes.

Powdered activated carbon can be used for sporadic contaminant episodes, such as algae blooms and industrial spills, that contaminate municipal influent waters. Powder can be added to the clarification process settling unit to remove these contaminants with activated carbon. It can also protect fixed activated granular carbon beds against sudden influent contamination.

Plants can use powder instead if they lack the infrastructure to use granular activated carbon or do not haveenough granular carbon between the influent and the effluent to economically use for removal in sporadic contaminant episodes. The single-use powdered activated carbon is used as a batch process to remove contaminants to acceptable regulated maximum contamination levels (MCLs) but not necessarily to zero or non-detected contamination.

Granular activated carbon

Millimetre-sized granular activated carbon can remove contaminants to concentrations below analytical detection limits, and compared to powder, it requires only about one-fourth the amount of carbon between influent and effluent.

However, a plant needs proper infrastructure to install the fresh carbon and remove the spent granular activated carbon for furnace reactivation. Reactivated activated carbon costs about half as much as fresh or unused granular activated carbon. Granular activated carbon use is a continuous process, and it is a multiple- use product based on thermal reactivation. Thermal reactivation enables the carbon to be classified as "greenchemistry."

Where the possibility of industrial pollution is relatively high, more activated carbon must be readily available for possible emergencies. It can be kept in fixed vessels between the influent and effluent, and more powdered carbon is needed as well.

Finally, pellets, or extra-large carbon granules, are used to control vapor phase municipal wastewater hydrogen sulphide and other odors. These relatively large forms of activated carbon enable gas streams to flow through carbon beds uninhibited. This decreases the use of fans and energy necessary to blow gas streams through tight beds. Regular and catalytic carbons are used for hydrogen sulphide odor control.

With regular carbon, mobile hydrogen sulphide is oxidized to immobilized sulphur, which accumulates on thecarbon surface. Using elemental sulphur build-up on working carbon has determined when the carbon needs to be replaced with fresh carbon at laboratories. Catalytic carbons transform hydrogen sulphide to sulfuric acid by oxidation. Sulfuric acid on this catalytic carbon can be washed from used carbon with water and be reused on site many times.

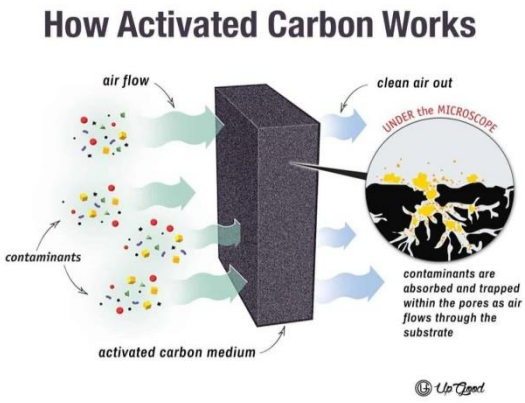

Fig -1 Working of filter

6. METHODOLOGY

Materials used are activated carbon, exhaust fan, acrylic sheets. The acrylic sheets were cut according to required dimensions so as to prepare the boxes. Two boxes were placed one over the other between which exhaust fan was placed. A hole was made on the box present at the bottom so that emission can be passed into the closed boxes with the help of pipe connected and extended externally. Activated briquette were placed vertically against the emission so that the pollutant traps into this activated carbon and only the purified or clean air passes through the filter and the pure air moves towards the exhaust fan and the readings were noted down from the both boxes before keeping activated briquette and after placing the briquette respectively. These readings were taken with the help of PUC testing machine.

MAJOR POLLU TANTS AND THEIR EFFECTS

The following are the major pollutants associated with emissions:

Ozone- The primary ingredient in urban smog, ozone is created when hydrocarbons and nitrogen oxides—both of which are chemicals released by automobile fuel combustion—react with sunlight. Though beneficial in the upper atmosphere, at the ground level ozone can irritate the respiratory system, causing coughing, choking, and reduced lung capacity.

Particulate matter- These particles of soot, metals, and pollen give smog its murky color. Among vehicular pollution, fine particles pose the most serious threat to human health by penetrating deep intolungs.

Nitrogen oxides- These vehicular pollutants can cause lung irritation and weaken the body's defences against respiratory infections such as pneumonia and influenza. In addition, they assist in the formation of ozone and particulate matter.

Carbon monoxide- This odorless, colourless gas is formed by the combustion of fossil fuels such as gasoline. Cars and trucks are the source of nearly two-thirds of this pollutant. When inhaled, CO blocks the transport of oxygen to the brain, heart, and other vital organs in the human body.

Newburn children and people with chronic illnesses are especially susceptible to the effects of CO.

Sulphur dioxide- Motor vehicles create this pollutant by burning sulphur-containing fuels, especially diesel. It can react in the atmosphere to form fine particles and can pose a health risk to young childrenand asthmatics.

Hazardous air pollutants- These chemical compounds, which are emitted by cars, trucks, refineries, gaspumps, and related sources.

Materials and its Properties

ACRYLIC SHEET

Acrylic (Poly Methyl Meth Acrylate or PMMA) is a transparent plastic known more commonly by the tradename "Plexiglass. The material is similar to polycarbonate in that it is suitable for use as an impact resistantalternative to glass. It was first produced in 1928 and was brought to market five years later by Rohm and Haas Company. It is generally considered one of the clearest plastics available.

ACTIVATED CARBON

A gram of activated carbon can have a surface area in excess of 500 m^2 (5,400 sq ft), with 3,000 m^2 (32,000 sq ft) being readily achievable.[Carbon aerogels, while more expensive, have even highersurface areas, and are used in special applications.

Under an electron microscope, the high surface-area structures of activated carbon are revealed. Individual particles are intensely convoluted and display various kinds of porosity; there may be many areas where flat surfaces of graphite-like material run parallel to each other, separated by only a few nanometers or so.

These micropores provide superb conditions for adsorption to occur, since adsorbing material can interact with many surfaces simultaneously. Tests of adsorption behavior are usually done with nitrogen gas at 77 K under high vacuum, but in everyday terms activated carbon is perfectly capable of producing the equivalent, by adsorption from its environment, liquid water from steam at 100 °C (212 °F) and a pressure of 1/10,000 of an atmosphere.

Fig 2. Activated Carbon

Fig -3 Exhaust fan

EXHAUST F AN

What do exhaust fans do?

Exhaust fans are used to pull excess moisture and unwanted odors out of a particular room or area. They are commonly found in bathrooms and kitchens, where moisture can build up due to activities such as showering,washing, or cooking.

They provide ventilation to areas, reducing chemical fume

Buildup and removing other contaminants that can be harmful when breathed in.

How do exhaust fans work?

Exhaust fans pull odors, fumes, and moisture from an area of the home, venting them outdoors for removal.The fan uses a motor to turn its blades, which function to pull air out of the space. The stale, humid, or contaminated air is propelled through the exhaust vent, exiting the home.

Exhaust fans operate using electricity. They can be controlled by a wall switch, or certain models are equipped with a thermostat that signals the unit to come on when certain temperatures are reached in the area.

BENEFITS OF EXHAUST FANS

Using an exhaust fan is very beneficial for the home, indoor air quality, and comfort of occupants.

- Exhaust fans can quickly cool down areas that have become too hot from activities such as cooking or showering. Hot air is vented outdoors, reducing the temperature of the space without using the air conditioning system.
- Exhaust fans remove excess moisture that can damage the home. Condensation from hot water use can build up on walls, ceilings, and other surfaces, leading to mold growth.
- Exhaust fans improve indoor air quality by removing humidity, odors, and contaminants. They provide adequate ventilation for areas where these air quality-diminishing agents can

build up. Stagnant air is ventedout of the home, allowing conditioned air to fill the space.

Fig -4 Working model

Fig -5 Working model

EXPECTED OUTCOME OF THE PROJECT:

1. Integration of commercial drones to existing publics, governmental and private infrastructure.

2. No air pollutants as all the drones operate on battery system.
3. The advantage of this system is ability to measure and purify the air pollutants.

4. Development in sensor technology that resulted in compact bundles packages that measured a variety of airpollutants and natural components.

5. It is economic, cost effective and eco-friendly.

7. RESULT AND DISCUSSION

By effective use of the above model, we come to the conclusion that the activated charcoal reduces the amount of pollutant present in air.

In our model we checked the pollutant content present in the emission of vehicle with and without activated charcoal, and seen that there is a reduction in the pollutant content with use of activated charcoal compared to non-use of activated charcoal emission.

The following are the readings got from emission test with and without activated purifier

Table -1: Sample Table

WITHOUT PASSING THROUGHACTIVATED CHARCOAL		**PASSING THROUGH ACTIVATED CHARCOAL**	
CO	01.661	CO	01.534
HC	009.31	HC	008.86
CO_2	04.31	CO2	03.98
O_2	13.07	O2	13.07

WITHOUT PASSING THROUGH ACTIVATED CHARCOAL		**PASSING THROUGH ACTIVATED CHARCOAL**	
CO	01.661	CO	01.435
HC	0.0931	HC	00.431
CO_2	04.31	CO_2	0.2.64
O_2	13.07	O_2	15.58
WITHOUT PASSING THROUGHACTIVATED CHARCOAL		**PASSING THROUGH ACTIVATED CHARCOAL**	
CO	01.529	CO	01.523
HC	00.862	HC	00.8860
CO_2	03.98	CO_2	03.96
O_2	13.67	O_2	13.76

CONCLUSION

It is economic, cost effective and eco-friendly. It is seen advantages in purification of the air and these can be made into panel structure and can implementinto the streets so as to purify the air. These panels automatically get rotated by the movement of vehicles and air is purified. These efforts will

definitely ensure the protection of our environment that is facing multiple challenges day by day.

REFERENCES

[1].Gallego E., Rosa F J. Perales J.F, Guardino "Experimental evaluation of VOC's removal efficiency of Coconut shell activated carbon for indoor air quality enhancement,67:14-25

[2]. Das D, Gaur V "Removal of volatile organic compounds by activated crabon fibers" Carbon 42:2949-2962

[3] Khan I.F, Ghoshal K.A,(2000) "Removal of volatile organic compounds from pollutant air" Journal of loss prevention in the process industries 13:527-545.

[4]. Shrimandilkar P.P., (March-April. 2013) "Indoor Air Quality Monitoring for Human Health"International Journal of Modern Engineering Research (IJMER) Vol.3, Issue.2, pp-891-897.

[5] Patnaik A., Kumar V., and Saha P., (2018). "Importance of Indoor Environmental Quality in Green Buildings", Environmental Pollution, Water Science and Technology Library 77, doi.org/10.1007/978-981- 10-5792-2_5

[6] Iqbaldin I.MN., Khudzir I.X., Azlan Mohd.MI., Zaidi AG., Surani, B., Zubri Z., (October 2013) "PROPERTIES OF COCONUT SHELL ACTIVATED CARBON" Journal of Tropical Forest Science, Vol. 25, No.4, pp. 497-503.

[7] Bansode R.R., Losso N.J., Marshall E.W., Rao R.M., Portier J.R., (2003) "Adsorption of volatile organic compounds by pecan shelland almond shell-based granular activated carbons" Bioresource Technology 90 175–184

[8]. Camufo D, Sturano G, Valentino A. Showcases: a really effective mean for protecting artworks Thermotic Acta. 2000; 365:65–77.

[9]. Schieweck A, Salthammer T. Emissions from construction and decoration materials for museumshowcases. Stud Conserve. 2009; 54:218–35.

[10]. Schieweck A, Salthammer T. Indoor air quality in passive-type museum showcases. J Cult Hermit. 2011; 12:205–13.