Smog Depleting Tower: A Review

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CHAPTER1 INTRODUCTION

Introduction of project work

The term smog was rose in19thcentury in London. During 20thcentury smog is ridiculous problem to developed & developing cities in the all over world. Smog effects on the lifecycle of human and city which causes disturbances and problems. This project shows smog problems evolved through the smog and their solutions. Smog depleting tower is the modern solution on this growing smogproblem.

Abstract

Tower contains a basic principle method of vacuum; at the top of towerpolluted air is pulled inside of the tower by vacuum action. Particles ofpolluted air are filtered by the action of ionic filtration with the help of high voltage current (1400kw). Dust particles contains positive charged. This positively charged dust particles are collected at electrode which contain negative charged particle and arrest dust particles. Ionic filters will charge and remove smog particles, blowing fresh air out of the tower's vents which are provided in tower. The tower is totally made of steel & it can be transportable. The electric energy need to the tower is can be produce easily from wind or solar energy (1400kw). Height of the tower is 23 ft. Tower best location is the center of the area, which is affected by smog or pollution. Smog depleting tower can clear the million cubic feet smog per hour. Means at a one day tower can purify the small town containing smog.

Problem statement

Smog is a kind of visible air pollution and the word „smog" is basically derived from the merging of two words; smoke and fog. In simple language smog can be defined as the combination of fog present in atmosphere & air pollutants. The main reason of smog is that pollutants are released directly into the air by gasoline or diesel run vehicles, industrial plants, etc. In general types of smog are Volcanic Smog, Photochemical Smog (firstly describe in 1950) Sulfurous Smog. This project is related to problems and solutions of photochemical smog caught incities.

Photochemical smog is generally produced in cities and it may stay there for long period due to calm winds. Major occurrence of smog is due to heavy motor vehicle traffic, high temperatures, and calm winds. Smog can form faster and be more severe on hot and sunny days. When temperature inversions occur and winds are calm, severe smog and ground-level ozone problems exist in many major cities.

- It is difficult to remove the particular matters in air by normal method in large areas.
- By other different method sit required large amount of cost.
- Fine particles size PM2.5 is hard to remove by other methods.

Objectives

- To provide cost effective solution for smog problem.
- To design and developed Smog Depleting Tower.
- To study the efficiency of Smog Depleting Tower.

Scope of projectwork

This method is effective method of smog resistance. The smog depleting tower collects the smog present in air and arrest smog particles. It runs on electricity. It can be applicable on buildings, public places & workplaces. Hence method is used in project. Why the smog depleting tower is is bold solution? Because, the smog free tower work independently with the high voltage electricity supply. It does not need any other material and negligible wastage is obtained in the result.

CHAPTER 2
LITERATURE REVIEW

Gabriela Penkova (June 2016) studied on Smog free project – saves the environment by turning smog into diamonds.

Smog depleting tower is 23-feet tall tower that vacuum in the smog particles. It is a 7.0 × 3.5m modular system, which uses energy-friendly and patented ionization technology lightweight construction with LEDs. The tower sucks in dirty air like a giant vacuum cleaner. Ion technology then filters it, before returning smog-free air through the tower‟s vents. By creating a field of ions, all the particles on the Nano scale get positively charged, therefore when the ground is negatively charged, you can drag them to the ground, and purify the air – 80 percent more clean. The great thing about the technology is that is safe and to have 30,000 cubic meters of clean air purified, it takes an hour and only uses about 30 Watts, which is like a light bulb, says DaanRoosegarde.

However, there are many issues associated with this project. Firstly, this tower is a prototype. It is only one and has to be transported around the world. Therefore, it is still tested and promoted in different countries. Roosegaarde‟s latest goal is to install his towers in 20 to 25 public parks in Beijing. He plans to offer leases to bring down costs. Yet, the task is not easy. “You have to build trust; it's China,” “It's a very sensitive, political topic.” he says. He would like to expand later to other developing nations like India and Mexico, which face similar air pollution problems.

Shih-Cheng Hu (February 2015) studied on Particles removal by negative ionic airpurifier in room.

This study investigated effectiveness of negative ionic air purifier in lowering the concentration of particles in a closed test chamber. The performance test was carried out in a closed test chamber under natural decay, as well as with an air mixing mechanism. Compared with natural decay, the air mixing mechanism could reduce particles concentration better (under the flow field condition). However, air change rate effect is limited in super clean rooms that require suitable approaches to enhance control of particles concentration and to raise the effective clean in grate of negative ionic air purifier.

study investigated the concentration gradient of particles at various heights and distances from the source of negative ions. Experiment results indicate that performance near the negative ionic purifier was better than in the rest of the clean room. In terms of height, the highest removal efficiency was observed at a height of 60 cm from the floor; it decreased substantially with increase in height. The empirical curves fit based for the concentration gradient of NAI generated was developed for estimating the NAI concentration at different heights and distances from the source of negative ionic air cleaner.

V.S.Sawant(Apr2013)studied on Control of repairable particles in indoor air with portable negative air ion generator.

Portable negative air ion generator has been designed and tested. This device generates continuous emission of unipolar (negative) ions and it was evaluated by investigating its ability to remove respirable particles such as different smoke verities (mosquito coil smoke, cigarette smoke, petrol smoke) from indoor air environment. The experiment was carried out in closed glass container, decay rate for particle concentration were obtained in presence and in absence of negative air ions. Theparticle removal efficiency was obtained and it can be observed that removal efficiency was highest for petrol smoke as compared to cigarette/mosquito coil smoke. The experiment confirms removal of about 95% respirable particles from indoor air in addition to the natural decayeffect.

In this study, we concluded that the designed Negative Air Ions can remove the aerosol pollutants such as variety of smokes in closed chamber. The particles are charged primarily by the diffusion charging mechanism. The particle removal depends on the ion emission rate. The rate of change of particle removal efficiency is slightly higher for petrol smoke as compared to mosquito coil smoke. This study results that about 95% repairable particles has been removed fromair.In future varying capacity ion generators will become an efficient tool for controlling airpollution.

Jae-HongPark(April2009)studied on Removal of sub micron aerosol particles and bio aerosols using carbon fiber ionizer assisted fibrous medium filter media.

When humans inhale, particles in the air enter the body. Micron particles are intercepted by the hairs of the nostril, but submicron particles can reach the lungand deposit in the alveoli. Bio aerosols are airborne particles with biological origins, including viruses, bacteria, fungi and a variety of living materials, and are known to be etiological agents of many diseases. Fibrous filters are used to remove these aerosol particles. However, it is difficult to remove submicron particles using fibrous filters, and the bio aerosol collected on fibrous filter surfaces can be cultivated and release bad odors.

It was proposed that the installation of an air ionizer in front of a fibrous medium filter will enhance the removal of submicron aerosol particles and bio aerosols. Continuous emission from an ionizer was found to increase the collection efficiency of a filter while not affecting the pressure drop in front of a fibrous medium filter will enhance the removal of submicron aerosol particles and bio aerosols. Continuous emission from an ionizer was found to increase the collection efficiency of a filter while not affecting the pressure drop.

V.S.Sawant(2012)studiedon Laboratory experiments on aerosol removal by negative airions.

In the present work an attempt is made to investigate the possibility of reduction of smoke collected in the closed container with the help of ion generator. For development of ion generator a high voltage power supply is designed and developed indigenously. The high output voltage is developed by using isolation transformer, autotransformer, and high voltage neon transformer and it is converted into DC voltage by using Wheatstone bridge circuit and high voltage capacitor. Formation of negative corona and voltage current characteristics of corona ionization was studied. By adjusting -8.5 kV electric voltage to discharge electrode, the performance of this circuit was tested for removal of mosquito coil smoke and petrol smoke collected in closed glass container. Various runs were carriedout.The light intensity was measured for each run as a function of time,in presence and absence of negative air ions generated by the discharge electrode of the

designed ion generator. After operating this device continuously for 6 minutes, 98% of the aerosol particles were removed from container in addition to thenatural decay effect. The particle removal efficiency increases with increasing ion emission rate and the time ofemission.

Artificial ionized air is commonly used for reducing particle concentrations in indoor environment. Daniels (2002) reported that negative air ions (NAIs) reduce aerosol particles, airborne microbes, odors and volatile organic compounds (VOCs) in indoor air. The particle removing mechanisms by NAI is due to particle chargingbyemittedionsandelectromigrationwhichincreasesmigrationvelocity of particles. Several studies have been conducted for particle removing efficiency using ionic cleaners to remove particles from the air. The high voltage used for ion generation produces Ozone above threshold voltage of 16000 volts. Hence precaution is to be taken to avoid Ozone production which is having negative effect on plants and animals. The ion emission has been tested by several investigators for its ability to reduce the indoor aerosol concentration.

Combustion of firewood, cigarette, tobacco, mosquito repellent coil, petrol, oil fumes etc leads to air pollution in the form of various gases and smoke particles, which are composed of various chemical components. Incomplete combustion results in the formation of polycyclic aromatic hydrocarbons (PAHs) and other chemical compositions. Removal of the atmospheric pollutants such as suspended particle, pollutant gases such as CO, NOx and Volatile organic compounds is urgent need of the future to control global warming and Ozone production in troposphere. Ozone in troposphere levels is highly poisonous for plants and animals. The Oxygen ion production using corona discharge is powerful tool for removing effect of above pollutants along with removing suspended biological species.

BinaRani(2011)studied on Photo chemical smog pollution and its mitigation measures.

Photochemical smog is a unique type of air pollution. In the 1940s a new type of smog, known as photochemical smog, was first described in Los Angeles. Major

Air Pollutants responsible for photochemical smog are carbon oxides (CO, CO2) , nitrogen oxides and nitric acid (NO, NO2, HNO3), sulphur dioxide and sulphuric acid (SO2, H2SO4),

suspended particulate matter (SPM) ,ozone (O3) ,volatile organic compounds (VOCs).The reactions that lead to the formation of photochemical smog. Photochemical smog is a serious problem in many cities and continues to harmful for senior citizens, children, and people with heart and lung conditions such as emphysema, bronchitis and asthma. Vegetation s easily harmed main agents of damage are ozone and PAN. Smog can also accelerate the deterioration of rubber, plastics, paints and dyes, damage to metals, stone, concrete, clothing, rubber and plastic is directly related to contaminants in the air. Photochemical ozone concentrations can be decreased by reduction in hydro carbon and other VOC emissions and by reduction in NOx but there is an on- linear (and sometimes inverse) dependence of ozone production on precursor emissions have developed models to predict ozone concentrations and their response to different control measures.

Nagoya.J.(1979)studied on Effects of photo chemical air pollution on the human eye concerning eye irritation.

This paper is presented to make both ocular symptoms and signs clear, by means of some experiments on the eye affected by photochemical air pollution. This paper summarizes three experiments, these results and discussion. The first series of experiments were performed in order to research eye irritation caused by photochemical synthetic irritants. They proved the threshold of eye irritation and the grade of irritable pollutants. Effects of photochemical air pollution on the human eye were epidemiologically investigated in the second series of experiments. Tear lysozyme and tear pH were chiefly traced as factors of the affected eye. In the third series of experiments, hen egg lysozyme was examined under various synthetic pollutants to seek what substances reduce the tear lysozyme. As a result, it has been suggested that ozone (03) was primarily responsible for its reduction under photochemical smog. Finally in this paper, it has been discussed why ocular symptoms and signs occurred in photochemical smog.

Paper details	Publication details	Findings
To calculate smog depleting tower test around pune ,Maharashtra india	Jr. of industrial pollution control 28 (1)(2012) pp 41-44 EM international printed in india . All rightsreserved.	The peper aims to study area is in and around pune,town were several stone units are running following CPCB (Central Pollution Control Board,India) norms to feed crushedstone for various health problem.

Study Area.

Indira college of engineering campas which is located at 3 km next to talegon.It's a develop area of around 108 acres,which is continuously under the influence of Crushing unit

CHAPTER 4
METHODOLOGY

Table No:-1 Data Collected
(ref.Jae-hongpark)

Air Quality Index Particulate matter	Min	Safe At Under	Max
AQI For PM 25	91	50	142
AQI For PM 10	64	50	86
AQI For O3(Ozone)	22	50	114
AQIForNO2(Nitrogen dioxide)	34	50	81
AQI For CO	15	40	50
Temperature	$11^{o}C$	$27^{0}C$	$36^{o}C$
Humidity	24%	50%	92%

Procurement ofMaterial

The materials required for a prototype model of Smog Depleting Tower are ion generator, Air blower, Emission measuring device. These materials were procured from various online vendors.

Development ofModel

- We constructed a small scale prototype model of Smog Depleting Tower having a scale ratio1:25.

- Also we conducted experimental testing on this prototype using trial anderror

  techniques.

5 CONCLUSION

From the above experimental analysis we can conclude that,

- SDT can be used as cost effective equipment to reduce gaseouspollutants such as CO, CO2 etc. Hence it is very useful to face novercome upcoming problem of smog formation around the world.
- Existing prototype model with minor modifications can be implemented on life size scale to achieve maximum efficiency in removing various air pollutants present in air.
- The efficiency of Smog Depleting Tower studied in this project work came to be 95.95% which can be considered asgood.

6 REFERENCES

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