

New Techniques for the Prevention Control of Smog and Air Pollution in Pakistan

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Abstract

Smog is one of the most concerning issue for Pakistan, confronting some prior years. Exhaust cloud is a blend of Smoke and mist which is framed because of air contamination of NO_x , SO_x communication with the mist or water vapors and ground-level ozone. we have talked about the reasons, impacts, new strategies to control or tidy up the pipe gases (Water Showering truly outstanding and conceivable arrangements which surrendered the most extreme accomplishments to 70 to 80 percent to evacuate the contaminations, water ingests the toxins and clean gasses move towards condition), past innovations, and 6 new systems (like DME, gas to fluid, Liquid Air, Hydrogen added substance and some more) to anticipate of both air contamination and brown haze. High transports, employments of non-renewable energy sources, unburnt ignition motors, and our processing plants discharge their toxins in a domain which are the reasons for air contamination and it prompts making exhaust cloud in temperature reversal season like winter. Consequents of these issues Pakistan are confronting their kin passings, harms, and different risky human sicknesses.

Keywords: Smog; Air and air pollution; Environmental effects; Global warming; Health hazards; Technologies

Introduction

Smog

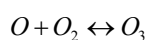
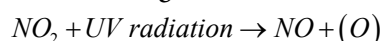
Smog is fundamentally a blend of smoke and mist. Exhaust cloud is the Chemical contamination of the air which are caused by the human exercises. It is a yellowish or blackish mist which is framed by a blend of barometrical contaminants and the ground level ozone. Exhaust cloud which is framed now daily can be characterized as the blend of the gasses with residue and water vapours. This is done because of the augmentation of poisons in climate [1,2]. That was caused by the consuming of coal. Brown hazes which are seen in present days are because of the fumes gases delivered by the vehicles and industry. Exhaust cloud comprise of the particles from smoke, Sulphur dioxide and different segments when presented to the daylight they respond and frame the auxiliary mixes. These optional mixes then mixed with essential emanations which make petrochemical brown haze. Environmental contamination in city Lahore, Pakistan and in different urban communities is increasingly detectable when the reversal traps the tainting near the ground. There are two sorts of exhaust cloud one of them is decreasing brown haze and other one is oxidizing exhaust cloud. Diminishing brown haze is the assignment for the blend of city and modern exhaust cloud with fog, happening amid the year. Contingent upon the modern contamination, winter exhaust cloud is principally made from Sulphur dioxide and others certain substances which are liable to oxidation effectively. These substances have a solid diminishing impact on their environment. The oxidizing exhaust cloud was found in California City in twentieth century. This sort of brown haze has solid oxidation, forceful chafing and poisonous impacts [1,3]. Some after figures are demonstrating the brown haze issue in various urban areas of Pakistan.

How smog is formed

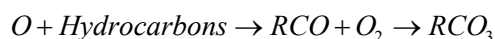
The atmospheric contaminations and the gasses which are the reasons for making brown haze are out noticeable all around when coals are singed. Brown haze is shaped when the daylight and its warmth interrelate with these gases and fine particles of air which is because of the air contamination. At the point when the responses happen in

light between the unpredictable natural mixes (VOC), Sulfur dioxide (SO_2) and nitrogen oxides (NO) the ground level ozone and fine particles are discharge in climate. These all unpredictable natural mixes, Sulfur dioxide and nitrogen oxides are antecedents [1,4]. The primary wellsprings of these forerunners are poisons which are discharged from gas, diesel motors, modern plant and other warming exercises. It is frequently caused by the high temperatures, substantial traffic and other temperature sources or dampness, these are couple of fundamental factors behind the expanding of brown haze issues. Wind speed is low amid the winter season because of this reason smoke and haze is stagnate at one place which are primary driver of making exhaust cloud and turn out to be extremely destructive for the general population on ground level [1,4,5]. It irritates nature and our perceivability locale. Brown haze just relies upon temperature because because of the temperature reversal wind or air can't move upwards and remain on ground level which serves to from exhaust cloud.

Reactions of smog formation



Ozone so formed oxides NO to $\text{NO}_2 + \text{O}_2$

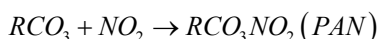
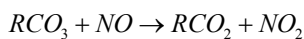
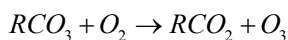
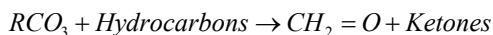


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Received December 25, 2018; Accepted January 30, 2019; Published February 05, 2019

Citation: Usman M, Aamir HM, Naz Iqbal HF, Arshad HA (2019) New Techniques for the Prevention Control of Smog and Air Pollution in Pakistan. Environ Pollut Climate Change 2: 166. DOI: [10.4172/2573-458X.1000166](https://doi.org/10.4172/2573-458X.1000166)

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The presence of excessive O₃ along with aldehydes ketones, produce PAN Photochemical Smog.

Effects of smog

Exhaust cloud is exceptionally destructive to people, creatures, plants notwithstanding for entire nature because of its parts that makes it. Because of brown haze numerous individuals passing's were recorded or numerous different hazardous ailments. Substantial exhaust cloud overseas decreasing the bright radiations. Heavy weight exhaust cloud outcomes in a low production of the critical component of nutrient D essential to instances of rickets among individuals. Exhaust cloud can be the reason for digger issue to the hazardous illnesses which can be lethal, for example, lung malignant growth [1,6]. Numerous different issues are expected to of exhaust cloud like aggravation in the eyes pneumonia. That is the reason we ought not move in outside in exhaust cloud since it can influence on your body and primary dangers of asthma assaults since individuals are enduring this infection. The very influenced individuals included old, kids and those with cardiovascular and respiratory grievances. Brown haze is additionally a principle reason of mishaps on streets and numerous individuals have lost their lives because of this [6]. As per the news reference date 19/1/2018 report there are parcel of passing's happen close around 20000 because of the exhaust cloud in Pakistan in Figure 1 [7].

Reasons of increasing the air pollution in Pakistan

There many different factors behind the increasing of air pollution in Pakistan some of them are given below

1. Increasing the pollution day by day
2. Globalization

3. Urbanization
4. Usage of heavy transport
5. High temperature or sunny climate
6. Bricks making fireplace
7. Lack of gardening

Increasing of population means increasing of needs and demands of people which lead to the pollution.

Sources of air pollution

Some of the above-mentioned air pollution are released to the environment during the burning of coal or combustion of fuels like petroleum, wood, coal and many more. Some of the examples are given below for these air pollution

1. Vehicles runs on fuels like gasoline and diesel e.g. cars, trains, trucks...etc
2. Industries and factories
3. Power sectors
4. Fireplaces
5. Engines where incomplete combustion

Pollutants mix with air through evaporation also some sources of such like air pollution are

1. The places where solvents are paints used.
2. There are service stations, fuels terminals and other refineries.
3. Storage tankers of petroleum and their transport.

High temperature and bright days are additionally turned into the reason of expanding an unnatural weather change. Generally, contaminations are discharged in the earth by vehicles, manufacturing plants, enterprises which comprise of the results of nitrogen oxides and other natural mixes, which are respond with one another to frame ozone which are the principle element of brown haze. Amid the winter season temperature reversal can trap minor particles of smoke and other fumes from vehicles like autos, trucks, chimneys and other fuel consumed motors. Because of this the contamination holds near the ground level correct where individuals are living.

Methods and Technologies Available

Methods to clean the flue gases and control of air pollution

Air release restrictions have turned out to be stricter over the most recent couple of years because of expanding worries around the impacts of air contamination. Directions at the government and national levels have decreased admissible outflow rates of numerous mixes and will keep on being updated to manage more wellsprings of air contamination as regarded proper. Sources subject to emanation constraints frequently need to regulator a substantial piece of their outflows with an air contamination control gadget. Sources not particularly subject to an outflow constraint may likewise need to control emanations in view of limited impacts of discharges. Such impacts can be hardware harm from long haul introduction of unprocessed releases, effects of outflows on particularly touchy territories, and inordinate effect because of area of the cause. The innovations and midair contamination regulator techniques that should be careful while assessing emanation control can be single of three methodologies: additional controls, reformulation, or

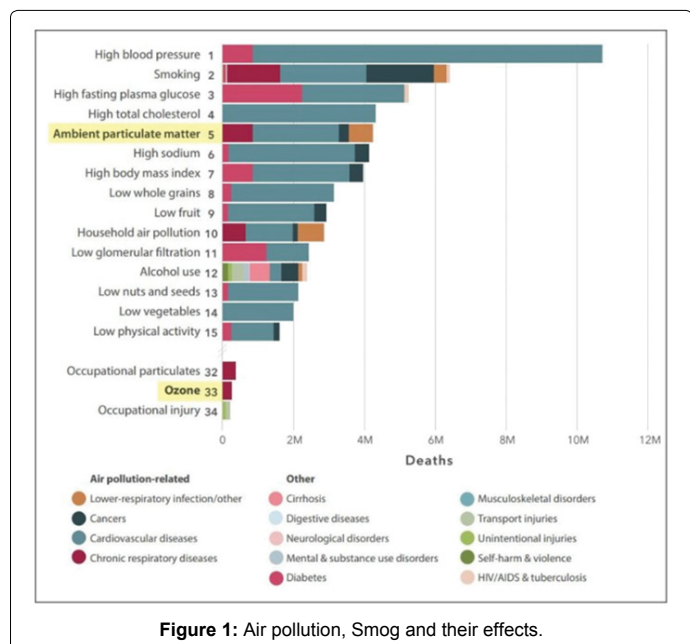
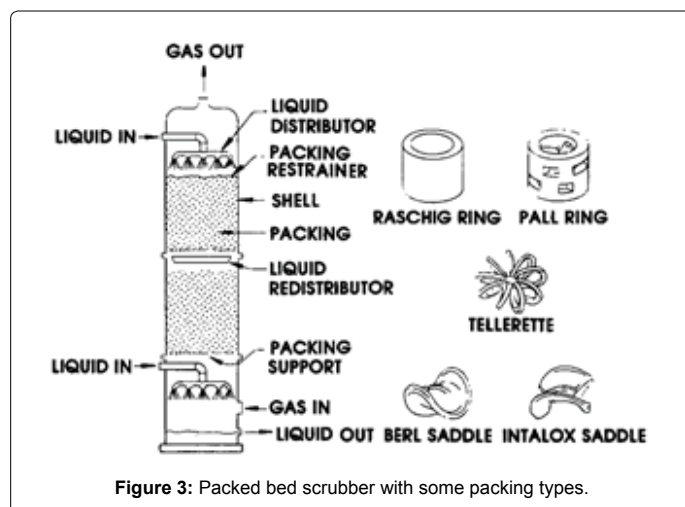
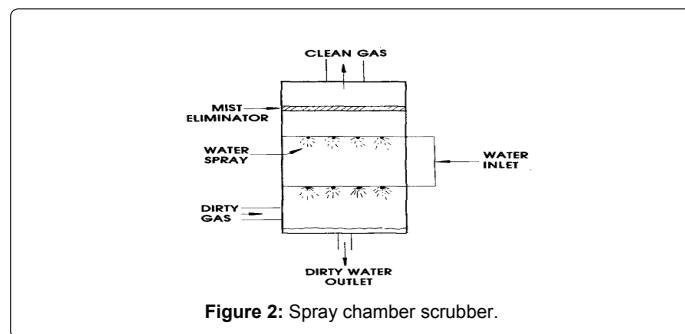
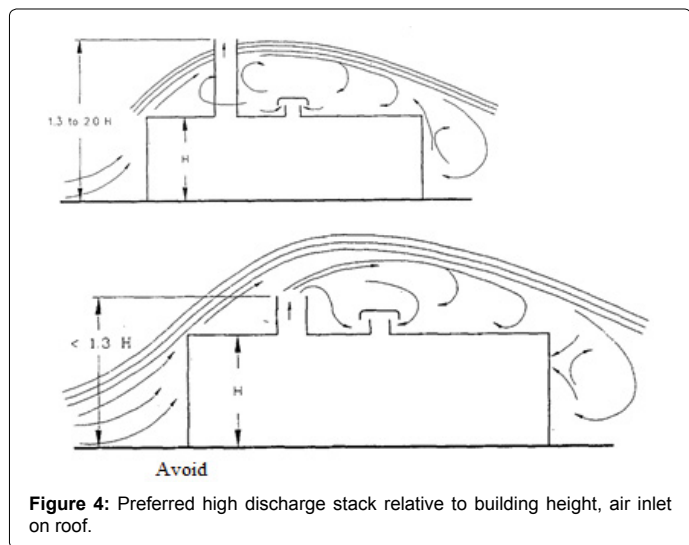


Figure 1: Air pollution, Smog and their effects.

procedure change. In deciding the essential level of control, every one of the three of these requirements be considered as conceivable decrease strategies. Frequently, the last two strategies are ignored, yet it is to the greatest advantage of a source to think about all decrease methods. Further, administrative organizations will regularly require such a complete assessment [8-10]. The conventional strategy for contamination control is the extra control gadget. A few sorts of extra gadgets for control are furnaces, condensers, carbon absorbers, scrubbers, and texture channels, to give some examples [10,11]. These components are put on the fumes watercourse from the procedure and have the benefit of needing insignificant changes in the development itself, Such devices, be that as it may, are frequently exceptionally costly to buy, work, and keep up and can additional one contamination issue (air) for added (tainted aquatic release or hazardous waste age). Be that as it may, these gadgets, frequently alluded to as end-of-pipe controller, are important as a rule [9-11]. The sort of contamination issue will manage the kind of extra control gadget utilized. In the metal-completing engineering, contaminations of apprehension are unpredictable natural mixes Volatile organic compounds and corrosive/soluble base fogs/particulates and gasses. The most widely recognized wellsprings of Volatile Organic compounds in metallic completing are cleaners contained in dyes, layers, and natural dissolvable cleaning activities. Corrosive/antacid fogs are entrained in the nearby fumes freshening of several completing activities. Possible likewise exists for different outflows, for example, cyanide mixes, and to a little grade, metals [10,11]. The accessible switch gadgets designed for every one of these issues can be isolated into two classes, Volatile organic compounds switch and particulate regulator. Volatile Organic compounds, the significant focal point of considerable air contamination direction, need refined controller methods. Furnaces or max engine thrust oxidize organum's to CO₂ and liquid and are originate on some covering activities. Entanglements emerge from wasteful ignition or pollutants other than basic hydrocarbons in the fumes stream. Contingent upon the Volatile organic compounds being measured, the kiln itself may need a regulator gadget to evacuate bothersome results of ignition, (for example, HCL because of a chlorinated composite being singed), The benefit of cremation is that, under legitimate conditions, there is no optional transfer concern. Interestingly, other volatile organic compounds control gadgets don't pulverize poisons, however gather them for reprocess or transfer [11,12]. Condensers work by refrigeration the air brook to a theme wherever the organum's consolidate to a fluid and are gathered. Carbon absorbers authorization the polluted fumes stream finished a divan of introduced carbon, which holds the low boiling points liquids. The carbon is formerly exposed of the adsorbed Volatile organic compounds by warm and the organa are gathered. In the metal-completing manufacturing, drizzly authorities (additionally called scrubbers) are the greatest suitable contamination switch gadgets for expelling corrosive/soluble base toxins [11,12]. In the least difficult scrubber, a splash cavity scrubber (Figure 2), water droplets are persistently showered interested in the gas stream, anywhere water-dissolvable pollutants are consumed by the drops. The admirer pulls the air over the splash and a mist eliminator, and afterward discharges it to air, permitted of the liquid-solvent impurities. The fog eliminator deceptions aquatic beads and fogs conveyed by the energy of the midair from actuality discharged through the heap [13]. Pressed divan scrubbers (Figure 3) remain the greatest capable of the generally utilized rainy gatherers. They stand like splash cavity scrubbers yet are loaded up with a pressing substantial that expands gas fluid interaction. The vapor stream goes in the chamber after the base and the retaining fluid (regularly aquatic) is showered on the pressing substantial since



the best [14]. The aquatic streams descending finished the pressing, while the vapor stream goes rising through the pressing and water. The expansive superficial territory for gas-fluid interaction kinds pressed divan scrubbers exceedingly capable for together water-solvent vapor and fog expulsion. Albeit record scrubbers can promptly accomplish fog expulsion efficacies of 90% to 99%, it is critical to pick the correct scrubber to expand its vaporous evacuation productivity. The bodily and substance attributes of the air stream are essential when settling on the kind of scrubber required. Attributes, for example, capacity of gathered air, pollutant dissolvability in liquid, safety of the pollutants in the gas watercourse, and beads might show an inclination intended for a specific kind of scrubber [11,14]. When a scrubber takes selected, convinced highlights can be included or different that will expand the scrubber's proficiency. Establishment of high-weight spouts accomplishes littler bead estimate and higher bead speed, which builds gas-fluid contact and in this way expands the expulsion proficiency of a splash chamber scrubber. In any case, high-weight spouts plug effectively and are costlier. Acquainting the wind current with the shower chamber scrubbers extraneously will force a winding movement to the air stream. The winding movement will drive a vast level of the air stream to the dividers of the chamber anywhere the splash is coordinated. The pressing quantifiable in stuffed bed scrubbers can be altered to build superficial region then Figure 4 the highest release heap in respect to structure stature at top is favored. The little release stack with deference to construction stature and air channels" (base) ought to be maintained a strategic distance from. These above figures spread over just to the basic instance of a little working without encompassing deterrents on sensibly level territory. Letter that little mass on the cover of a structure might cause the arrival of pollutants into the working



through introductions along these lines, gas-fluid interaction. A liquid re distributes halfway over the pressing redispenses the liquid stream equitably to guarantee unchanging water stream all through the scrubber. In any corrosive cleaning framework, keeping up an antacid pH will likewise expand expulsion proficiency [14,15]. Shower chamber scrubbers for the most part utilize framework where the retaining fluid is gathered at the base of the hollow and after that is totally expelled from the framework. Stuffed divan scrubbers recycle moderately a lot of the gathered retaining fluid once more into the shower stream. Tainted retaining fluid is expelled from the distribution circle at around 0.1 to 0.3 gpm/1,000 CFM of fumes midair. The engrossing fluid distribution is around 5 to 15 gprpd l000 CFM. Distribution proposals cost funds through lessening the amount of crisp retaining fluid required to work the scrubber effectively. Consumption safe platinum sheets are utmost ordinarily utilized for development of scrubbers and deplete taking care of channels in the electroplating and metallic completing industry. PVC scrubber lodgings are ordinarily manufactured of inflexible PVC or of FRR Internals are normally a mix of PVC, FRR and polypropylene, and occasionally tempered steel materials. On the off chance that water-recycling cumbers are found outside, distant inside sumps built of erosion safe resources are obligatory for solidify assurance. Rainy scrubbers are not appropriate gadgets for volatile organic compounds control because most volatile organic compounds are unsolvable in the water-based engrossing fluid. Depletes from forms utilizing volatile organic compounds ought to be isolated from all watery procedure depletes. National air value experts may need control of huge amounts of volatile organic compounds by actuated carbon adsorption, warm oxidation, or process changes [15,16].

Beginning expense ought to be one of various elements to study when acquiring air contamination control hardware. The physical and substance possessions of the pollution issue, and additionally the upkeep, benefit, and operative costs, might be coordinated with the accessible controller innovation to guarantee the greatest productive buy. The most ecologically stable and regularly financially savvy technique for contamination control is process alteration. Now and then, with direct exertion, less contaminating methods for accomplishing the same outcome can be create. New plans of numerous coverings layers and other volatile organic compounds containing mixes be that have diminished or wiped out natural diluents. Many liquid-based paints

are promptly accessible with execution like customary dyes [15]. There is steady improvement of original plans that hold Tess volatile organic compounds and are as simple to use as past items. In genuine electroplating activities, some of the time less dirtying options can be originate. The supplanting of cyanide plating tasks with no cyanide activities takes out cyanide outflows. Procedure changes can be a troublesome course to trail in outflow decreases because of the horde decisions occasionally accessible, and the shortage of direction offered by administrative authorities.

Technologies for the control of air pollution

From numerous years, there were covers between our experts who oversee the air contamination control and their techniques, procedures or systems for the anticipation of air contamination. They attempted their best to plan and appropriate hardware yet at the same time there are some cover. Due to this our country confronted numerous issues are as yet confronting like, wellbeing perils our condition aggravate air contamination are expanded step by step. Here are some key purposes of these covers:

1. Fixed the pollutants emission limits
2. All emission sources should be identify
3. Find out the modification for the process
4. Define the problems
5. Selecting the control systems for problems

Fixed the pollutants emission limits: The first and introductory issue for the air contamination control is the impediments for the toxins discharge in the earth by enterprises, household or different sources as per the national air quality guidelines. The air quality standard for the outflow for Pakistan are characterized however there is some lack to apply these principles which are the reason for the expanded contamination step by step and face numerous issues [17].

All emission sources should be indentify: After the restrictions of the emanation the second step is to recognize the sources there are numerous sources, ventures, local, control parts, transports, and human exercises. A portion of these are low emanation sources however some discharge their outflows in uncountable points of confinement. There the numerous different sources which are excluded in the above which are unintentional discharges, undesigned emanations and re outflow.

Find out the modification for the process: After the study of the process, it should be considered to modification in the process to efficient for the emissions control. This type of control modification often shows the economical and efficient way to reduce the emissions and the loss of equipment controls. There are some techniques to make it efficient for reduce emissions

- i. Less toxic or less volatile solvent
- ii. Replacement of the raw materials with purity
- iii. By changing the Operating conditions
- iv. By recycling of the streams

Define the problems: The final step before the section of the control is to define the problems created and their properties because without know this, we cannot select the proper control system for the problem created by the emission of the pollutants from many sources. For the besic data is required like temperature pressure, composition particulate size, gasses, liquids, vapors, pollutants, flowrates, physical

and chemical properties like solubility, reactivity, toxicity and many other necessary for the stream.

Selecting control system for problems: There are many factors involve for the selection of any system because our system should be economical, efficient and should be reliable for everyone. Some of the main factors are discussed below in the categories of environment, engineering and economics. Because the knowledge of all these above fields are essential to select the system.

Main factors in environment related are: locations, sites, conditions, availability of the labor, utilities, facilities, pollution emissions limits, wastewater, noise, effluent and many other like that. In engineering side factors like chemical and physical properties of the pollutants, particle size, toxicity, volume. Flowrate, temperature, pressure, humidity, and many others in the designing of equipment's, material, feasible, flexible, efficient economical and some limitations' in term of economic factor the cost of equipment, engineering and installation, operating cost like utilities, operations and maintenance cost and their life time value.

The control system of air pollution is designed and select for the requirements and conditions of the pollutants in the air or gasses like:

Control systems for particulate: There are some equipment's which deal with the size of particulate, some of these are settling or gravity chamber, cyclone filtration, bag filters, precipitates and wet scrubbers [16].

Control systems for gasses and vapors: Equipment's or methods use for the gasses and vapors are wet scrubber which is used for adsorption, absorption, chemical oxidations, biofiltrations and scrubber, and chemical reactions of ozone by ultraviolet light [16].

New Methods or Techniques

Six new technologies which can be improved the air quality

It would not be wrong to say that there are very improvements needed for Pakistan to improve the atmosphere clean for the survival. Air pollution is one of the serious problems for Pakistan. Here are some new techniques which could help to improve the quality of air [18].

1. Gas to liquids
2. Hydrogen fuels additive
3. Autonomous vehicles
4. Liquid air
5. Photo catalytic material
6. Air purifications

Gas to liquids: One of the best option to tackle the air pollution is to change the fossil fuels engine to the alternative fuels. Electric and LPG option are also given but there are many other options to reduce the air pollution. For example, Shells has advanced the new artificial gas to liquid which is derived from the natural gas and can be used for the place of diesel. Shells gas to liquid expertise change the natural gas which is cleanest fossil fuels to the high-quality liquids goods that would otherwise made by crude oil. For this type of fuels, no need of modification in the engine design. After the testing of gas to liquid fuels, use in heavy traffic and other vehicles, it could reduce the 5 to 37% NO_x and 8 to 10% particulate matter. Similarly, natural gas could be change in to dimethyl ether which ca used to reduce the approximately 25% of the NO_x .

How the Gas to liquid production process works: There are three different stages to produce Gas to Liquid

1. In the first phase synthesis gas, a combination of hydrogen and CO, is manmade from normal gas by fractional oxidation. Impurities are detached from the syngas.

2. A second phase changes the mixture gas into fluid hydrocarbons using a reagent. In this phase, a liquid is shaped which looks and feels like wax at room temperature.

3. The last stage is furious and isomerization, which "modifies" the particle chains into products with anticipated goods. This yields high-quality liquids such as diesel, fuel and lubricant oil.

The emergence of DME as a diesel replacement: Several OEMs have been exploring the potential for DME as a clean diesel replacement for over 20 years. The core focus has come from companies in Japan/Korea, Scandinavia and in the USA, most recently with Ford's announcement to investigate DME as a fuel for passenger cars. The motivating force behind this activity is the realization that when used in a modified diesel engine, DME can perform very well as a diesel replacement, but with a much lower level of emissions. As DME has no carbon-carbon bonds, there are no soot emissions. Other SO_x and NO_x impacts are also much better than that of traditional refined diesel. With GHG emissions and an increasing focus on low carbon fuels and air quality, momentum is rising on the emergence of DME as a diesel fuel. Aum Energy seeks to be at the forefront of these developments and to provide all the assistance that local project developers require to start building small-scale GTL facilities, thereby creating a supply and distribution capability [18].

Uses of hydrogen fuels additive: With the help of additive, we can reduce the emission of pollutants and increase the combustion cycles in the existing vehicles used in the daily life. The UK developer has introduced a new technology zero1 by this feeding of the small amount of hydrogen in the engines of heavy vehicles can make the efficient combustion of fuels. Tested showed that it can enhance the efficiency of combustion and reduce the NO_x , particulate, carbon dioxide, carbon monoxide and other hydrocarbons emission.

Autonomous vehicles: Now a day which trend is looking forward for the selection of automatic vehicles are autonomous vehicles which can drive automatic. And this type of modification is very necessary for all of us because automatic vehicles drive on a network and would not stop like when people drive car. A previous study shows that we can improve the fuel efficiency by 15 to 40% and can reduce the local pollutants emissions by autonomous vehicles.

Liquid air: New technologies for the reduction of emissions of pollutants in atmosphere are being developed. For example, due to increase of population in the cities of the Pakistan the sources of pollutions are also increased major of them are the air conditioners, refrigerated buses and other vehicles. There are uncountable vehicles move on the roads of of Pakistan and emits 29 times more than particulate matters and 6 times of the NO_x as the modern research. Because of this researcher and developing countries and technology Dearman try to change toward liquid air which will produce zero emissions on the roads.

Photo-catalytic materials: Our researcher and professionals are tried to produce an alternative way to reduce the emissions of pollutants in the environment or air. For example, many multinational and national industries use the photo catalytic treatment which remove the pollutants form the air in the presence of sunlight. These types of treatments can be uses for the range of surfaces. According to the

recent published report of environmental industries commission that photo catalytic treatment on the roads are the cheapest way to reduce the particulate matter and NO_x pollution. Although new methods and knowledge would be required to find its potentials for the reducing of emissions.

Air purifications: Researcher and professionals are also looking forward to finding out the technologies or methods to clean up the air of urban environment. A Dutch designing company Studio Roosegrade, has developed a smog free tower which is used to sucks the pollutants from the air and emit the clean air in the atmosphere. The first tower was installed in the Rotterdam, and the inventor claimed that the single tower can clean the 3.5 million cubic meters of the air per day.

Results and Conclusion

Air contamination and brown haze arrangement are among the most concerning issue of the Pakistan. In this paper we have attempted to defeat these Challenge. We have talked about the water showering techniques to clean the vent gasses which discharges from the vitality and a wide range of parts. We have seen that most extreme toxins can be expelled by this technique from the vent gasses. Furthermore, clean gasses can be emanating in the earth decisively. As per our insight this strategy is just a single of the plausible and efficient which we saw amid our examination and the hypothetical work from many research papers. We have talked about the past advancements and new methods like, DME, Gas to fluid, Liquid Air. And so forth which can be useful to secure our condition on the off chance that we would acknowledge and apply it on our condition.

Declaration and Acknowledgment

This is a review and research paper, written by us to acting for the current issue of Pakistan which are highly affecting on our health and environment. All the above data have been taken by some useful sites and Environmental protection authority sites and survey data, because

of no proper research in Pakistan for this problem. We have no funding sources for this paper. It will be honor for us if our paper is accepted for you highly esteemed journal.

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