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Method Controlling Smog in Pakistan: A Review

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Abstract

Pakistan is vulnerable to smog from the last two to three years especially in winter season and it produces haze in the atmosphere which is ultimately vanishing due to rain and it badly affects the public. Smog is related to air pollution and it causes eyes, nose, lung, throat infection which is allergic one and spread rapidly and causes fever and skin diseases. In this article number of factors and reason behind that are vehicle emission, urbanization and burning of waste are discussed and how to mitigate and prevent our atmosphere. So there is a need to cope up this problem through long term planning that is better for the public and for our future generation.

Keywords: Smog, Pollution, Nox

1. Introduction:

The Punjab is badly affected due to smog from the last three years and there is a need to save the environment for our sustainability. Number of factor contributing in smog formation is vehicle emission, furnace oil based thermal power plants, Brick kiln emission, wheat husk, burning unwanted herbs, coal thermal power plants, burning of plastic includes toys, pipes water storage tanks, pipes, utensils, disposable cups, buckets of paints and house hold usage, plastic bags, waste packing fruits, formation of NO_x from the nitrate and urea plant, paper burning, explosive and dynamite that is used for the breaking of stones and large number of industrialization and private housing societies also contributing in this problem.

Being Asia the most populated region of the world is facing depletion of its various resources to meet the demands of this growing population artificial methods are used to fulfill its demands which is

another challenge for the environment. Government should take responsibility to launch or to educate the society how to control the population because as the population increases the requirement of society increases.

2. Health Effects:

Smog is related to air pollution and it causes eyes, nose, lung, throat infection which is allergic one and spread rapidly and causes fever and skin diseases especially in the winter season. It causes haze in the atmosphere when it mix with the water vapors it becomes more thick layer in the atmosphere which ultimately leads to poor visibility and even the flights were diverted towards other stations [1]. In the winter season due to smog the General Trunk road number of accident happen and people loss there precious life and other one got severe injuries and even the motor way was closed. Other associated problems related with are schools were closed and staff can't reach their duties on time [2]

Following are the main reasons which contribute in the smog

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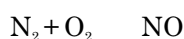
2.1 Vehicles:

Pakistan is a populated country and to meet the demands of the nation government import used vehicles and there is need of the proper maintenance to control the pollution or un-burnt fuel [1]. Vehicles emissions are hydrocarbons and volatile matter which is in the presence of sunlight photochemical reaction takes place and that is the main source of smog. Government should upgrade the trains and also educate the nation to shift towards or benefits of train and this economical.

2.1.1 NOX Reactions:

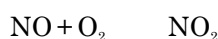
Step 1

Vehicle emissions are oxidation of nitrogen



Step 2

In another oxidation reaction nitric oxide oxidizes to form nitrogen dioxide



Step 3

In the presence of sun light reduction reaction takes place



Step 4

Atomic oxygen is very reactive and reacts with the oxygen to form ozone



Step 5

Another reaction which is also temperature dependent



Alternative reaction:

Oxides of nitrogen also react with hydrocarbons and form other volatile compounds in the presence of sunlight [2-8]

As Pakistan is an agriculture country and due to overpopulation the unnecessary housing societies are unfortunately are working in each city and its numbers increases day by day which ultimately reduces the cultivated Areas and other resources also depleted due to this reasons. In new housing societies contractor construct new roads that causes dust which is the main source of air pollution causes eyes, lungs diseases [1]. Housing Societies also

promotes the luxury items which fascinates the consumers. Paints, varnishes, Distemper which are used in these housing societies also produce volatile matter that also promotes smog. As metal and woods life is enhances due to Paint and Varnishes. Otherwise it corrodes or de-torriated due to insects and ultimately worthless. To use paint on the wood or metal thinner is use to easily apply generally kerosene oil, spirit and varnish are used for this purpose. As these are volatile matter and retain in the atmosphere and due to photochemical reaction it produces smog. There is a need to synthesize such type of thinner that are easily available less harmful to the environment and economical.

3. Burning of Waste:

Waste are of many types and there are proper disposal of waste but unfortunately wastes are not properly dispose and burn in open atmosphere which causes smog.

1. Agriculture waste
2. Plastic Waste
3. Industrial Waste
4. Paper and Board waste
5. Waste Rubber tiers
6. Bricks Kiln

3.1 Agriculture waste:

Pakistan is an agriculture country and our economy is mainly based on this factor and due to harsh weather conditions and laborious tradition technology of harvesting the crops is difficult so due to this reason we should rely on advance technology and there is disadvantage behind this method is to use harvester and thrasher that cause fine dust particles. Burning of unwanted wheat and rice husk causes air pollution [9]. Our land is quite fertile and unwanted herbs are also grown easily on the fields that should be manually crushed but we rely on the herbicides and pesticides or to burn them. But it is quite better way to cut them and bury them to control the smog. This is only done to educate the former about to save the environment. Unwanted herbs are grown in the spring season of each year and these should be manually cut them that there seeds cannot grow next year. It is one time fatigue rather to burn in each year and spring season is easily bearable by the formers.

Thrasher:

During the wheat harvesting season husk is collect that is used as animal food. Thrasher also causes environmental pollution and it is loss of husk because the fine particles are not collected and due to change in air direction farmers are unable to collect this husk. It also causes dust allergy, asthma and eye diseases. So there is need of modification in the collecting method a rectangle shape block is fitted on the exit of thrasher husk that is align with the thrasher a net is fixed on the scaffolding which

is easily fitted and dismantled that increase the collection efficiency of husk.

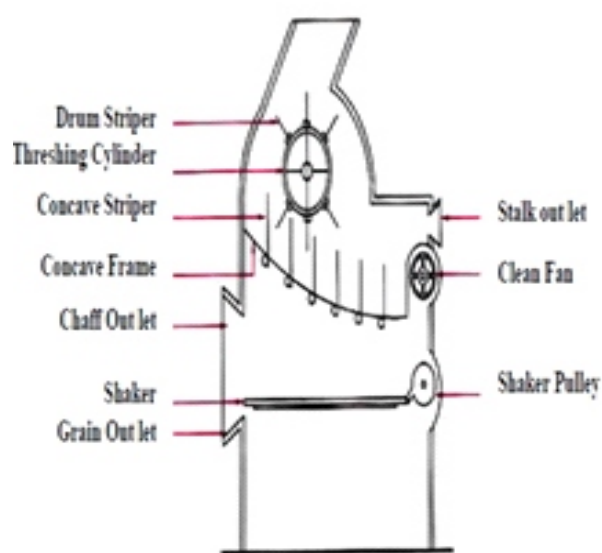
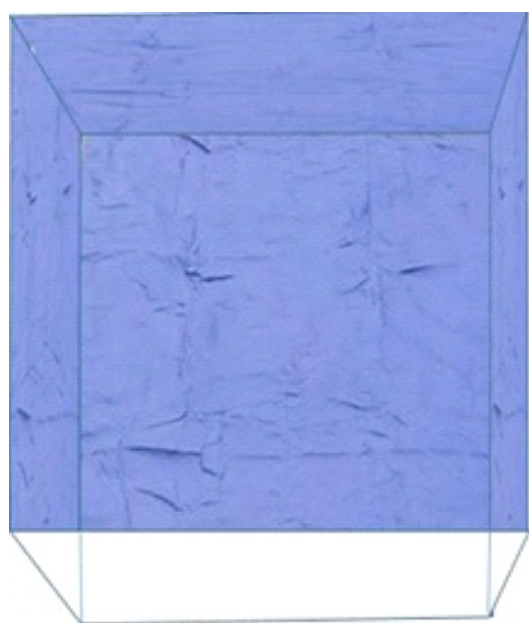


Figure 01. Collection of fine particles from the thrasher [10, 11]

3.2 Plastic Waste:

It is a synthetic material that is made up from organic substances which are soft and easily molded in to different shapes. Generally it has high molecular weight and derived from petrochemicals [12]. Plastic is economical and has a number of uses like shopping bags, PET bottles, Ropes, Polyvinyl Chlorides, utensils, water storage tanks, toys, disposable Cups, Spoons, fast food, fruits, vegetable packing material and house hold cleaning equipment. Burning of plastic waste is a main factor of air pollution which releases hazardous gasses dioxin, Furan, Hg and polychlorinated biphenyl are incinerates that produces halogens. Therefore these substances as a whole threat to living organisms. Diseases caused by these substances are following

Polystyrene is harmful to Nervous system

Brominated compound causes cancer

Dioxin settle on the plants and on water channels which ultimately enter in to the food and disturb body system

Other associated diseases are asthma, headaches and heart diseases so for our better future there is need to manage and dispose the plastic or to develop alternative strategies.[13]

Following steps are needed to curtail the use of plastic i.e.

Use of clothes bags is an alternative of

plastic bags which is easily available

Plastic utensils should be replaced with the mud utensils which is our traditions that is economical and hygienic

Plastic ropes should replace with the cloth rope that is natural environmental friendly and has more strength than the plastic

Plastic Water storage tank in the public is replaced with the brick storage tank that can absorb the contaminants and retards the growth of microorganisms, while the plastic material promotes its growth.

PVC piping, valves and fitting that are also harmful and should be replaced with the iron.

Plastic toys are shifted to mud and wood.

House hold plastic waste should be buried on daily basis that a small collector is used for this purpose in each street which is ultimately collected by the municipal committee and dispose in to the dig outside the cities that is environment friendly technique or to burn /biodegradable material used for the collection of bio gas plants. Burning of waste in open area also causes the soil pollution so a trench or rectangular shape is used to bury the waste.

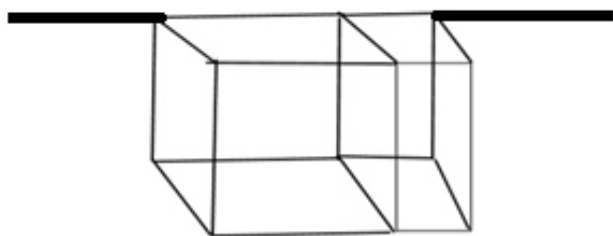


Figure 02: Trench used for the Burring of the waste

Although plastic is economical but it is the root of diseases it can't bear high temperature when it is used as a kitchen utensils it degrade slowly and also release harmful chemical that ultimately causes

cancer which has no cure and it treatment method is quite pathetic that is not affordable and also weak the immune system. Another common trend of disposable utensils that is quite harmful to human life. So we should recommend the steel utensils that are environment friendly and not harmful to human life.

3.3 Industrial Wastes:

Industrial wastes are the sources of air, water and soil Pollution. Furnaces kiln and brick kiln generally uses cheap fuel like coal, furnace oil that is the main source of SO_x , NO_x . Oxides of nitrogen are generally produced at a high temperature.

3.3.1 Thermal Power plants:

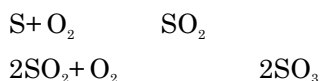
As our country has shortage of electricity from the last decade and relay on the alternative sources of electricity that is solar, coal and furnace oil based thermal power plant and wind turbines. Although the electricity generated from the wind, hydl, solar are environment friendly but as far as the coal and furnace oil is concern that causes air pollution and ultimately a source of NO_x and SO_x . Because the Pakistan has a potential of hydl and electricity generated from the hydl power plant is quite cheap and environment friendly but has a high capital investment. Being Pakistanis agriculture Country and overpopulated and relies on food which is manageable due to construction of dams.

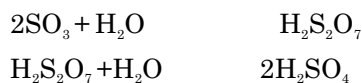
3.3.2 Emission of Coal:

Burning of coal produced particulate matter, SO_x , NO_x , carbon monoxides, other pollutants includes acid gasses and greenhouse gasses. Particulate matter quantity from the emission of coal can be controlled by the use of filters.

3.3.3 Sulfur oxide Emission:

SO_x emission from the coal is dependent on the sulfur content, heating value and alkali concentration. Alkali content absorbs the sulfur content and reduces its concentration in the stack. Smog (SO_x reactions are)





3.3.4 NO_x Emission:

NO_x Emissions from the coal are the function of boiler design, firing configuration and amount of excess air lowers the amount of excess air lessen the amount of nitrogen compounds but it increases the ash fouling.

3.3.4.1. Controls::

3.3.4.1.1 Particulate Matter:

Electrostatic precipitator and fabric filter with collection efficiency as high as 99.5% are used to remove particulate matter from the coal, scrubbers and cyclone combination are also used to remove particulate matter [14,15-16,17].

3.3.4.1.2 Oxides of Sulfur:

Flue gas desulfurization techniques are currently used on the number of boiler. Generally dry, wet and SO_x absorbent are available methods are used to remove the sulfur content. But wet system is commonly applied that uses alkali slurries as SO_x absorbent medium to remove in excess of 90% of incoming of SO_x. Lime stone scrubbers, sodium scrubbers' spray drying are the economical methods for the removal of Flue gas Desulfurization.

Spray drying is a scrubbing method in which a solution of alkaline material is sprayed on the reaction vessel as a fine mist and mixes with the flue gasses. Sulfur dioxide reacts with the alkali solution to form salt. Slurry is dried by the latent heat of the flue gases to about 1% free moisture. Dry alkali continues to react with the sulfur dioxide in the flue gases to form sulfites. Lime stone continues to feed in to the furnace to react with sulfur dioxide to form calcium sulfates [18].

3.3.4.1.3 NO_x Removal Technique:

Both over fire air and LNB Techniques are used to control the NO_x from the boilers. In over fire air involves diverting a portion of total combustion air (5 to 20%) from the burners and injecting in to the burners from the top level via nozzles. This technique may have 20 to 30% efficiency. In low NO_x burner which reduces the NO_x formation by controlling both stoichiometric and temperature

profile of the combustion process. Low NO_x burner techniques are on new installed boiler. It also depends on the design of the boiler. Over fire air and low NO_x formation can be applied separately or in combination to achieve 90% efficiency [19]

3.4 Hydl Power Plant:

Pakistan is dependent on the thermal/hydl power plants. About 40,000MW potential is indicated and only 16.25% of it is utilizes and if remaining is properly utilizes then it meet the growing demand of the country.

NWFP has a huge potential of hydl energy due to its geographical location. SHYDO carried out reasonable work on many hydl scheme of more than 6000 MW and also identified many location on different areas of Chitral, Dir., Kohistan and Swat. Under the vision program of 2025 both hydro/thermal power plant wapda has taken feasibility and construction projects. Feasible reports of other projects are Bunji 5400 MW, Kohala 600 MW. After completion of these Projects the expected Capacity would be 4200 MW. NWFP and AJK has also potential of run of Rivers. Pakistan can also utilize these resources [20].

3.5 Paper and Board:

Paper and board are synthesized from the wood. Paper is used for writing purpose and board for the packing material. Burning of paper and board also contribute to air pollution. Burning of Waste paper and board should be recycle as it is loss of trees and increases in the level of carbon dioxide.

3.6 Brick kiln:

Brick kiln contribute to air pollution as their traditional design [1] is just to throw waste in to the environment which require modification to control the exit stream to reduce air pollution.

3.7 Waste Rubber tires:

Government implement law not to burn waste tires as it causes air pollution which is used to produce furnace oil that has number of uses [21].

3.8 Collection of Dust from the Roads:

Government should launch scheme on electronic, print and social media on the cleanliness of roads, street and Channels and to form committees in each village, Town, tehsil and district levels. People voluntarily participate in this moral cause that's

why it becomes effective.

4. Comparison of Data:

Public is mainly effected due unawareness of the smog effects and government should launch awareness via print, electronic and social media

and also launch active plan to upgrade the air quality monitoring index of the cities.[22]

Table 1. Data of the air quality standards [23]

Parameter Description	Respirable Particulate matter (Pm10)	Respirable particulate matter (PM2.5)	CO Average	Nitrogen Oxides as (NO)	Nitrogen Oxides as (No ₂)	Sulphur Dioxide (So ₂)	Ozone (O ₃)
Measuring Unit	ug/m ³	ug/m ³	(mg/m ³)	ug/m ³	ug/m ³	ug/m ³	ug/m ³
PEQS	150	35	10	40	80	120	130
Jail Road, Lahore November 18, 2017	216	163	5	143	116	75	27
Lahore Met office, AQMS 03 December 2018	180.340	164.188		390.851	159.524	30.377	42.894

The data shown by the environmental protection agency of Pakistan that particulate matter PM₁₀ and PM_{2.5}, CO, Average Nitrogen Oxides, Nitrogen Oxides as (NO₂), Sulfur Dioxide, Ozone (O₃) are contributing in the smog. Reason behind these polluted contents is also discussed in the previous

sections. Data of 2017 and 2018 shown that majority of the components have increasing trends and so there is a need to control these factors through developed long term planning and awareness in the public that the sustainability of environment is better for our future generations

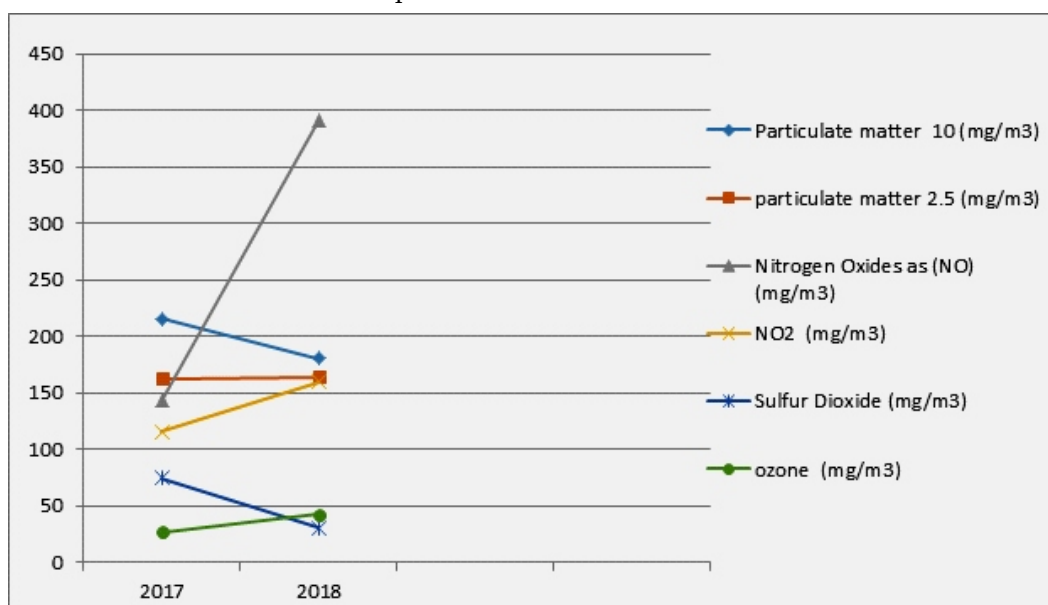


Figure 3: comparisons of different smog compositions.

The intensity of the winter season 2020 is severe in the form of heavy snow and rain fall as compared to the previous years and have a harsh impact in hilly regions specially in AJK and Quetta in loss of more than 100 precious lives, number of wounded and in short both loss of human and economic activities. Government officials and civil society believe this is due to air pollution caused by human activities in destroying the ecosystem.

The Director General of Pakistan Meteorological Department Muhammad Riaz clearly said that the impact of climate changes is the evident in the current cold wave episode. At the annual Meeting of upper Indus Basin Network Pakistan Chapter, to protect the Hindu kush Himalayan region. The director general of Pakistan Metrological Department, Environmental Experts, civil society Muhammad Riaz, says that the cold wave is due to

the impact of smog phenomena. Smog Produces NO_2 which is ultimately converted in to ozone that badly effect the Punjab and Urban Sindh. It produces haze in the atmosphere that blocked the solar radiations that's why the temperature of day time closes to night time temperature, this situation is prolonged became one of the reason of sustainable cold in Pakistan. Dr. Ghulam Rasul, the Regional Program Manager at the International center for integrated Mountain Development says, for the past decades the monsoon season has been starting early or late. He also added that weather is quite uncertain from the last decade that both winter and summer season along with its intensity is unbearable or prolonged which is clearly shown in the pattern of extreme weather conditions that is heavy snow fall in Afghanistan Pakistan adjoining Area and unpredictable rain fall in middle east[24].

Table 2: Maximum and Minimum Temperature of Lahore city [25]

Years	High Temperature °C 2018	High Temperature °C 2019	High Temperature °C 2020	Low Temperature °C 2018	Low Temperature °C 2019	Low Temperature °C 2020
January	24	22	21	4	2	2
February	29	23	28	7	5	6
March	38	33	31	12	9	11
April	41	41	37	16	16	15
May	44	46		21	20	
June	44	46		23	20	
July	39	43		22	22	
August	38	38		22	23	
September	36	39		18	21	
October	34	34		14	17	
November	29	23		10	11	
December	36	24		3	0	

If look at the temperatures of the last years data of the Lahore city there is abrupt changes due to smog and Air Pollution the day time temperatures were less and it were clearly shown in January 2020 that have severe cold which is unbearable to the living organisms and disturbing the ecosystem .it is a

great challenge for our country to take precautionary steps to overcome this issue to save our future generations.

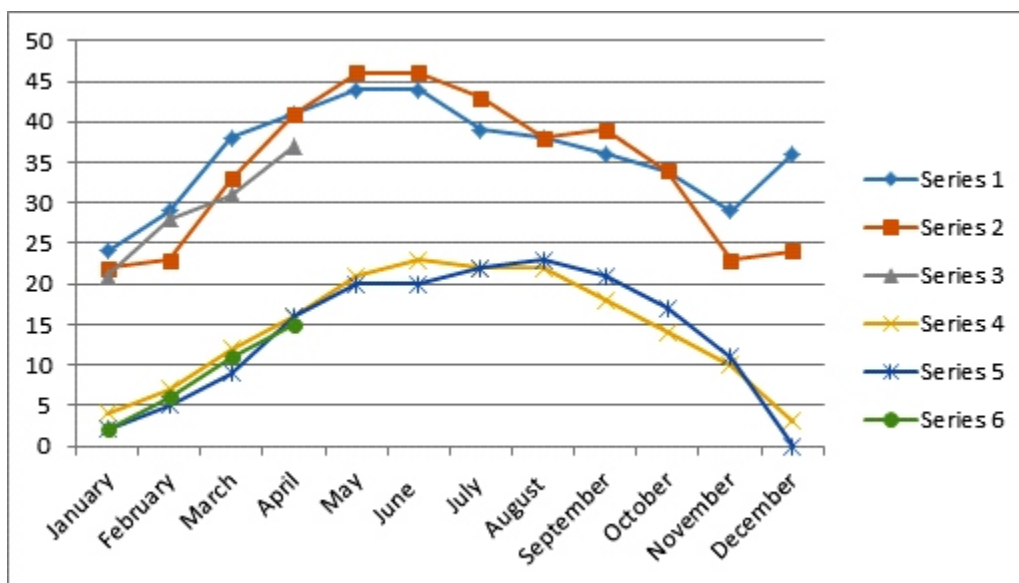


Figure 4: Variation in temperature of Last Two Years

5. Conclusions:

World facing both hunger and poverty as a worst challenge in this decade besides the technology is great tool to invent new discoveries. But unfortunately specially ecosystem of Asia is badly affected and all over the world facing environmental Pollution due to excessive man made activities on the earth without keeping in view of forecasting effects or use of lethal weapons on the name of war and occupation. So it is need to maintain harmony, peace and promote stability instead of war and generate resources for the developing countries to overcome this global problem of smog and environmental pollution. Otherwise heat wave, severity of the winter, floods and barren will ultimately become the destiny of human being. Reasonable budget should be allocated in the field of research to develop alternative friendly energy generation resources which are sustainable to overcome the energy shortages in the countries. Because Environmental pollution is not containing to the borders it is a global problem. In short legislation is the only key to curtail the environmental Pollution.

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