Impact of Air Pollution on Human Health in India

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ABSTRACT

Natural and artificial environmental factors have combined to produce poor air quality in the majority of the world's megacities. Development countries face an even more acute and intricate problem with pollution in the air than industrialized nations. Emissions and trans boundary movement of air pollutants are two possible sources of control for pollution levels in the atmosphere. Each factor enters the atmosphere in a different way and has a varied effect on the environment. The issue that needs to be dealt with is figuring out how and where emissions come from. Air pollution is an important issue, but it's even more difficult to investigate and solve the patterns or chemistry of the most prevalent air pollutants. It is critical to locate the primary sources of air pollutants since secondary air pollutants can only be generated by these sources. Primary air pollutants, their nature, emission budgets, and their influence on environmental and human health are discussed in detail in this review, which aims to shed light on the basic principles of air pollution. In the end, some of the policies and regulations to reduce primary air pollutants are discussed.

Keywords-- Air Pollution, Human Health, Air Quality, Monitoring, Difficulties

I. INTRODUCTION

Human and plant health are negatively impacted by air pollution, which is described as "the alteration in the earth's atmosphere due to the presence of contaminants that induce physical, chemical, or biological changes over the short or long term." Pollutants can be produced by a variety of activities, including combustion or industrial process sources located in a specific area, the same sources present along the periphery of that area, or natural or manmade processes present in the Earth's atmosphere. It is possible for pollutants to travel long distances or for their concentrations to alter as a result of changes in the weather. Anthropogenic and natural factors both contribute to air pollution. Air pollution is largely caused by human activities, such as automobiles, industrial, agricultural, mining, and home activities. Additionally, natural factors like volcanic activity, dust storms, and forest fires contribute to poor air quality. The level of pollution in the air is influenced by two factors: the location and the time period. The time it takes for air pollutants to accumulate in the environment is dependent on a variety of factors, including the type of pollution, the location, and even the season of the year. Respiratory, cardiovascular, lung, and other health problems in humans and plants can be exacerbated by pollutants in the air, as can a drop in photosynthetic activity, sunken stomata, chlorosis, and necrosis in leaves.

Recent years have seen an increase in the problem of air pollution caused by rapid growth in urbanisation, industrialisation, a large fleet of vehicles, and high energy consumption. These are the primary and secondary contaminants that reach the atmosphere, respectively. A primary pollutant is one emitted directly into the atmosphere, while a secondary pollutant is one created in response to primary pollutants in the atmosphere. Time in the atmosphere is an important consideration in atmospheric science research. Depending on the stability and type of the pollutant, each pollutant might have a varying residence time in the atmosphere. Any contaminant that remains in the air for an extended period of time has the potential to significantly contribute to pollution in that particular region. One of the climate-changing pollutants that tends to build in the atmosphere for many centuries, thus its warming effect persists over time. Ozone and black carbon, on the other hand, exist in the atmosphere for only a brief period of time.

Since their emissions were lowered, this could have positive effects on the environment. It is possible for these contaminants to travel great distances and cause permanent damage to the environment. In light of these concerns, the current study aims to explore general concepts of air pollution by stressing more explicitly primary air pollutants, the nature of primary air pollutants, emission budgets, and their impact on environmental health by taking plants and human health into consideration. In the end, some of the policies and regulations to reduce primary air pollutants are discussed.

Even though we contaminate the air we breathe every day, the progress and development we seek and the efforts we put in to achieve them have made air pollution an unavoidable danger. Several Indian towns are now among the world's most polluted, a result of significant population growth and economic development during the

last seven decades in India. According to IQAir Group and Greenpeace's World Air Quality 2018 study (AirVisual, 2019), 15 of the world's 20 most polluted cities are in India.

Table 1: The most polluted cities in the world.

Rank	City	Year - 2018
1	Gurugram	135.8
2	Ghaziabad	135.2
3	Faislabad, Pakistan	130.4
4	Faridabad	129.1
5	Bhiwadi	125.4
6	Noida	123.6
7	Patna	119.6
8	Hotan, China	116
9	Lucknow	115.6
10	Lahore, Pakistan	114.9
11	Delhi	113.5
12	Jodhpur	113.4
13	Muzaffarpur	110.3
14	Varanasi	105.3
15	Moradabad	104.9
16	Agra	104.8
17	Dhaka, Bangladesh	97.1
18	Gaya	96.6
19	Kashgar, China	95.7
20	Jind	91.6

Source: The Hindu, Koshy, 2019

1.1 India's Air Pollution Levels

In densely populated areas, many different types of pollution are present. Some of the more traditional sources of air pollution are cars, coal-fired power plants, industry, and agriculture, all of which emit pollutants as they operate. Anthropogenic or naturally occurring air pollution are both possible. Burning organic and plastic debris by the side of the road as well as cooking with solid biomass and cow dung are just some examples of the many ways in which waste is disposed of in developing countries (Figure 1-2). The local emission inventories indicate that rubbish burning in Delhi releases around 5300 and 7550 tonnes of PM10 and PM2.5 each year, whereas construction produces 3250 and 10,750 tonnes of pollutants each year. Temporary power generation from diesel generators, traffic jams, and unregulated small industries are all examples of this type of source.
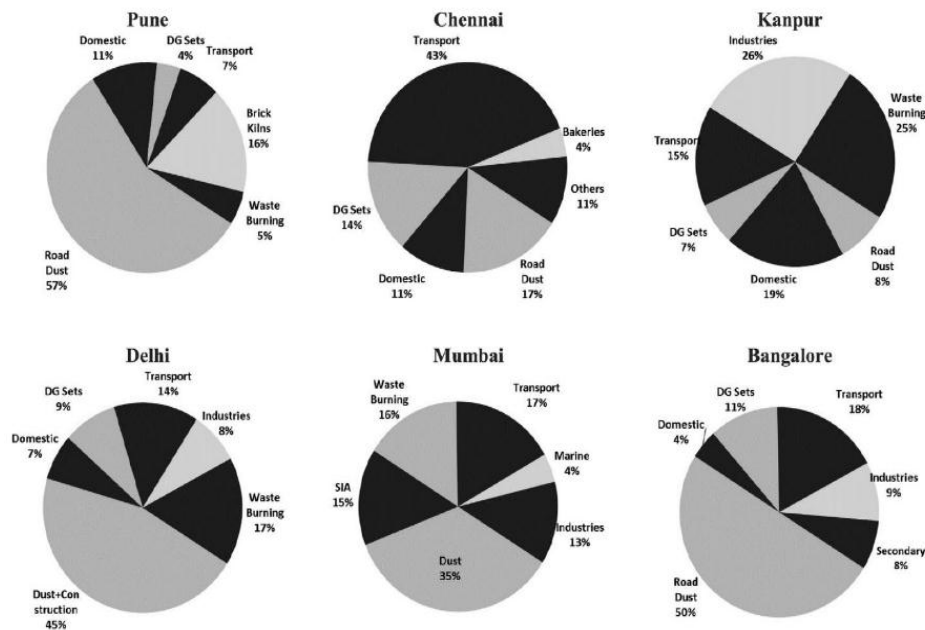
Figure 1: Toxicological contributions from key sources based on CPCB inventory data
Sources: Guttikunda et al. 2014

Figure 2: Lidl, brick kilns, loose soil and trash dumping, and biomass burning for cooking in chulhas are just some of the uncontrolled and unaccounted-for causes of pollution.
Source: Kumar et al. 2015

1.2 Air Pollution's Effects on Human Health

Exposure to air pollution has long been linked to a wide range of disorders, including cardiovascular diseases like stroke and heart disease; cancer; chronic obstructive pulmonary disease; respiratory diseases like acute respiratory infections; and poor birth outcomes. In

addition, they have negative health, economic, and developmental impacts (WHO, 2018).

According to a study published in The Lancet (Cohen et al., 2017), ambient particulate matter pollution was responsible for 50% of global mortality and disability-adjusted life years in 2015. Air pollution is responsible for one out of every eight deaths in India. Researchers from the University of Chicago's Energy Policy Institute (EPIC) found that if India followed the WHO's recommendations, individuals would live an additional 4.3 years (EPIC, 2018).

II.   DEVELOPMENTAL EFFECTS ON AIR POLLUTION

Many studies have established a strong correlation between an increase in urbanisation and an increase in air pollution. As a result of urbanisation, pollution-emitting sources such as vehicles and factories, as well as changing meteorologies such as greater temperatures and reduced wind speeds, have an impact on air quality.

For example, the National Capital Region (NCR) of India has seen significant development in urban and built-up areas during the past few decades (17-fold increase in the urban extent). According to the research, land use and land cover changes in cities during the last five decades have resulted in surface temperatures rising by 1.5–2 degrees Celsius during the day and by 4–5 degrees Celsius at night, according to the research.

2.1 Techniques for the Monitoring of Air Pollution
- The CPCB, the central nodal monitoring agency, has two types of monitoring systems. Samples of the air are taken and transmitted to a lab for analysis under a manual monitoring network. Continuous ambient air quality monitoring (CAAQM) equipment generates real-time data, which is also displayed online for the general public. There are currently 134 manual monitoring stations in the country (CPCB, 2018), while there are 157 CAAQ monitoring stations (CPCB, 2019). Fourier transform infrared (FTIR), gas chromatograph, and mass-spectrometer devices are some of the most commonly used tools for air pollution monitoring (Prasad et al., 2011).
- There are a variety of low-cost sensors available now for reducing pollution in the air (European Commission, 2016). Gases in the air react with an electrode inside a sensor, causing a chemical reaction to occur. In addition to measuring NO_2 and CO, they can also measure NO_2, SO_2, O_3, NO_2, and CO_2.

- Metal oxide sensors (resistive sensors, semiconductors) are also used to measure air pollutants like NO_2, O_3, and CO. These pollutants react with the sensor surface and change the sensor's resistance.
- In order to determine the concentration of VOCs in the air, photoionisation detectors ionise the compounds in question and then record the resulting electrical current.
- Optical particle counters measure the light scattered by particles to detect air pollution. The absorption of infrared light by optical sensors allows them to detect chemicals like carbon monoxide and carbon dioxide.

III.   METHODS OF AIR QUALITY

Modeling of air quality is useful not only for predicting but also for air quality management. However, in order to have confidence in the model's applicability, it is important to do a preliminary examination. Performance should be evaluated for multiple simulation design combinations, sensitivity to different physical parametrization, and different chemical mechanisms for simulation of air pollutants such as particulate matter and ozone.

Modeling frameworks are useful in determining the source contributions of different air contaminants. It also aids in the investigation of the long-distance transfer of pollution.

It was found that long-range transit in Delhi's National Capital Territory can contribute as much as 26 percent to 97 percent during summer and 13 percent to 68 percent during winter circumstances, especially during heavy pollution episodes, according to model simulations in recent studies. It was hypothesised that the high levels of PM10 concentration were caused not just by local pollution but were also heavily influenced. Furthermore, air pollution forecast models provide a framework for evaluating various pollution abatement mitigating approaches.

IV.   EFFORTS THE GOVERNMENT OF INDIA'S

To combat air pollution in India, the country's government is exploring new ways to do it (WHO, 2016).
- Citizens are urged to adopt cleanliness in all aspects of their lives by the Swachh Bharat Abhiyan, which is both topical and relevant.
- The "Smart Cities" effort ensures environmentally friendly urban planning, construction of energy-efficient housing, and a solid public transportation

network. As a result, sustainability is ensured through the incorporation of citizen participation.

- Encouraging more households from low- and middle-income groups to join the LPG distribution list and eliminating blanket subsidies for cooking gas for higher-income households are important measures toward reducing indoor air pollution in households.
- As part of its efforts to combat air pollution, the government has formed a multisectoral steering committee, which includes WHO India.
- The Cigarette and Other Tobacco Products Act, 2003, is already in effect in India to prevent exposure to second-hand smoking. The WHO Framework Convention on Tobacco Control, signed in 2004, also includes India as a signatory.
- Methods and Techniques in Use (Gurjar et al, 2016)
- The Environmental Protection Act of 1986 mandates the installation of pollution control technology in industrial facilities in order to comply with emission standards. Air quality strategies have been drawn up to improve the air quality in the CPCB's 24 critical pollution hotspots. The ash concentration of coal utilised in power plants located more than 1000 kilometres from the mine head must be below 34%.
- An environmental impact assessment (EIA) study, a public hearing, and the submission of an environmental statement are all required for the formation of development projects (29 categories) that require environmental clearance from the Ministry of Environment and Forest (MoEF).
- Besides that, various mitigation methods, such as reducing the sulphur content of the coal, moving enterprises to the outer outskirts of the city, using less ash and sulphur content coal, and applying air pollution control systems, have been taken into account.
- Enclosed structures and water spraying systems have been implemented to reduce stone crusher dust emissions. Electrostatic precipitator filter-type air purifiers, which remove tiny particles like dust and smoke, are the most commonly used in the industrial sector.
- The flow of gases through the unit is slightly impeded by applying an induced electrostatic charge.

- Flue gas desulphurization, bag filters, wet collectors, multi-cyclones, carbon sequestration, industrial fans, gas conditioning systems, catalytic reduction, and fabric filters are other technologies in use.

As a result, the government has implemented a number of policies aimed at reducing vehicle emissions, including the use of cleaner fuels (such as unleaded gasoline and ultra-low sulphur diesel), better engine technology, the implementation of Bharat Norms (equivalent to Euro standards), and other modes of transportation (such as the Delhi Metro rail system). Since the year 2000, the Ministry of Road Transport and Highways has implemented ever harsher emission reduction standards (Bharat Stage I-IV). From the early 1990s to the early 2000s, leaded fuel was phased out across India, and benzene concentrations in gasoline were capped at 3%. Furthermore, a huge step is being taken by moving towards hybrid and electric vehicles in a planned manner.

V. AIR POLLUTION CONTROL FACE DIFFICULTIES

- Due to a lack of coordinated air pollution laws and a lack of information exchange on best practises in urban air quality management, there has been little regional cooperation in the fight to improve urban air quality. The country has densely populated areas with higher emissions as a result. Hence, a "regional airshed approach" (e.g., the Indo-Gangetic Plane) should be used to establish air pollution control measures.
- To address the basic problem of urban air pollution, a well-coordinated, sponsored project is needed to leverage existing technical skills, funds, and international cooperation and to lay the groundwork for future regional cooperation.
- Advanced research and analysis are also required to generate cost-effective solutions that may be integrated into the policy framework for a variety of areas, such as transportation, health care, and even industrial policy.
- A framework for mitigating temperature changes caused by urbanisation will go hand in hand with a framework for mitigating pollution.
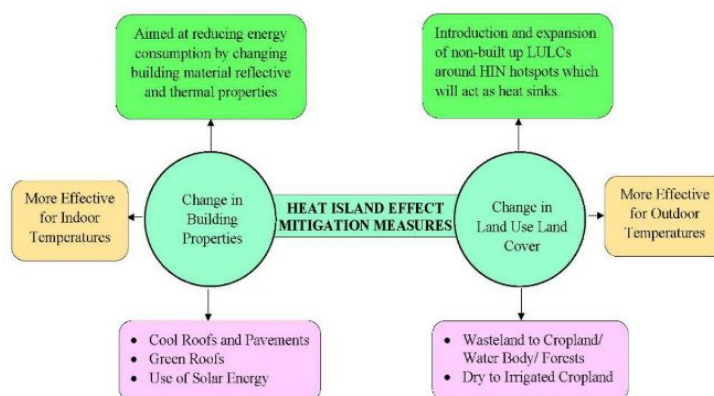
Figure 3: The reduction in energy demand as a result of Heat Island mitigation techniques helps to reduce air pollution
Source: HISAT Policy Report, 2018

VI.   CONCLUSION

Air pollution is a global problem that needs to be handled in terms of identifying the many sources, impacts, and control and prevention measures. Not only is it necessary to pinpoint the source's location, but it is also necessary to devise strategies for enhancing air quality. The path of a pollutant's emission isn't always evident; for example, a given pollutant can come from multiple sources in addition to the one from which it is being emitted. In developing countries, there is still a lack of attention paid to air pollution, which means that there are fewer studies on the sources and effects of air pollution than there are on water and soil contamination. Particulate matter, a pollutant that contributes to a substantial number of respiratory disease cases in many developing nations, has yet to be effectively characterised as a pollutant control measure. This review therefore summarises an overview of global air pollution and discusses in depth the origins, impacts, and control methods that may be taken to improve air quality while taking each pollutant into consideration in detail.

REFERENCES

[1] Gupta, M., & Mohan, M. (2015). Validation of WRF/Chem model and sensitivity of chemical mechanisms to ozone simulation over megacity Delhi. Atmospheric Environment, 122, 220–229.
[2] WHO (2016) Healthy Environment; Healthy People.
[3] Mohan, M. (2018). HISAT Policy Report. Odisha State Pollution Control Board

[4] Sati, A. P., & Mohan, M. (2018). The impact of urbanization during half a century on surface meteorology based on WRF model simulations over National Capital Region, India. Theoretical and Applied Climatology, 134(1), 309–323.
[5] Kumar, P., Khare, M., Harrison, R.M., Bloss, W.J., Lewis, A.C., Coe, H., &Morawska, L. (2015). New directions: Air pollution challenges for developing megacities like Delhi.
[6] Guttikunda, S. K., Goel, R., & Pant, P. (2014). Nature of air pollution, emission sources, and management in the Indian cities. Atmospheric Environment, 95, 501-510.
[7] Gupta, M., & Mohan, M. (2013). Assessment of contribution to PM10 concentrations from long range transport of pollutants using WRF/Chem over a subtropical urban airshed. Atmospheric Pollution Research, 4(4), 405-410.
[8] N. Hickey, I. Boscarato, J. Kaspar, (2014), Air Pollution from Mobile Sources: Formation and Effects and Abatemen, Strategies In: G. Cao and R Orru' (eds.), Current Environmental Issues and Challenges, Springer.
[9] Z. Klimont, S.J. Smith, J. Cofala (2013). The last decade of global anthropogenic sulfur dioxide: 2000-2011 emissions. Environmental Research Letters 8:014003.
[10] A.K. Tripathi, M. Gautam, Biochemical parameters of plants as indicators of air pollution. Journal of Environmental Biology 28, 2007, 127- 132.
[11] CPCB (2018) National Air Quality Index December-2018
[12] CPCB (2019) Continuous Ambient Air Quality Monitoring. https://app.cpcbccr.com/ccr/#/caaqm-dashboard-all/caaqm-landing
[13] Koshy, J. (2019, March 5). Fifteen of the 20 most polluted cities in the world are in India. The Hindu.