

Effect of Air Pollution on Environment, Vegetation & Human Health

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Abstract—Air pollution can harm human health, the environment, and cause property damage. The objective of this paper is to discuss the relationship between the human health and air quality. This conceptual paper is focusing on the findings from air quality literature review and the significant health effects related to it. Air pollutants (for example PM, O₃, SO₂ and NO₂) contributed to various respiratory problems including bronchitis, emphysema and asthma. Agriculture crops can be injured when exposed to high concentration of various air pollutants. CO₂, a greenhouse gas, is the main pollutant that is warming earth which is very harmful to sustain a life in the earth.

1. INTRODUCTION

Air pollution is the introduction of particles, biological molecules, or other harmful materials into Earth's atmosphere, causing diseases, death to humans, and damage to other living organism such as animals and food crops, or the natural or built environment.

An air pollutant is a substance which may harm vegetation, material, humans or a substance in the air that can have adverse effects on humans and the ecosystem. It is estimated that we breathe 20,000 liters of air each day. This means the more polluted the air is, the more we breathe into our lungs dangerous chemicals. Air can be polluted both indoors and outdoors. Tobacco and other kinds of smoking are examples of indoor air pollution. Air pollutants (dangerous things that make the air unclean) come in the form of gases or particles. Air pollution can result from both human and natural actions. Natural events that pollute the air include forest fires, volcanic eruptions, wind erosion, pollen dispersal, evaporation of organic compounds and natural radioactivity. Pollution from natural occurrences is not very often.

1. Some Basic Pollutants

i. **Gaseous pollutants** contribute to a great extent in composition variations of the atmosphere and are mainly due to combustion of fossil fuels. Nitrogen oxides are emitted as NO which rapidly reacts with ozone or radicals in the atmosphere forming NO₂. The main anthropogenic sources are mobile and stationary combustion sources. Moreover, ozone in the lower

atmospheric layers is formed by a series of reactions involving NO₂ and volatile organic compounds, a process initiated by sun light. CO, on the other hand, is a product of incomplete combustion.

ii. **Particulate matter** (PM) is the generic term used for a type of air pollutants, consisting of complex and varying mixtures of particles suspended in the breathing air, which vary in size and composition, and are produced by a wide variety of natural and anthropogenic activities. Major sources of particulate pollution are factories, power plants, refuse incinerators, motor vehicles, construction activity, fires, and natural windblown dust[1][2].

iii. **Heavy metals** include basic metal elements such as lead, mercury, cadmium silver nickel, vanadium, chromium and manganese. They are natural components of the earth's crust; they cannot be degraded or destroyed, and can be transported by air, and enter water and human food supply. In addition, they enter the environment through a wide variety of sources, including combustion, waste water discharges and manufacturing facilities. To a small extent they enter human bodies where, as trace elements, they are essential to maintain the normal metabolic reactions. However, at higher (although relatively low) concentrations they can become toxic. Most heavy metals are dangerous because they tend to bioaccumulate in the human body. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment.

iv. **Persistent organic pollutants** form a toxic group of chemicals. They persist in the environment for long periods of time, and their effects are magnified as they move up through the food chain (bio-magnification). They include pesticides, as well as dioxins, furans and PCBs. Generally, the generic term "dioxins" is used to

cover polychlorinated dibenzo-dioxins (PCDDs) and polychlorinated dibenzo-furans (PCDFs) while polychlorinated biphenyls (PCB) are called "dioxin like compounds".

2. IMPACT OF AIR POLLUTION ON ENVIRONMENT

- i. **Effects on wildlife:** Toxic pollutants in the air, or deposited on soils or surface waters, can impact wildlife in a number of ways. Like humans, animals can experience health problems if they are exposed to sufficient concentrations of air toxics over time. Studies show that air toxics are contributing to birth defects, reproductive failure, and disease in animals. Persistent toxic air pollutants (those that break down slowly in the environment) are of particular concern in aquatic ecosystems. These pollutants accumulate in sediments and may bio-magnify in tissues of animals at the top of the food chain to concentrations many times higher than in the water or air[3].
- ii. **Ozone depletion:** Ozone is a gas that occurs both at ground-level and in the Earth's upper atmosphere, known as the stratosphere. At ground level, ozone is a pollutant that can harm human health. In the stratosphere, however, ozone forms a layer that protects life on earth from the sun's harmful ultraviolet (UV) rays. But this "good" ozone is gradually being destroyed by man-made chemicals referred to as ozone-depleting substances, including chlorofluorocarbons, hydrochlorofluorocarbons, and halons. These substances were formerly used and sometimes still are used in coolants, foaming agents, fire extinguishers, solvents, pesticides, and aerosol propellants.
- iii. **Global climate change:** The Earth's atmosphere contains a delicate balance of naturally occurring gases that trap some of the sun's heat near the Earth's surface[4]. This "greenhouse effect" keeps the Earth's temperature stable. Unfortunately, evidence is mounting that humans have disturbed this natural balance by producing large amounts of some of these greenhouse gases, including carbon dioxide and methane.
- iv. **Acid rain** is precipitation containing harmful amounts of nitric and sulfuric acids. These acids are formed primarily by nitrogen oxides and sulfur oxides released into the atmosphere when fossil fuels are burned. These acids fall to the Earth either as wet precipitation (rain, snow, or fog) or dry precipitation (gas and particulates). Some are carried by the wind, sometimes hundreds of miles. In the environment, acid rain damages trees and causes soils and water bodies

to acidify, making the water unsuitable for some fish and other wildlife. It also speeds the decay of buildings, statues, and sculptures that are part of our national heritage. Acid rain has damaged Massachusetts lakes, ponds, rivers, and soils, leading to damaged wildlife and forests[5].

2. Impacts of air pollution on Vegetation

- i. Eutrophication is a condition in a water body where high concentrations of nutrients (such as nitrogen) stimulate blooms of algae, which in turn can cause fish kills and loss of plant and animal diversity. Although eutrophication is a natural process in the aging of lakes and some estuaries, human activities can greatly accelerate eutrophication by increasing the rate at which nutrients enter aquatic ecosystems.
- ii. Haze is caused when sunlight encounters tiny pollution particles in the air. Haze obscures the clarity, color, texture, and form of what we see. Some haze-causing pollutants (mostly fine particles) are directly emitted to the atmosphere by sources such as power plants, industrial facilities, trucks and automobiles, and construction activities.
- iii. Crop and forest damage: Air pollution can damage crops and trees in a variety of ways. Ground-level ozone can lead to reductions in agricultural crop and commercial forest yields, reduced growth and survivability of tree seedlings, and increased plant susceptibility to disease, pests and other environmental stresses[6].

3. IMPACT OF AIR POLLUTION ON HUMAN HEALTH

- i. Irritation of the eyes, nose, and throat
- ii. Wheezing, coughing, chest tightness, and breathing difficulties
- iii. Worsening of existing lung and heart problems, such as asthma
- iv. Increased risk of heart attack

Short term exposure to particulate pollution will lead to following health effects:

- i. death from respiratory and cardiovascular causes, including strokes;
- ii. increased mortality in infants and young children;
- iii. increased numbers of heart attacks, especially among the elderly and in people with heart conditions;
- iv. inflammation of lung tissue in young, healthy adults;
- v. increased hospitalization for cardiovascular disease, including strokes and congestive heart failure;
- vi. increased emergency room visits for patients suffering from acute respiratory ailments;

- vii. increased hospitalization for asthma among children;
- viii. increased severity of asthma attacks in children[7].

Despite the above deadly affect, breathing daily in particulate pollution (year round exposure) can lead to the following health effects:

- i. increased hospitalization for asthma attacks for children living near roads with heavy truck or trailer traffic;
- ii. slowed lung function growth in children and teenagers;
- iii. significant damage to the small airways of the lungs
- iv. increased risk of dying from lung cancer;
- v. increased risk of death from cardiovascular disease;
- vi. increased risk of lower birth weight and infant mortality[8].

4. FUTURE ADOPTED TECHNOLOGIES FOR AIR POLLUTION CONTROL ADOPTED UNDER INDIAN CRITERION

The following items are commonly used as pollution control devices by industry or transportation devices. They can either destroy contaminants or remove them from an exhaust stream before it is emitted into the atmosphere.

6.1 NO_x Control

- i. Low NO_x burners
- ii. Selective catalytic reduction (SCR)
- iii. Selective non-catalytic reduction (SNCR)
- iv. Catalytic converter (also for VOC control)

6.2 Scrubbers

- i. Baffle spray scrubber
- ii. Cyclonic spray scrubber
- iii. Spray tower
- iv. Wet scrubber

6.3 VOC control

- i. Catalytic converters
- ii. Bio filters
- iii. Absorption (scrubbing)
- iv. Cryogenic condensers
- v. Vapor recovery systems

6.4 Acid Gas/SO₂ control

- i. Wet scrubbers
- ii. Dry scrubbers
- iii. Flue-gas desulfurization

6.5 Mercury control

- i. Sorbent Injection Technology
- ii. Electro-Catalytic Oxidation (ECO)
- iii. K-Fuel

5. CONCLUSION

Air pollution has negative effects on the, environment, vegetation, and health of population worldwide. A large fraction of the world population lives in China, India and other rapidly developing economies in Asia with associated large increases in energy production and consumption. Air pollutants emissions are high, producing widespread "atmospheric brown clouds" with negative impacts on air quality at very large distances from the main source areas. It will be a major challenge to reduce the negative environmental effects of the economic development in order to provide better standards of living in this part of the world.

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REFERENCES

- [1] Smith T. W., Axon C. J., Darton R. C., " The impact on human health of car-related air pollution in the UK, 1995-2005", *Atmospheric Environment*, 77, 16,May 2013, pp. 260-266.
- [2] Mabahwi N. A. B., Leh O. L. H., Omar D." Human Health and Wellbeing: Human health effect of air pollution", *in Procedia - Social and Behavioral Sciences*, 153, 4,January 2014, pp.221 – 229.
- [3] Lasslop G., Kloster S.," Impact of fuel variability on wildfire emission estimates", 121, November 2015, pp.93-102.
- [4] Shelke G., Sadeque M., "Monitoring of Particulate Matter and Gaseous Pollutant in Aurangabad City", *in IOSR Journal of Mechanical and Civil Engineering*, 14(1), 1-4 January, pp.10-15.
- [5] Jr. R. K. S., Kimmell K. L.," Department of environment Protection", *Street Boston*, 19, august 2013.
- [6] MD J. D. A., MD F. A. F.,"Handbook of Clinical Nutriation(Fourth Edition),2006.
- [7] Kampa M., Castanas E., "Human health effects of air pollution", *Environmental Pollution*, 151, 2008, pp.362-367.
- [8] Brunekreef B.," Air Pollution and Human Health: From Local to Global Issues", *Procedia Social and Behavioral Sciences*, 41, 2010, pp. 6661–6669.