AIR POLLUTION and ITS TREATMENT

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Abstract

Air is defined as the elastic, invisible and tasteless mixture of gases that surrounds the earth. Air pollution is an environmental evil. Under ideal conditions, the air that we inhale has a qualitative and quantitative balance that maintains the wellbeing of a man. When the balance among the air components is disturbed, air is said to be polluted.

Air pollution is an increasing problem in all countries where urban growth and population increases are accompanied by rapid and extensive industrial development and extensive use of automobiles. Air pollution is attributed as the price of industrialization. air pollution can impair health and sometime cause health

CAUSE OF AIR POLLUTION

- High rate of population growth
- Rapid industrialization
- Transportation facilities
- Radioactive substances

1. **High rate of population growth:** consequent to high population density there is higher rate of fuel consumption

2.**Rapid industrialization:** this is one of the major cause the smokes from the factories, coke oven and furnaces, steam engines, exhaust fumes from power plants etc. are the common source of atmospheric pollution

3. **Transportation facilities:** intensive increase in transportation services such as motor vehicle, rail-trains, aero planes etc throughout the world is another moajor contributing factor to air pollution. the exhaust fumes from the automobiles pollutes the atmosphere considerablely in the urban area.

4. **Radioactive substances:** evolution of radioactive gases and suspended radioactive dusts from atomic explosions and accidental discharges from the nuclear reactors are very dangerous sources of air pollution

5.**Natural causes:** The natural sources which cause air pollution include the organic compounds from vegetation, ground dust, salt spray from oceans, cosmic dust and evolution of hydrogen supplied from natural source. These natural sources are beyond the control of man.

CLASSIFICATION AND SOURCES OF AIR POLLUTANTS

1. Categories of air pollution

- Personal air pollution
- Occupation air pollution
- Community air pollution
- **Personal air pollution:** this represents the exposure of an individual to dust, fumes and gases. The common example of personal air pollution is when a person indulges in smoking of cigarette , cigar or pipe.
- **Occupational air pollultion:** this represents the exposure fo individual to aerosols, vapours and gasesin harmful concentrations in their working or occupational environment.
- **Community air pollution:** It represents pollution from a variety of sources and factors which cause adverse social, economic and health effects. Apart from affecting individuals the community including plant, animals, property and the weather.

Sources of air pollution:-There are two main sources of air pollution:-

- Natural air pollution source
- Man made air pollution source

(a)Natural air pollution source: the natural air pollution source consist of following:-

- Windblown dust
- Salt particles from sea water
- Dust of meteoric origin
- Micro-organisms
- Gases and odours

(b)Man made sources: these are the pollution made by man such as dust, fumes , smoke etc

Classification of pollutants

Air pollutants can be classified under three:-

Natural contaminants

- Aerosols
- Other contaminants

1. Primary and secondary air pollutants

Air pollutants can be broadly classified into two groups

- Primary air pollutants
- Secondary air pollutants

Primary air pollutants are those which are emitted directly from identifiable sources. The atmosphere contains hundreds of air pollutants from natural or from anthropogenic sources. All such pollutants are called primary pollutants. Important primary pollutants are:-

- Particulate matter
- Sulphur oxides and sulphur compounds
- Nitrogen oxides
- Carbon monoxide
- Hydrocarbon
- Halogen compound
- Organic compounds
- Photochemical oxidants

Secondary air pollutants are those which are formed in the atmosphere as a result of interaction between two or more primary pollutants. These are the therefore chemical substances which are often more harmful than the original basic chemicals that produce them. Examples:-

- Sulphuric acid (H2So4)
- Ozone
- Formaldehyde
- Proxy-acetyle-nitrate
- Photochemical smog

CHARACTERISTICS OF IMPORTANT AIR POLLUTANTS

Natural contaminants:

The natural contaminants consist of natural fog, pollen grain, bacteria and products of volcanic eruptions. Out of these, pollen grains are most important since these can be carried away by wind to a great distance. These are discharged into the atmosphere from natural

vegetation such as trees plants grasses weeds etc. these are borne pollutants produce allergic responses in sesitive individual, causing asthma, hay fever, etc.

Aerosols (particulates).

Aerosols refer to dispersion of solids or liquid particles of microscopic size in gaseous media, such as smoke, fog or mist. An aerosol can also be defined as a colloidal system in which the dispersion media is a gas and the dispersed phase is a solid or liquid in general the term particulate represents to all atmospheric substances that are not gases. The various types of aerosols are

- Dust
- Smoke
- Mists
- Fog
- Fumes

Dust: dust is a commonly used term applied to solid particles larger than colloidal particles and capable of temporary suspension in air or other gases. These are formed by natural disintegration of rock and soil or by the mechanical process grinding and spraying with their sizes varying from 1 to 200 microns.

Smoke: smoke consists of finely divided particles resulting from incomplete combustion or other chemical processes. They consist predominantly of carbon particles and other combustible materials with their size less then 1 microne.

Mists. Mist is made up of liwuid droplet which are formed by condensation in the atmosphere or are released from industrial operation. Natural mists particleformed from water vapor in the atmosphere are rather large, ranging from 40-500 microne in size.

Fog: fog is a loose term applied to liquid dispersed aerosols in air by condensation. Fog refers to visible aerosols in which dispersed phase size of particles ranges from 1 to 40 microns

Fumes: fumes are solid particles generatedby condensation from the gaseous state, generally after volatilization from melted substances and often accompanied by chemical reaction such as oxidation. These are released from chemical or metallurgical processs. Particle size is 0.1 to 1 microne

EFFECTS OF AIR POLLUTION

In general the effects of the polluted atmosphere can be classified under the following four heads

- Effect of certain materials

- Effect on plans
- Effect on animals
- Effect on human health
- Effect of air pollutant on physical feature of atmosphere 1. **Effect of air pollutants on certain materials:**

there are following five ways:-

- Abrasion
- Deposition and removal
- Direct chemical attack
- Indirect chemical attack
- Corrosion

2. Effect of air pollutant on plants:air pollutants effecting plants are

- Sulphur dioxide
- Hydrogen fluoride
- Hydrogen chloride
- Chlorine
- Ozone
- Oxides of nitrogen
- Ammonia
- Mercury
- Ethylene
- Hydrogen sulphide
- PAN
- Smog

3. Effect of air pollutant on animal:- The effect of pollutants on farm animals take place in two steps

1. Accumulation of air pollutants in the vegetation plants and forage
2. Subsequent poisoning of the animals when they eat the contaminated vegetation

4, Effect of air pollutant on human health

The inhalation of undesirable gases from the atmosphere has marked adverse effects on human health. There adverse effect can be divided into two classes: acute effects and chronic effects. Acute effects manifest themselves immediately upon short term exposure to air pollutants of continuous exposure to low levels of air pollution. Following is the list of health effect of air pollutants.

- Ear, nose, throat irritation
- Irritation of respiratory tract
- Odor nuisance due to hydrogen sulphide Chronic pulmonary diseases Pollens etc.

Effect of air pollutant on physical features of atmosphere

- Effect on visibility
- Effect on urban atmosphere and weather condition
- Effects on atmospheric constituents

1. **Effect on visibility:** the visibility is reduced due to the concentration and physical properties of particulate pollutants present in the atmosphere. The measurement of prevailing visibility is a standard meteorological practice. The stormy wind raises dust particles resulting in decrease in the visibility. In unsaturated humidity conditions, the hygroscopic particles pick up moisture and as they increase in size, the visibility is effected
2. **Effect on atmosphere:** urban air pollutants is mainly caused due to smoke dust fog and other aerosol and all of these affect the weather condition. Polluted area becomes more cloudy, more foggy, resulting in reduction of solar radiation to an extent of about 30%
3. **Effects on atmospheric constituents:** due to air pollution, the balance between various constiruents of air is disturbed. Atmospheric carbon dioxide is the main source of organic carbon in the biosphere. It has been noted that there is steady increase in the percentage of CO2 in the atmosphere due to combustion and other factors causing air pollution.

AIR POLLUTION CONTROL METHODS AND EQUIPMENT

There are following four methods of controlling air pollution

1. Proper planning of industrial area like zoning
2. Dilution of source discharge by use of tall stacks
3. Using source correction methods through

- Raw material changes
- Process changes
- Equipment modification or replacements

4. Reduction of pollutant discharge at source by use of controlling equipments

1. **Air pollution control by zoning:**

Air pollution can be effectively controlled by adopting the zoning system at the planning stage itself. Cumulative zoning in the past has resulted in less availability of land for industries. This system has been now modified as permissible system though this system has also resulted in crowding of industrial zones with other uses also besides industry. The next improved system is the exclusive zoning system which provides for compatible uses for each zone, excluding other use.

2. **Dilution of source discharge by use of tall stacks.**

Various aspects of atmospheric dispersion of pollutants have already been discussed earlier. The atmosphere, like natural stream, possess self-cleansing properites which continuously clean and remove the pollutans from the atmosphere under natural conditions, provided the pollutants are discharged in the atmoshphere judiciously son that effective dispersion takes place. If the pollutants are carried away to some distance or taken to high attitudes, they are reduced in concentration by diffusion and dilution. The pollutants are taken to high altitudes by means of tall stacks. The height of the stack should be such that the maximum ground level concentration, which varies inversely with the square of the stack height is within the permissible limits.

3. **Control by using source correction methods:-** This method is known as air pollution prevention at source. This can be achieved through
   - Change in raw materials
   - Process changes
   - Equipment modification

1. **Changes in raw materials:** if one type of raw material, currently in use results in air pollution problem, while a substitute material. Which may be purer grade, does not, the substitution will be more desirable. A typical example in this context is the use of low sulphur fuel in place of high sulphur fuel. The raw material I n current use may contain certain ingredient which is not essential for the process but which contributes to pollution.
2. **Process modification:** atmospheric pollutants emissions can some times be reduced by adopting modified or new processes. A typical example is the use of exhaust hood s and ducts over several types of industrial ovens have not only reduced pollutants but also have resulted in the recovery of valuable solvents that could have became air pollutants. Similarly, volatile substances can be recovered by condensation and the non- condensable gases can be recycled for additional reactions.
3. **Equipment modification or replacement:** old equipment which contribute to greater degree of air pollution can be modified or completely replaced. For example, basic oxygen furnaces that are completely replaced. For example, basic oxygen furnaces, that are replacing the open heath furnaces in the steel industry, pose lesser pollution problems. In

many cases, newer types of equipments are less pollution prone.newer types of equipment in paper and pulp industry also cut down the quantity of pollutants emitted. Also air pollutants emissions from industrial operations can be reduced by proper equipment.

4. **Reduction of pollutants discharge at source by use of controlling equipment:** this is a method of reducing the pollutants at source y use of air pollution control equipment. In the subsequent articles, we will discuss the pollutants control methods, both for aerosols as well as gaseous emission separately.

EQUIPMENT FOR CONTROL OF PARTICULATE POLLUTANTS

Following are the equipment or devices which are used to control the emission of particulate pollutants:

- Gravity settling chambers
- Inertial or impact separators
- Cyclones
- Fabric filters
- Electrostatics

CONCLUSION

Air pollution is an important problem facing by our society. The solutions require a global approach. The international agencies (e.g. UN) are playing an active role in developing treaties (see chapter on regulations). The level of activity to control air pollution varies from one nation to another. A part of the pollution problem is caused by our desire to progress. The progress leads to movement of more people to a developed area and increased consumption of resources. The solution to the pollution problem involves politics, economics, science, technology, sociology and life style changes.

Not understanding the consequences of pollution is also part of the problem. For years, people thought that they could safely get rid of garbage, sewage, exhaust, and other waste products by throwing them away, flushing them down the drain, or releasing them into the air. Thus basic awareness and appropriate education in conjunction with that awareness is called for.

REFERENCES

[1] https://en.wikipedia.org/wiki/Air_pollution

[2] Evidence growing of air pollution's link to heart disease, death at the Wayback Machine (archived June 3, 2010) // American Heart Association. May 10, 2010

[3] "Environmental Pollution". Theenvironmentalblog.org. 2011-12-16

[4] Health effects of outdoor air pollution. Committee of the Environmental and Occupational Health Assembly of the American Thoracic Society. (1996). [Comparative Study Review]. American journal of respiratory and critical care medicine, 153(1), 3-50.

[5]Andersen, Z. J., Hvidberg, M., Jensen, S. S., Ketzel, M., Loft, S., Sorensen, M., Raaschou-Nielsen, O. (2011). Chronic obstructive pulmonary disease and long-term exposure to traffic-related air pollution: a cohort study. [Research Support, Non-U.S. Gov't]. American journal of respiratory and critical care medicine, 183(4), 455-461.

[6] B.C. Punmia, A.K. Jain, Wastewater Engineering