

MODULE 30 - AIR POLLUTION

OBJECTIVES

By the end of the session students will be able to:-

1. Know about Air Pollution
2. Learn details about causes and effects of Air pollution
3. Learn more about harmful effects of Air pollution on plants Animals, human beings and materials.
4. Appreciate the impact of air pollution on different components of Environment and know about. A various control measures.

SUMMARY

Almost all living beings require air for their growth and development. But unfortunately this precious natural resource is being polluted by various anthropogenic activities. Rapid industrialization, automobiles, modern agricultural activities, thermal power plants, refineries and chemical industries are chiefly responsible for contaminating our air.

Air pollutants have been classified as primary and secondary. SO_2 , NO_2 , CO_2 , Cl and particulate are main examples of primary pollutants, while ozone (O_3) peroxyacetylene nitrate (PAN). Sulphuric and nitric acids are common examples of secondary pollutants. According to the CPCB many Indian cities are facing serious air pollution problems. Ahmedabad, Kanpur and Indore are few of them.

Being toxic and corrosive in nature air pollutants harmfully affect the nature. Air pollutants adversely affect plants, animals and materials. In plants air pollution injury appears on leaves in the form of injury symptoms like chlorosis and necrosis, Tipburn and flecking. Arsenic, lead and fluorides are the main particulate pollutants which affect the growth and development of livestock. Liver necrosis, depression of central nervous system, breathing trouble, fluorosis of teeth are some health hazards observed in animals as a result of living and foraging in polluted habitats.

Polluted air also affects human beings in various ways. Prolong exposure to air pollution can result in cancer, asthma, chronic bronchitis and emphysema. Particulate pollutants like asbestos and silica can result in asbestosis and silicosis like lung diseases.

Polluted air not only affects living being, they also damage to a variety of nonliving materials. Because of their corrosive nature acidic gases corrode metallic surface and stones especially marble. The stone cancer of Taj Mahal is a common. —example. Oxides of nitrogen also cause fading of cotton and rayon fibers. Harmful effects of air pollution can be checked taking steps at government as well as individual levels. Air pollution can be controlled by strict pollution control measure by installing catalytic converter, using mass transport system going back to bicycles is a good solution to air pollution abatement. Planting more and more air pollution resistant trees and using non conventional energy source can be a good answer in controlling the air pollution.

TRANSCRIPTION

INTRODUCTION

Air is one of the most important natural resources essential for the substance of living beings. Man breaths nearly 22,000 times a day and inhales approximately 15 Kg of air per day. The importance of air lies in the fact that almost all living beings require air for their existence. It is a matter of serious concern that the ambient air is being contaminated day by day especially due to human activities. Air pollution is not a localized environmental problem but it is affecting the whole globe. Rapid industrialization has created hazards to health and environment. Presently Indian Air almost all metropolitan cities of our country are facing serious air pollution problem, Prevention and control of pollution, Act 1981 defines air pollution as any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentrations that may or tend to be injurious to human beings or other living beings or other living creature or plants or property or enjoyment.

According to the encyclopedia Britannica Air pollution is the presence in the earth's atmosphere of man-caused or man-made, contaminants, which may adversely affect property, or the lives of plants, animals or human. Common air pollutants include sulphur dioxide, nitrogen oxide, carbon dioxide, carbon monoxide ozone, smoke and lead.

SOURCES OF AIR POLLUTION

There are many ways to classify the types of Air pollution chiefly they are classified as natural and manmade i.e. Anthropogenic.

Natural sources

The natural sources include volcanic eruptions, forest fires, sea salt sprays, pollen grains and pores. Radioactive minerals present in the earth crust are the sources of radioactivity in the air.

Man made Sources

These pollutants are generated due to various industrial and domestic activities of man. These include thermal power plants, Industrial units, fossil fuel burning, vehicular activities and agricultural operations. Thermal power plants are the major sources of SO_2 and fly ash releasing units in our country. Fertilizer units,

Smelters, textile mills, refineries and chemical industries are others sources of Air pollution. Automobile exhaust is another major source of air pollution in our country. About 40% air pollution is caused by automobiles.

TYPES OF AIR POLLUTANTS

According to origin air pollutants may be classified as primary and secondary. Primary pollutants are those which are directly emitted into the atmosphere from the sources. These include SO_2 , NO_2 , CO_2 and carbon monoxide (Co). Secondary pollutants are derived from chemical or photochemical reaction in between primary pollutants and normal atmospheric constituents. Ozone, peroxyacetyl nitrate (PAN), photochemical smog, sulphuric acid and nitric acids are common secondary air pollutants.

Air Pollution in India

The world health organization (WHO) Which rates only the major cities of the world has rated New Delhi as the fourth most polluted city in the world. However, compared to other cities in India, Delhi is not on the top in the list of polluted cities this rate goes to. Ahmedabad followed by Kanpur. According to CPCB Indian hitting critical levels Indore is one of them. In order to control the air pollution within limits CPCB Central Pollution Control Board has setup national ambient air quality standard which are as follows

EFFECTS OF AIR POLLUTION ON PLANTS AND ANIMALS

On plants: Air pollutants usually affect plant leaves by entering through minute pores called stomata during normal gaseous exchange. They destroy green pigment chlorophyll and affect the process of photosynthesis. The damage to leaves usually appears in the form of visual injury symptoms like chlorosis i.e. loss of chlorophyll causing yellowing of leaf, necrosis i.e. dead areas on leaf, bronzing on undersurface of leaves, epinasty i.e. down ward curling of leaf and excessive abscission i.e. dropping of leaves. These symptoms may result in over all retardation of plant growth.

Particulates deposited on leaves such as soot and cement can form encrustations and plug the stomata. The damage can result in death up plants. The extent of damage to the plant depends upon the nature and concentration of pollutants, time of exposure, soil condition, and stage of growth, relative humidity and extent of sunlight availability.

On animals: Arsenic, lead and fluorides are the main pollutants which cause damage to livestock. These air borne pollutants accumulate in vegetation and forage and affect the animals when they eat such contaminated vegetation.

Arsenic occurs as an impurity in coal and many ores. It is also used in insecticides. Live stock foraging near smelting and other industrial operations suffer arsenic poisoning. The symptom appears as salivation, thirst, liver necrosis and depression of central nervous system.

Lead is another very toxic common air pollutant which is emitted from metallurgical operations, coal combustions, lead arsenate sprays and automobile exhausts. Lead poisoning occurs in live stock as depression, lethargy, gastritis, paralysis and breathing trouble. Cattle such as sheep are particularly susceptible to fluorine toxicity which causes fluorosis of teeth and bones in which teeth are lost and bones become weak.

EFFECTS OF AIR POLLUTION ON HUMANS AND MATERIALS

On Humans: Air pollution has many effects on the human health. Adults exposed to low levels of pollution experience coughing soreness in chest and headaches. Prolong exposure to air pollutants adversely affect natural defenses and can result in lung cancer, asthma, chronic bronchitis and emphysema i.e. acute shortness of breath.

Sulphur dioxide (SO_2) causes constriction of respiratory passage and can cause bronchitis like symptoms. Oxides of Nitrogen especially NO_2 irritate the lungs and cause conditions like chronic bronchitis and emphysema. When High amount of carbon monoxide (Co) reaches the lungs combine with hemoglobin to form carboxyhaemoglobin. Haemoglobin is therefore unable to transport oxygen to various parts of body, this cause's suffocation carbon monoxide affinity with haemoglobin 210 times greater than oxygen. Prolong exposure to carbon monoxide may cause dizziness, unconsciousness and even death. Many other air pollutants like benzene, formaldehyde and particulates like polychlorinated biphenyls (PcBs) and dioxins generated by the burning of polythene can cause mutations, reproductive problems and even cancer. Particulate pollutants from slate pencil industry and asbestos factories can cause respiratory disease like silicosis and Asbestosis.

On materials: Air pollutants not only affect and damage the living beings they also affect the different types of non living matter. Because of their corrosive nature gases and particulates cause damage to exposed surfaces. Presence of SO₂ and moisture together can accelerate corrosion of metallic surface and stones. SO₂ can affect fabric leather, paint, paper, marble and lime stone. The stone cancer of famous Taj Mahal is a well known example of air pollution injury. Ozone in atmosphere can cause cracking of rubber. Oxides of nitrogen can also cause fading to cotton and rayon fibers.

GLOSSARY

Abscission- The dropping of leaves, fruits or flowers from a plant

Amphysema - Acute shortness of breath

Asbestosis- A lung disease caused by the deposition of asbestoes particles in the lungs

Bronchitis – An inflammation of the air passages

Chlorosis – Loss of green pigment chlorophyll causing yellowing of leaf

Epinasty –The downward curling of leaf

Flurosis – A disease of teeth caused by fluorine toxicity resulting in teeth loss

Gastritis –Inflammation of the stomach lining

Necrosis -Dead areas on the leaves

Primary pollutants – Pollutants which are directly emitted into the air from the sources such as so₂, no₂, and CO

PCBs - Polychlorinated biphenyls

Secondary pollutants – Pollutants which are derived from the chemical and photochemical reaction between primary pollutants and normal atmospheric constituents Peroxyacetyl nitrate (PAN) and sulphuric acid are common examples.

Stone cancer - Corrosive effect of acidic precipitation on a delicate stone such as marble

FAQ's

Que 1. What is air pollution ?

Ans. According to encyclopedia Britannica air pollution is the presence of man-caused or manmade contaminants in earth's atmosphere which may adversely affect property or the lives of plants, animals or human beings.

Que 2. When was the Indian Air Act passed ?

Ans. The air act was passed in 1981.

Que 3. What are Air Pollutants ?

Ans. The common air pollutants are sulphur dioxides, nitrogen oxide, carbon dioxide, carbon monoxide, ozone, smoke and lead.

Que 4. Name the types of pollution sources.

Ans. There are two types of pollution sources: natural and manmade sources, which are also known as Anthropogenic sources.

Que 5. What are Primary Pollutants ?

Ans. Primary pollutants are those which are directly emitted into the atmosphere from the pollution source such as SO₂, CO₂, etc.

Que 6. How secondary pollutants are formed in air ?

Ans. Secondary pollutants are derived from the chemicals or photochemical reactions in between primary pollutants and normal atmospheric constituents. Ozone, peroxy acetyl nitrate (PAN) and sulphuric acid are common secondary pollutants.

Que 7. What is the full form of PAN?

Ans. The full form of PAN is peroxy acetyl nitrate.

Que 8. What is Smog ?

Ans. Smog is a secondary pollutant formed to the interaction of smoke and fog constituents. SMOKE + FOG = SMOG.

Que 9. Name the common particulate pollutants.

Ans. The common particulate types of air pollutants are road dust and fly ash generated from thermal power plants.

Que 10. What is epinasty?

Ans. Epinasty is the downward curling of leaf. It may occur as an effect of air pollution.

Que 11. How do the air pollutants enter the leaves?

Ans. Air pollutants usually enter leaves through minute pores found on leaves known as stomata.

Que 12. Name the disease caused by excessive amount of fluorine fluorides.

Ans. The excessive amount of fluorides causes "fluorosis" in which teeth and bones become weak.

Que 13. What is common cause of bronchitis ?

Ans. Sulphur dioxide is a common cause of Bronchitis.

Que 14. How carboxy haemoglobin is formed ?

Ans. When high amount of carbon monoxide reaches to lungs it combines with haemoglobin and form carboxy haemoglobin.

Que 15. What is silicosis ?

Ans. Silicosis is a lung disease which results due to the deposition of pesticides from slate pencil industry.

CASE STUDY –1

TAJ MAHAL

The Taj Mahal Constructed by Emperor Shah Jahan at Agra is a symbol of love. It was constructed over a period of twenty two years employing twenty thousand workers and was completed in the year 1648. This memory of Mumtaz Mahal the dear wife of Shah Jahan is now facing the danger of air pollution. The industries in and around Agra releases a large amount of air pollutants including SO_2 , particulate matter NO_2 and soot causing blackening and yellowing of marble. These oxides react with rainwater and result in acidic precipitation which in turn causes deterioration and corrosion of delicate marble. This effect is known as stone cancer. To protect this symbol of love from damaging effects of air pollution Shri M.C. Mehta an environmental lawyer filed a public interest litigation in 1984 following this, the supreme court of India ordered 292 industries in the Taj area to be shutdown and or adopt cleaner control Technologies. This is a classical example of protecting important monuments from the damaging effects of air pollution.