UNIT-2:
POLLUTION AND ENVIRONMENTAL EDUCATION

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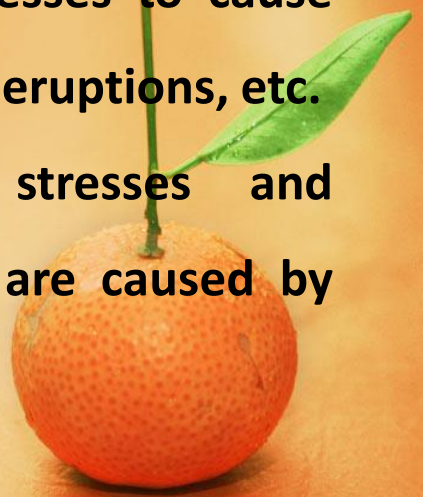
2.1 Meaning and definition of Environmental hazards and pollution.

Meaning and definition of Environmental hazards

- **Environmental hazards may be stated as those extreme events caused by natural process or man's activities which exceed the tolerable magnitude within or beyond certain time limits, make adjustment difficult, result in losses of property and lives.**
- **The events are caused by natural processes or human activities are called extreme events which aggravate natural environmental processes to cause disaster for human society such as earth quake, floods, volcanic eruptions, etc.**
- **The terms environmental hazards, environmental stresses and environmental disasters are used for extreme events which are caused by natural process or human activities.**



- **The environment hazards are the abnormal processes which cause environmental disasters or the results or environmental hazards or extreme events, The intensive of environmental disasters are assessed in terms of damages done to the human society.**
- **The environmental quality is lowered and deteriorated by these extreme events which are termed hazards and disasters.**
- **The environmental or ecological balance is disturbed; the resultant state of the highly disturbed natural environment is called 'Environmental Stress'.**
- **The natural sudden physical processes and events become hazards and disasters when humans live near a danger.**

- ***Meaning and definition of Environmental and pollution***
- **Environmental pollution and degradation are used interchangeably by most of the people because both are, concerned with the lowering of the 'quality of environment.' There are two aspects-(i) lowering the quality of environment and (ii) deterioration of the quality of environment. The deterioration of environmental quality refer the magnitude or intensity of the area covered.**
- **Environmental pollution means lowering of the quality of environment local caused by human activities for exploitation of resources.**
- **Environmental degradation means deteriorating the environmental quality at global, regional and local levels by both natural processes and human activities.**

- ***Definition of Pollution***
- **The adverse changes by human activities in the environmental quality at local level is generally called pollution, but sometimes the effects of human activities are so wide that the environment is degraded at global and regional level as well.**
- **Pollution is an undesirable change in the physical, chemical and biological characteristics of air, water and soil that may harmfully affect the life or create a potential health hazard of any living organization.**
- **Pollution is thus direct or indirect change in any component of the biosphere that is harmful to living organisms and man, affecting adversely the industrial progress, cultural and natural resources or general environment.**

2.1.1 Types of environmental hazards and disaster.

The extreme events are divided into two categories on the basis of causative factors:

(1) Natural hazards and disasters and

(2) Man-induced hazards and disasters.

The brief description and sub-types of natural and man induced hazards and disasters have been given in the following paragraphs:

1. Natural Hazards and Disasters. It involves rare high-intensity processes and extreme events caused by Terrestrial or Endogenous hazards and atmospheric or exogenous hazards. Thus, natural hazards and disasters are of two types:

(a) Terrestrial or endogenous hazards and disasters.

(b) Atmospheric or exogenous hazards and disasters.

(a) *Terrestrial or Endogenous Hazards and Disasters*. Normally, include those extreme events which are caused by endogenetic forces evolve from within the earth.

The causative factors of such extreme events and hazards are hidden deep within earths which are not observable, only their effects are observed and experienced.

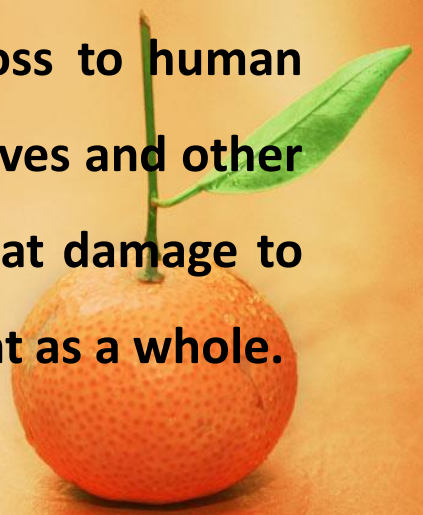
These can be further classified into three categories-

(i) Volcanic eruptions,

(ii) Earthquakes and

(iii) Landslides.

- These extreme events are caused by endogenetic thermal conditions of the interior of the earth. It is the result of disequilibrium in any part of the earth crust. In India earthquakes are along the Himalayas and foothill zones and Bihar. The three types of hazards and events are interrelated to each other. These extreme events are also causative factors to one another. The land slides are in hilly regions due to earthquakes.
- These hazards and disasters have resulted in great damages to human constructions-buildings, roads, rails, factories, dams, heavy loss to human property. On the other hand there is great disaster for human lives and other organisms. The quality of environment is deteriorated and great damage to human structures, towns and cities, dams and human settlement as a whole.



- **These extreme events cannot be prevented or checked, because these are beyond human control and management.**

***(b) Atmospheric or Exogenetic hazards and Disasters*.** **These are normally related to weather and climatic extreme conditions. These nature hazards are caused by atmospheric processes or forces which generate from with the atmosphere so these are known as "exogenetic natural hazards".**

- **The causative factors are not observable, but are recorded by meteorologists to forecast about the weather conditions.**

2.1.2-Types of pollution, land, air, water, noise and radiation – green house effect, ozone layer depletion.

There are various types of pollution which have been classified in different ways and on different criterion on the basis of the type of environment being polluted, may be classified in the following categories. Pollution is generally caused by human activities which can be divided into two broad categories:

1. Physical Pollution. It is caused by human activities due to lowering of the quality of physical components of the environment and this is further divided into three sub-types

(a) Air Pollution.

(b) Water Pollution.

- **2. Social Pollution.** It is caused in different aspects of the society due to cumulative effects of extreme events/hazards and pollution. It may be further subdivided into several categories:
- (a) Population Explosion.
- (b) Sociological Pollution-Educational and social backwardness, efc..
- (c) Economic Pollution-Poverty, devolution of currency, lower per-capita income.
- Another way to classify the pollution is the nature of pollutants. The pollutants are broadly classified into two categories.

- **1. Non-Degradable Pollutants. These are the materials and poisonous substances like aluminium, Mercuric salts, long-chain phenolics, etc., which do not degrade or degrade very slowly in nature. They are not cycled in ecosystem naturally.**
- **2. Biodegradable Pollutants. These are the domestic wastes that can be rapidly decomposed under natural conditions. They may create problems which they accumulate.**

Basis for cost of pollution.

The following are the main basis for evaluating cost of pollution :

(i) Damages to crop production.

(ii) Loss of resources by unnecessary wasteful exploitation.

(iii) Medical care of health due to disease.

(iv) Soiling of buildings and textiles.

(v) Corrosion of metals as iron, steel, copper, brass, zinc, lead, etc.

(vi)Pollution control involving money, funds, manpower etc., for disposal of pollutants and for control devices developed.

Land Pollution or Soil Pollution

- Soil is very important environmental component for human, animals and plants. It is the basic medium for food, vegetation and natural resources. It is also the base for the development of human culture and civilization. There are various aspects and components of soils-texture, structure, moisture, profiles and horizons.
- "The contamination of soil with excess of chemicals, fertilizers, insecticides, herbicides is known as soil pollution." The decrease in the quality of soils either due to human activities or natural sources or by both is known as soil pollution or soil degradation. The soil pollution is caused due to soil erosion, decrease in plant nutrients, decrease in soil micro- organisms, excess or deficit of moisture content, high fluctuation of temperature and lack of human content.

The Sources of Soil Pollution

The minor sources of soil pollution are accelerated rate of soil erosion, soil eruption, deforestation, excessive use of chemical fertilizers, pesticides, insecticides, polluted waste water from industries, urban areas, forest fires, a few micro-organisms, dumpling of urban and industrial wastes, water-logging and related capillary process treating processes drought, etc.

The air and water pollutants are also responsible for the soil degradation.

The sources are divided into five categories.

1. Physical sources, e,g. soils erosion, volcanic eruption.

2. Biological sources, e,g. the micro-organisms, bacteria and protozoa.

3. Air-born sources, e.g'., thermal power plants, industry and factory waste products.

4. Urban and industrial sources. Urban wastes degrade the soil properties, urban sewage pollute the soil.

The Effects of Soil Pollution

The soil pollution affects the human beings, animals, and plants adversely and degrades the quality of soils, soil pollution results in decrease in agricultural production. Soil erosion converts the fertile soil into waste land. The use of chemical fertilizers, pesticide and herbicides cause various diseases and several deaths.

Control of Soil Pollution

It is very essential to control and prevent soil pollution, because the existence of man, animals and vegetation depend upon the quality of soil' It is necessary to maintain and also increase tt e quality of soils' The essential commodities required for man, animals and plants come from soils' The following are suggestions to control soil pollution :

(i)To check the soil erosion by using controlling measures.

(ii)To use judiciously chemical fertilizers and pesticides and insecticides.

(iii) To restrict the use of DDT.

(iv)To dispose properly urban and industrial wastes.

(v) Crop management and proper land use.

(vi) To educate the farmers about the use of fertilizers and biocides.

(vii) To provide the awareness through adult education'

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AIR POLLUTION

The air pollution is generally accomplished through the pollutants of gases and solid and liquid particles of both organic and inorganic chemical. It is true that air is never pure because some gases such Sulphur dioxide, carbon monoxide, hydrogen sulphide emissions from volcanoes, swamps, dusts, salt spray, pollens from plants, etc. are continuously added to the air by these natural processes. Thus, the air becomes polluted when its natural composition is disturbed either by natural or man-made sources or activities or by-both.

The contamination of air with dust, smoke and harmful gases is called air pollution.

The atmosphere is a gaseous envelope which surrounds the earth from all sides and the air is a composition of several gases mainly nitrogen, oxygen, argon and carbon dioxide. Air is very important for all types of life in the biosphere. Even human life is not possible without air because man can survive for a few days without water and for a few weeks without food, but cannot live even for a few minutes without air or oxygen.

Sources of Air Pollution

There are two major sources of air pollution as follows:

1. Natural Sources. Such as volcanic eruptions, deflation of sand and dust, forest, or wild fires of natural vegetation, etc.

2. Manmade Sources or Human Activities. Such as industries, factories, urban centers, aircraft, nuclear experiments, automobiles, agriculture, power plants, etc.

From the different sources of air pollution, a variety of pollutants are released into atmosphere. The principal air pollutants emitted from these different sources are as follows:

(i) Carbon Compounds. These are mainly carbon dioxide and carbon monoxide, the former released by complete combustion of fossil fuels and the latter by automobile exhausts.

(ii) Sulphur Compounds. These include SO_2, H_2S and sulphuric acid mostly released by fossil fuel (coal, etc.) based power generating plants (Thermal plants) and industrial units as refineries.

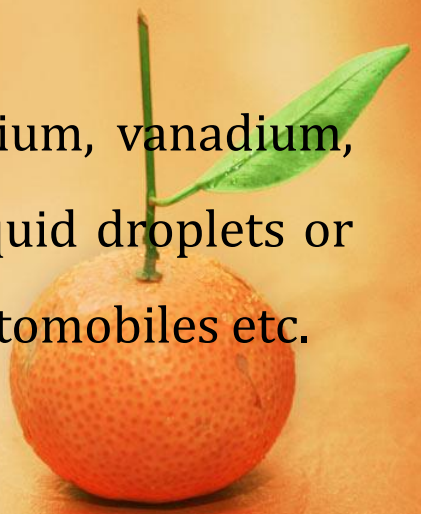
(iii) Nitrogen oxides. These include chiefly nitrogen monoxide, nitrogen oxide, Nitric acid mostly released by automobiles' power plants and industries.

(iv) Ozone. (O_3).Its level may rise in atmosphere due to human activities.

(v) Fluorochloro carbon. These come from industries, insecticides spray, etc'

(vi) Hydrocarbons. These are chiefly benzene' benzene' etc which is mostly discharged by automobiles and industries.

(vii)Metals. These include chiefly lead, Nickel, arsenic, beryllium, vanadium, titanium, cadmium, etc. Present in air as solid particles or liquid droplets or gases. They are produced mostly by metallurgical processes, automobiles etc.



Types of Air Pollution

Air pollution is classified on two bases as follows:

(1) On the basis of types of pollutants and

(2) On the basis of types of sources of pollutants

(1) On the basis of types of pollutants are further divided into two categories (a) Gaseous pollution and (b) Particulate air pollution.

2. On the basis of sources of air pollution is sub-divided into six categories- (a) Automobile Pollution, (b) Industrial Pollution, (c) Thermal pollution, (e) Rural Pollution and (e) Nuclear Pollution.

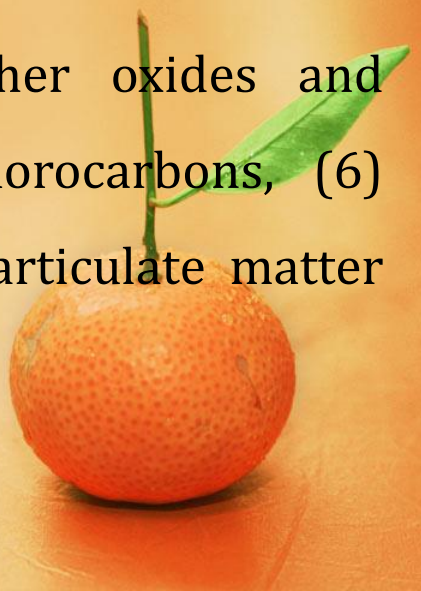
Generally, these pollution approaches are used to describe the air pollution. There is overlapping among the various ways used for this purpose

l. Automobiles Air Pollution. During this period of technological development, there is very rapid increase of cars, trucks, buses and two wheelers. It has raised the traffic density in our cities and towns. The vehicles create tones of gaseous pollutants into the air daily.

2. Industrial Air Pollution. India is the agricultural country but there is rapid development in the agricultural technology and engineering. The economic development is based on both agricultural and industrial development of a nation. There is also rapid industrial development in our country. There are industrial towns and complexes in our big cities. There are number of industries which are sources of air pollution. Kanpur city of Uttar Pradesh is the biggest industrial city of the state which has the heaviest air pollution due to dust and smoke of the factories.

3. Thermal Pollution. There are a number of thermal power stations and super thermal power stations in the country. The National Thermal Power Corporation (NTPC) is setting up four mammoth coal-powered power stations to augment to energy generation. The coal consumption of thermal power plants is millions of tons. The main pollutants are fly ash, sulpher dioxide and other gasses and hydrocarbons.

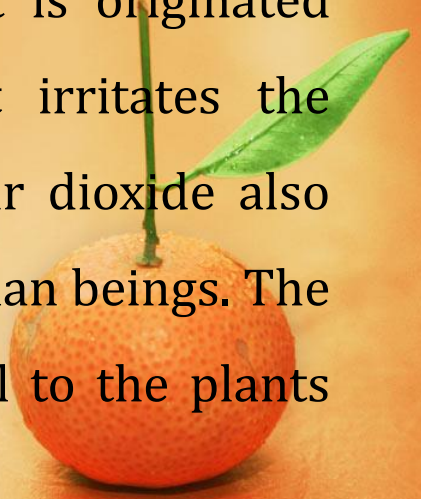
The different sources of air pollution release a variety of pollutants into the atmosphere as follows (1) carbon compounds, (2) Sulpher oxides and compounds, (3) Nitrogen Oxides, (4) ozone gas, (5) Fluorocarbons, (6) Hydrocarbons (7) Metals. (8) Photochemical products, (9) particulate matter and (10) Toxicants other than heavy metals.



Types of Air pollutants

1. Carbon compounds. The carbon monoxide is significant gaseous air pollution which is harmful to human health. It is mainly released from gasoline engines and burning coal and power thermal plants of factories. It combines with hemoglobin in human blood. and affects nervous system. An increase of carbon compound in atmosphere may result in Green house Effect, and damaging effect quality of the environment.

2. Surphur compounds. One of the common gaseous air pollutants which is known to be harmful to human heart is sulpher dioxide. It is originated primarily from the combustion of coal and petroleum. It irritates the respiratory epithelium and impairs normal breathing. Sulphur dioxide also causes in increase in cough, eyes irritation and headache in human beings. The increase in sulpher compounds in atmosphere is also harmful to the plants and animals.



3. Nitrogen Oxides. Even in unpolluted atmosphere, these are present in measurable amounts of nitrous oxide, nitric oxide and nitrogen dioxide. Of these nitric oxide (NO) is the pivot compound. It is produced by the combustion of O_2 and N_2 during lightning discharges and by bacterial oxidation of NH_3 in soil.

The main nitrogen compounds are Nitrous oxide, Nitric oxide, Nitrogen oxide. The nitrogen oxides are most important gaseous air pollutants which arise due to burning of fossil, fuels in automobiles and power plants. The most common type of nitrogenous air pollutant is nitrogen oxide. It reduces ultra-violet light in the atmosphere.

4. Dust Pollution. Dust is found to travel several thousands of kilometers across deserts and seas. Air-borne particles of the Sahara desert sand cross the Arabian Sea and reaches India. Thar Desert sand gradually reaching to the other states of the country. The dust air pollution is harmful to human health and it may lead to disease like allergic asthma bronchitis and fibrosis of the lungs. The dust air pollution can be controlled by certain evergreen plants, grasses and epiphytes like orchids. Certain plants are better dust collectors.

5. Benzene. A liquid pollutant is emitted from gasoline, It cause lung cancer. Benzpyrene is most potent cancer inducing hydrocarbon pollutant. It is also present in small amounts in smoke, tobacco, charcoal boiled stakes and gasoline exhaust. Methane (march gas) is a gaseous pollutant, in minute quantity in air about 0.00027% by volume. In nature this is produced during decay of garbage, aquatic vegetation, etc" This is also released due to burning of natural gas and from factories. Higher concentrations may cause explosions. In air the common metals present are mercury lead zinc and cadmium. They are released from industries and human activities in the atmosphere.

6. Mercury. A liquid volatile metal (found in rocks and soils) is present in air as a result of human activities as the use of mercury compounds in production of fungicides, paints, cosmetics, paper pulp etc.

7. Zinc. It is not a natural component of air, copper, lead and steel refineries also release some zinc in air. Zinc in air occurs as white zinc oxide fumes and is toxic to man.

8. Cadmium. It occurs in air due to industries and human activities. Cadmium - containing materials and those in refining, of copper, lead and zinc are the major sources of cadmium in to air.

9. Toxicants. There is a wide variety of toxic substances besides air pollutants which have the harmful effect on human health. Nickel is used in chemicals. Petroleum and metal products, electrical goods.

WATER POLLUTION

Water is most important natural resource. It is vital for the maintenance of all forms of lives and vegetation. We depend on water for irrigation, industry, domestic needs, drinking purpose for sanitation and disposal of waste. Our water bodies are ponds, lakes, sea, rivers, oceans which have become polluted due to industrial development and urbanization.

"The contamination of water with soluble sewage and industrial waste is called water pollution."

"Foreign materials either from natural and other sources are contaminated, with water supplies and may be harmful to life, because of their toxicity, reduction of normal oxygen level of water, aesthetically unsuitable effects and spread of epidemics." –World Health Organization (1966)

"Water pollution may be defined as alteration in physical, chemical and, Biological properties of water may cause harmful effects on human and aquatic Iife".

Source of Water Pollution

There are two main sources of water pollution as follows:

1. Natural Sources of water pollutants include soil erosion, volcanic

Eruption, landslides, coastal and cliff erosion, floods, decomposition of plants and animals.

2. Man-induced Sources of water pollutants include industrial development, urbanization, and agricultural sources, cultural sources (religious fair and pilgrimage) Kumbha fair at Allahabad is an example of cultural source of water pollution.

The main sources of water pollution are:

(i) Sewage and other waste in cities.

(ii) Industrial effluents and waste products.

(iii) Agricultural discharge, chemical fertilizers used.

(iv) Thermal power plants and nuclear plants waste.

Water pollution may be divided on the basis of sources and storage of water such as : 1. Surface water pollution.

2. Lake water pollution.

3. Ground water pollution.

4. Sea water pollution.

5. River water pollution.

Water pollution is also classified on the basis of sources of water pollution as follows.

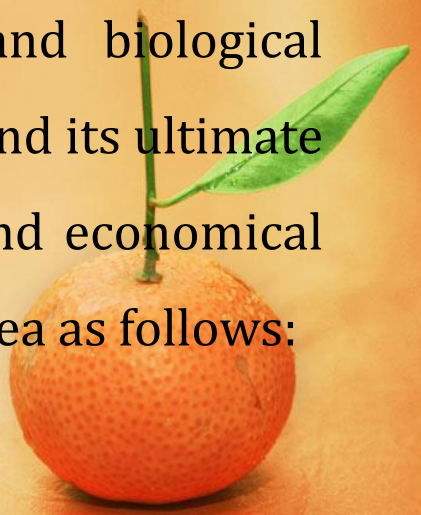
1. Sewage water pollution.

2. Domestic waste pollution.

3. Industrial waste water pollution.

4. Solid waste water pollution.

Each type of water pollution affects the physical and biological components of various aquatic systems in different degrees and its ultimate effect on man remains quite drastic in medical, aesthetic and economical sense. The well known ecological effects of water pollution area as follows:



1. Sewage Pollution. The primary source of sewage pollution is the discharge of untreated sewage in water bodies, sometimes due to improper sewage-handling processes of municipal bodies. This is very common in major cities of the country. Sewage is the waterborne waste derived from home (domestic waste) and animal or food processing plants. It includes human excreta, paper, cloth, soap, detergents, etc. These are a major proportion of the pollutants entering our water. There is uncontrolled dumping of wastes of rural areas towns and cities into ponds, lakes, stream or rivers.

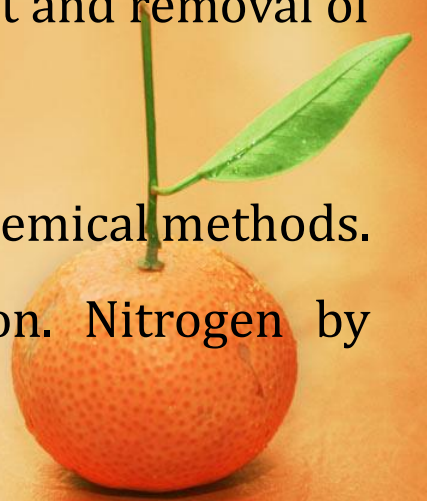
The following methods are to be used to check the water pollution through sewage waste.

(i) The waste water must be treated before its discharge into lake or river. This would limit its nutrient input.

(ii) To stimulate bacterial multiplication in order to reduce the amount of nutrients solubilized in water. This would help disruption of algal food-web.

(iii) To check recycle of nutrients into the water through harvest and removal of algal bloom upon their death and decomposition.

(iv) To remove dissolved nutrients from water by physical or chemical methods. For instance, phosphorous can be removed by precipitation. Nitrogen by biological nitrification and denitrification or by air stripping.



2. Industrial Effluents. A wide variety of both, inorganic and, organic pollutants are present in effluent from breweries, tanneries, dying textiles, paper and pulp mills, steel industries, mining operation s, etc. The pollutants include oils, greases, plastics, plasticizers, metallic wastes, suspended solids, phenols, toxins, acids, salts, dyes, cyanides, DDT etc". Many of which are not readily susceptible to degradation and thus cause serious pollution problems. Sulphuric acid waste from coal mines is a serious pollutant that increases the hardness of water, has disastrous effect on live organisms and corrodes concrete.

3. Thermal Pollution. The two chief pollutants are heat and radioactive Substance. These are the wastes chiefly from power plants-Thermal and Nuclear, which use large quantities of water. Some other industries also give out waste water after use. Nuclear power plants are the source of radionuclides. The quantity of waste water is highest in the thermal power plants in the country. This waste water is returned after use at very high temperatures to the streams-a river, lake. This affects the aquatic life in these water bodies. This is also called thermal pollution.

4. Agricultural Discharges. It is another kind of water pollution. These include chiefly the chemicals used as fertilizers and the pesticides (biocides) used in disease control. Their discharges reach into the water bodies. As compared to developed nations, India has relatively a low use of these chemicals, thus discharges into water are still low. India uses about 16 kg/h. of fertilizers. Modern agriculture rely heavily on a wide range of synthetic chemicals which include various types of fertilizers and biocides. They are dangerous, harmful and disturb the natural ecosystem. These chemicals affect the quality of the food stuffs. The chemical make water unfit for drinking and also cause diseases.

Pesticides are the chemicals used for killing the plant and animal pests. There is a wide scope of chemicals used as biocides, but these are most harmful to man by entering into our food chain. Pesticides create various types of diseases related to kidney, blood, urine and brain tissues.

Prevention and control of water pollution

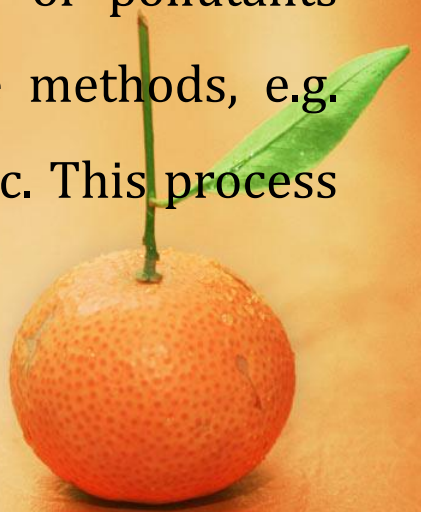
Control of water pollution requires several remedial measures. The following measures are suggested to control water pollution:

1. Maintaining stability of the ecosystem
2. Reutilization and recycling of waste
3. Removal of pollutants
4. Management of water pollution.

1. Maintaining Stability of the Ecosystem. It is most scientific method to control and prevent water-pollution. The basic principles are the reduction in waste input, thus water pollution is controlled at source. Several methods like biological as well as physical can be used to restore species diversity and to maintain ecological balance in the water bodies.

2. Reutilization and Recycling of Waste. The various types of waste include industrial effluents and thermal pollutants which may be reutilized. The urban waste is reused to generate, cheaper fuel gas and electricity. The efforts are being made in the development of suitable technology for waste water. so that it can be utilized in agriculture and prepare some useful products.

3.Removal of Water Pollutants. There are various types of pollutants present in water bodies which can be removed by suitable methods, e.g. absorption, electro dialysis, ions exchange, reverse osmosis, etc. This process is used for purifying water from sewage.



Soil or Land Pollution

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"The contamination of soil with excess of chemicals, fertilizers, insecticides,

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The Sources of Soil pollution

The major sources of soil pollution are accelerated rate of soil erosion, soil eruption, deforestation, and excessive use of chemical fertilizers, pesticides, insecticides, polluted waste water from industries, urban areas, forest fires, a few micro-organisms, and dumping of urban and industrial wastes, water-logging and related capillary process treating processes drought, etc.

The air and water pollutants are also responsible for the soil degradation. The sources are divided into five categories.

1. Physical sources, e.g. soils erosion, volcanic eruption.

2. Biological sources, e.g, the micro-organisms, bacteria and protozoa.

3. Air-born sources. e.g, Thermal power plants, industry and factory waste products.

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Control of Soil Pollution

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(ii) To use judiciously chemical fertilizers and pesticides and insecticides.

(iii) To restrict the use of D.D.T.

(iv) To dispose properly urban and industrial wastes.

(v) Crop management and proper land use.

(vi) To educate the farmers about the use of fertilizers and biocides.


Thank You