PUC Ist year - Semester – II

Unit VII: Environmental issues: Causes,effects and control measures

Module No: 37. Water pollution and Soil pollution

Water pollution:

Water pollution may be defined as the "Alteration in physical , chemical , and biological characteristics of water which may be cause harmful effects on human and aquatic biota. "

Or

Water pollution can be defined as the addition of some substances (organic, inorganic, biological or radiological) or factor (heat, pH) which degrades the quality of water so that it either becomes health hazard or unfit for use.

Water is one of the most essential things for survival of living organisms . Water pollution adversely changes the quality of water and makes it unsuitable for the living being . It disturbs or destroys the balance of ecosystems and cause hazards to public health .

Sources of water pollution:

1. Sewage and other waste: Sewage is the water borne waste derived from home (domestic waste) and animal or food processing plants. It includes human excreta, paper, cloth, soap, detergents ,organic matter in the form of food residue etc. These are a major proportion of the pollutants entering our water. Phosphates are the major ingredients of most detergents. The organic matter increases the biological productivity. Bacteria and fungi grow fast using oxygen of

water rapidly and making the medium unsuitable for other organisms due to the absence of oxygen.

Biological oxygen Demand (BOD): It is the amount of O_2 required for biological oxidation by microbes in any unit volume of water. The test is done at 20^0C for atleast five days. BOD value generally approximates the amount of oxidisable organic matter, and is therefore, used as a measure of degree of water pollution and waste level. Thus BOD value is proportional to the amount of organic waste present in water.

2. Industrial effluents: A wide variety of both inorganic and organic pollutants are present in effluents from chemical, fertilizer and pesticide manufacturing units, breweries, tanneries , dying textiles, paper and pulp mills , steel industries, mining operations etc. The pollutants include oils, greases, plastics , metallic wastes, suspended solids, phenols , toxins, acids, salts, dyes, cyanides, DDT etc. These effluents are acted upon by the bacteria and they are degraded into simpler substances. This process is called biodegradation. These biodegraded substances or metabolites may be more toxic than the substances from which they are degraded. Most of the organophosphorus group of compounds are biodegradable.

3. **Agricultural discharges:** Today use of fertilizers and biocides have become a compulsion to grow more vegetables, fruits and crops. Fertilizers mainly consists of nitrogen, phosphorus and potassium . Excess quantity of these fertilizers drained into ponds, rivers or lakes. This causes increase in growth of algae and the process is known as **algal bloom or eutrophication**. Dead algae is decomposed by bacteria . During the process of decomposition the bacteria uses much of the O_2 present in water. This leads to suffocation and death of aquatic life.

Biocides (insecticides, fungicides, herbicides) are composed of chlorinated hydrocarbons , thiocarbamates etc. Organo chlorine compounds (B.H.C.,DDT etc) have very long life and are more stable. They are lipophilic and soluble in fats. Hence they are highly toxic to aquatic organisms. These pesticides find their way to ground water and upset the aquatic ecosystem. They pass through food chains and accumulate mainly in the fatty tissues of animals. Their concentration continuously increases in successive trophic levels in a food chain . This phenomenon is known as **biomagnification** or biological accumulation.

4**. Marine Pollution:** All pollutants (Garbage, sewage, industrial effluents) are ultimately discharged into sea. The other source of marine pollution are navigational discharge of oil, grease and petroleum products . Radio active isotopes enter into the body of aquatic life (fish ,etc). when man consumes affected animals , these isotopes find their way into man's body causing many disorders of the body including mutation , cancer etc.

5. Thermal pollution: Electric power plants and nuclear power stations use water as a coolant. These units release hot water into the rivers, lakes, sea etc raising its temperature. Such hot effluents kill both plants and animals .

6. Silt pollution: Dust and dirt together is called silt. It is one of the components of soil with particle size 0.002 mm diameter. Silt is carried with water and choke irrigation channels. It affect adversely the aquatic life.

7. Oil pollution: Oil is a source of pollution in sea water. oil pollution is due to ship accidents, loading and discharging oil at the harbour, oil refineries and off shore oil production. It is extremely toxic and immediately affect living organisms.

8. Radio active wastes: In a nuclear reactor, water is used as a coolant. This water usually becomes radioactive due to radioactive matter leaking from the reactor. It

can find its way to river and sea. These radio active isotopes cause serious effects on plants and animals that live in water. It causes chromosomal aberration and gene mutation. When these aquatic animals are consumed by man , these isotopes find their way in their body.

9. Heavy Metals: Heavy metals are added to water resources from the waste water effluents of industries. Almost all metals are toxic. Toxic metals change the biological structures and systems leading to deformity in the body or finally death.

Effects of water pollution:

The waters polluted with domestic sewage spred a number of epidemic diseases, such as cholera, typhoid, dysentery, diarrhoea, Paratyphoid fever, schistosomiasis, infection hepatitis, jaundice etc. Due to industrial pollution there is oxygen depletion in water which kills the living fishes and other aquatic animals. Heavy metallic ions such as mercury, can cause irreversible brain damage, mental disorder, blurring vision and numbness of limbs and even death in man who may have consumed fish containing mercury (**Minamita disease**). Arsenic causes lung and skin cancer and diarrhoea. Chronic exposure to arsenic causes **black foot disease.** Water contaminated by cadmium causes **Itai-Itai disease**. Fluorides cause skeletal fluorosis or **knock knee disease**. Nitrates cause **blue babies**. The insecticides which accumulate in the body of fish and other aquatic organisms are a source of potential danger to man. Their consumption may cause cancer, nerve disorders, leukemia and other serious diseases in man. Radio active materials also cause damage to aquatic plants and animals and a number of diseases in man.

Control of water pollution:

1. **Reutilisation and recycling of waste:** Various kinds of wastes which include industrial effluents (as paper pulp or chemicals), sewage, thermal pollutants (waste water etc) may be recycled to beneficial use.
2. **Removal of pollutants:** Various pollutants (radioactive, chemical biological) present in water body can be removed by appropriate methods such as adsorption, electro dialysis, ion exchange, reverse-osmosis etc.
3. **Treatment of waste waters:** Both industrial and sewage water is treated in effluent treatment plant (ETP), before it is discharged in the water bodies.
4. Cooling towers should be used in industries to control thermal pollution.
5. Bleaching powder in required quantities should be used to disinfect the drinking water.
6. Ammonia could be removed from waste waters by ion exchange technique.
7. Phenolics could be removed from waste water of paper mills, petroleum refineries, tanneries by use of polymeric absorbents.
8. Waste water from printing and sari dying industries could be decolourised by an electrolyte decomposition technique.

Soil Pollution:

The Soil pollution may be defined as " the presence of any substance which is foreign to the soil system and adversely affects the productivity of the soil." The soil pollution can be distinguished into 2 types- Positive soil pollution and negative soil pollution. The positive soil pollution includes the introduction of toxic substances such as industrial pollutants and pesticides. The negative soil pollution is caused by soil erosion.

Source and effects of Soil pollution:

1. The major sources of land pollution are the industries. These are paper mills, textiles, oil refineries, power plants, chemical and fertilizer manufactures, iron and steel plants, plastic and rubber producing companies etc. These industries produce countless pollutants causing soil pollution. These pollutants affect and alter the chemical and biological properties of soil and lead to serious effects on living organisms.
2. Modern agricultural practices pollute the soil to a large extent through the non judicious use of chemical fertilizers and biocides. Most of these are stable chemicals and remains in the soil for long periods. Due to the continuous use chemical fertilizers the soil micro organisms lose their ability of nitrogen fixation and also kill earthworms which are living fertilizer factories. This adversely affects the fertility of soil.
3. The excretory matter and faecal products of man and live stock pollute the soil by adding pathogens to soil which causes serious health problems to man and their domestic animals.
4. Disposal of domestic refuge, garbage of building materials, empty bottles, wastes of automobiles, plastics etc are causing serious soil pollutions.
5. Acid rain changes the soil pH and makes the soil infertile.
6. Radio active substances resulting from explosions of nuclear devices, atmospheric fall out from nuclear dust and radio active wastes penetrate the soil and accumulate there creating land pollution.
7. Increasing population of cows, cattle, pigs and poultries have resulted in considerable soil pollution. Animal wastes contain several pathogenic

bacteria and viruses which enter into plant metabolism and ultimately to man.

Control of soil pollution:

1. The solid wastes have to be collected from various streets and cities to the disposal area.
2. Dumping of solid waste is a popular and inexpensive way of getting rid of wastes. Land fill operation, which is a biological method of treatment involves the depositing of refuse, compacting and covering it with a soil.
3. Recycling and recovery of materials (paper, glass, plastic, rubber, metals etc) is the best solution for reducing soil pollution.
4. Converting waste into biogas.
5. Biological methods of pest control help in minimizing the soil pollution.
6. Restoring forests and grass land (Afforestation) to check soil erosion and floods.
7. Shifting cultivation can be replaced by crop rotation, which will improve the fertility of land.
8. Proper law should be made and enforced. Public awareness should be generated.

Agro-Chemicals and their effects

Modern agriculture relay heavily as a wide range of synthetic chemicals which include different types of fertilizers, pesticides and herbicides. T,hey are also toxic to non-target organisms such as earthworms, nitrogen fixing bacteria etc., that are important components of soil ecosystem. These chemicals along with waste are washed off lands through irrigation, rainfall, drainage etc. reaching into the rivers, lakes etc where they disturb the natural ecosystem and make water bodies nutrient rich and leads to eutrophication. There is a wide range of chemicals used as pesticides and herbicides. But the most harmful are those which either donot degrade or degrade very slowly in nature. These are highly

potent chemicals that enter our food chain and then begin to increase in their concentrations at successive trophic levels in the food chain (Biomagnification) and these harmful chemicals pose a great threat to human health.

Check Points

- The presence of any foreign substance other than the natural constituents of water can be the source of pollution.
- Sewage wastes, Industrial effluents, agricultural discharges, radio active wastes, heavy metals, oil, grease, petroleum products, silt etc cause water pollution.
- Biological Oxygen Demand (BOD) is used as a measure of degree of water pollution. Higher the amount of oxygen used greater is the amount of pollutants.
- Excessive accumulation of nutrients leads to Eutrophication.
- Polluted water spreads a number of epidemic diseases.
- Industries, agricultural practices, disposal of domestic refuge, garbage, acid rains, radio active substances cause soil pollution.
- Soil pollution affects the productivity of the soil.
- Fertilizers, pesticides and herbicides are toxic to non target organisms like earthworms and also pose a great threat to human health.

Object Type Questions:

1. The urbon soild wastes are known as

   A. **Refuge** B. Garbage C. Silt D. None
2. BOD of a lake is high it means the

   A. Lake does not have decomposers **B. Lake is polluted** C. Lake does not get enough light D. Lake is not polluted

3. The increase of concentration of biocides in successive trophic levels of the food chain is called

   A. Eutrophication B. BOD **C. Bio magnification** D. Multiplication

4. Silt is

   A. Dust B. Dirt C. Oil **D. A & B**

5. Itai-Itai disease is caused by

   A. **Cadmium** B. Fluorides C. Arsenic D. Nitrates

6. Skeletal fluorosis or knock knee disease is caused by

   A. **Fluorides** B. Cadmium C. Arsenic D. Nitrates

7. Increase in growth of algae due to pollution is called

   A. Bio magnification **B. Eutrophication** C. BOD D. Bioconcentration

8. Water polluted with domestic sewage causes

   A. Typhoid B. Diarrhoea C. Cholera **D. All**

9. One of the following method is employed to control water pollution

   A. Use of effluent treatment plants

   B. Polymeric absorbents

   C. Electrolyte decomposition technique **D. All**

10. One of the following is responsible for soil pollution

    A. Industries

    B. Modern Agricultural practices

    C. Increasing animal population **D. All**

11. Match the terms in column A with suitable diseases in column B

Column - A	Column - B
i) Arsenic	a) Minimata disease
ii) Nitrate	b) Itai - itai
iii) Mercury	c) Blue baby syndrome

iv) Cadmium	d) Skeletal fluorosis
v) Flouride	e) Black foot disease

Ans: i (e), ii (c), iii (a), iv (b), v (d)

Short Answer Questions:

1. Describe control measures of water pollution?
2. What is BOD?
3. Explain Eutrophication?
4. How soil pollution is controlled?

Long Answer Questions:

1. Explain the sources and effects of water pollution?
2. Explain the sources, effects and control measures of soil pollution?