MODULE 31 - SOIL POLLUTION

OBJECTIVES

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

1. Know about soil pollution.
2. Learn about main sources of soil pollution.
3. Know about effects of soil pollution.
4. Learn more about the effects of soil pollution on plants, animals and human beings.
5. Know harmful effects of soil pollution on overall ecosystem and methods to control it.

SUMMARY

Soil, which forms the uppermost layer of the Land, is the most precious natural resource because it supports the whole life system, provides food and fodder in the form of Vegetation and stores what is essential for life. Due to urbanization and industrialization this valuable source is getting polluted. Soil pollution can be controlled by judicious disposal of sewage, industrial effluents and urban solid waste and by practising the “4 R rule” i.e. Refuse, Reduce, Recover and Recycle the waste materials especially polythene. Use of bio fertilizers and bio pesticides is a good solution to control soil pollution.

TRANSCRIPTION

Soil is a very important constituent of the Lithosphere. The word “soil” is derived from a Latin word “solum” which means earthy material in which plants grow. Soil can be defined as the weathered layer of the earth’s crust with living organisms and their products of decay. It is a very complex physico-biological system containing water, mineral salts, nutrients air and variety of soil organisms. The study of soil is called PEDOLOGY. Soil provides support to the plants and supplies nutrients for their growth and development.

A good fertile soil is one which is free from any contamination which reduces its quality to support a healthy and bumper crop. A non polluted soil has a ph value near 6.5 which is considered good for a large number of crops. Highly acidic and alkaline soils are not fit for cropping. A fertile soil contains a large amount of organic matter.

Dumping of various types of material especially industrial, domestic waste, sewage or use of pesticides and fertilizers in agriculture are the main causes of soil pollution. Soil pollution can be defined as **"contamination of soil system by considerable quantities of chemicals resulting in the reduction of its fertility with respect to the qualitative and quantitative yield of the crops**". These chemicals enter in the food chain and impart toxic effects on the consumers. Presently soil pollution is receiving greater attention due to its direct impact on public health. It differs from water and air pollution because the pollutants remain in direct contact of soil for relatively longer periods and alter the chemical and biological properties of soil. These require more attention to study and control it than other types of pollution. In other words soil pollution is defined as "**undesirable characteristics in the physico-chemical properties, which have adverse effects on human beings, plant growth and animals**".

CAUSES AND SOURCES OF SOIL POLLUTION

The major sources or causes of soil pollution includes: mining and quarrying, household waste, industrial waste, biomedical waste, fertilizers and pesticides used in agriculture. Various chemical substances present in them reach the soil and eventually ground water, rivers, lakes, streams, through rainfall, irrigation, drainage etc. Thus, polluting and disturbing the natural balance of the ecosystem. Some important pollution sources are:

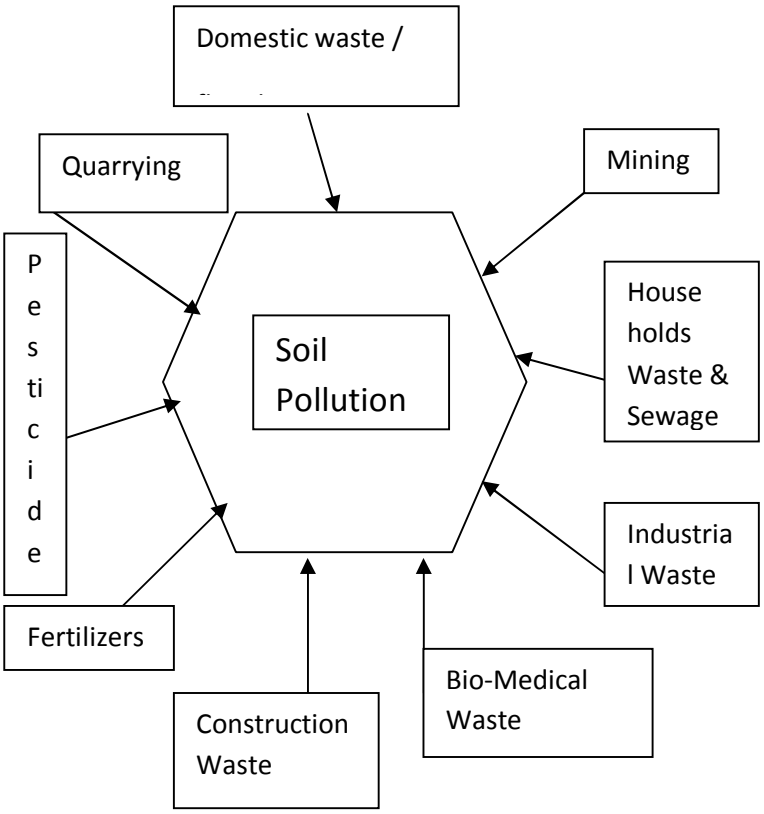

Fig:- Sources of Soil Pollution

1. Domestic Waste

Million tons of urban domestic waste is produced every year from critically polluted cities. Wastes from the residences are usually found dumped on soil and is a serious cause of concern. These wastes include polythene, garbage, organic waste, paper, glass, plastics, clothes, metal containers etc. plastic metal and glass do not degrade easily and cause more harm to the soils.

2. Industrial Waste

Wastes from textiles, tannery, chemicals industries, electroplating, glass, distilleries, paper, petroleum, thermal power plants and cement industries, etc enter the soil as it is disposed off or dumped as such. These wastes contain inorganic and organic materials that alter and change natural composition and chemistry of soil. Human and Animal excretion add pathogens to soil.

3. FERTILIZERS

The excessive use of nitrogenous fertilizers leads to nitrate discharge in the soil and ultimately pollute ground water. When human being drink this nitrate rich water the nitrates are converted to nitrites by the action of intestinal flora. The nitrites have an affinity to hemoglobin and combines with it to form **methamoglobin** which interferes the oxygen carrying capacity of blood. This phenomenon is called **methomoglobinaemia**. It is common in the infants and often results into blue baby syndrome. Its symptoms include blue coloration of the skin, vascular and respiratory problems, headache, giddiness and ocular tensions.

4. Pesticides

In modern agriculture the use of different pesticides to control various pesticides is increasing every year. Pesticides not only kill the target organisms but also affect large variety of living things including human beings. After the Second World War many countries suffered from food shortage and this resulted in the introduction of fertilizers and pesticides.

DDT (Dichloro Diphenyl Tricholroethane) is one of the first synthetic organic insecticides to be used. During the first ten years of its use (1942-1952), DDT is estimated to have saved about 5 million lives, primarily because of its use to control disease carrying mosquitoes, however DDT is a persistent type of pesticide, once applied it remains active for a long time. It do not break down easily and tend to accumulate in the soil and water. Persistent pesticides may accumulate in the bodies of animals and over a period of time their concentration increases if the animal is unable to flush them out of its body. Thus leading to the phenomena called **bio-accumulation.** When an affected animal is further eaten by another carnivore these pesticides are concentrated in the body of consumer. This phenomenon of acquiring increasing levels of substances in the bodies of higher tropic level organism is called **Bio magnification**. DDT is a well known case of bio-magnification of pesticide in the ecosystem.

5. Radioactive material

The radioactive wastes are generally released into the soil from nuclear explosion, atmosphere fallout from nuclear dusts, discharges from radioactive

laboratories. Radioactive elements such as Thorium, Uranium, Radium, and Cesium are commonly found in the environment that keeps emitting radiations.

EFFECTS ON LIVING ORGANISMS:

In the Vietnam war in 1970's dioxin was used as defoliant by the American army. It was found to cause congenital deformities and mental effects to the children born to the Americans soldiers and in the people of area where it was sprayed.

Nondegradable substances like glass, plastic, polythene and metal containers do not degrade easily and cause toxicity to the soil for very long periods. They also alter the physico-chemical properties of soil and disturb their natural composition. The nitrate fertilizer leads to blue baby syndrome in infants. Serious nitrate poisoning is reported in Rajasthan and Punjab due to excessive use of nitrogen fertilizers. Radiation emitted by radioactive substance dumped on soil persist for a long time. These radiations are known to bio-accumulate in plants also. Radiation can enter human beings when such exposed plants and food containing them are ingested resulting in mutations and genetic disorders.

SOIL POLLUTION CONTROL

As we know that industrial wastes, agricultural wastes, domestic wastes and toxic chemicals arising from the modern agriculture practices are the major sources of soil pollution. Thus, soil pollution can be reduced or controlled by practicing the following steps:

1. Effluents should be properly treated before discharging them into soil.
2. Solid wastes should be properly collected and disposed off by appropriate methods.
3. From the domestic or industrial waste recovery of useful materials should be done.
4. By practicing the "4 R rule" i.e. Refuse, Reduce, Recover and Recycle, the soil pollution can be reduced very efficiently.
5. Biodegradable organic waste should be used for composting or for generation of Biogas.
6. Wormy compositing is a good solution to reduce organic waste.
7. Cattle dung should be used for methane generation i.e. Biogas production.
8. Dustbins should be placed at every junction to avoid damping of wastes on the soil.
9. Industries should treat their wastes and dispose them in a proper way using appropriate technologies.

10. By using bio insecticides like Bacillus thuringiensis (Bt), Neem and Trichoderma which are eco-friendly and do not pollute soil.
11. General awareness should be created among the public regarding disposal of wastes through the seminars and lectures.

GLOSSARY

Lithosphere – Outer shell of the earth composed of the crust and the rigid outermost part of the mental.

Solum – A Latin word for soil.

Pedology – The scientific study of soil i.e. soil science.

Pesticides – Any chemical used in farming, gardening or indoors to combat pests.

Non-degradable – A substance which is not decomposed by micro organism.

Methamoglobinaemia – When nitrate is present in excess in drinking water it causes blue baby syndrome which is also known as methamoglobinaemia.

Nitrogenous – Substance containing nitrogen.

Blue baby syndrome – A disease in children in which a part of hemoglobin is converted into non-functional oxidized form due to the presence of excess of nitrate in drinking water.

Dioxins – Chlorinated hydrocarbon compounds used as defoliant, usually carcinogenic.

Defoliant – Any chemical which induces plant to shed off its leaves.

Bio-accumulation – Accumulation of non-bio degradable substance in the body of an organism.

Bio-magnification – Increase in the concentration of any non-biodegradable substance such as DDT at successive tropic levels in a food chain.

Compost – A nutrient rich soil amendment produced by biological degradation of organic material under aerobic condition.

Earth Crust – Soil outer zone of the earth.

DDT – Dichloro Diphenyl Tricholroethane, a pesticide.

Persistent – Chemicals which remain present in soil for very long time as such.

Carcinogen – Any agent promoting to know cancer e.g. chemicals, ionizing radiations.

Food Chain – A feeding series in an ecosystem.

FAQ'S

Q.1 What is soil?

A.1 Soil is the uppermost weathered layer of the Earth's crust with organisms and their products of decay in which plants grow.

Q.2 What do you mean by lithosphere?

A.2 Lithosphere is the outer shell of the Earth composed of the crust and the rigid outer most part of the mantle.

Q.3 Where from the word soil is derived?

A.3 The word soil is derived from a Latin word "solum".

Q.4 What is Pedology?

A.4 The study of soil is called Pedology.

Q.5 What are pesticides?

A.5 Pesticides are special types of chemicals used to kill pest like insects e.g. DDT.

Q.6 Define soil pollution?

A.6 Soil pollution can be defined as an "undesirable characteristics in its physico-chemicals properties, which have adverse effect on human beings, plant growth and animals.

Q.7 Name the major sources of soil pollution?

A.7 The major sources of soil pollution are mining, household waste, industrial waste, bio-medical waste and pesticides used in agriculture and polythene.

Q.8 Give the name of few common domestic soil pollutants?

A.8 The common domestic soil pollutants includes garbage, polythene, paper, glass, plastic canes, clothes and sewage.

Q.9 Which industrial waste is held responsible for soil pollution?

A.9 Waste generated from textile, tannery, electroplating, glass, paper mill and distillers are held responsible for polluting soil.

Q.10 What do you know about methamglobinaema?

A.10 The nitrate coming from agriculture waste have more affinity to hemoglobin than oxygen, thus it combines with hemoglobin and form methamoglobin thus interfere with oxygen carrying capacity of blood this condition is known as methamoglobinaemia.

Q.11 Why DDT is called persistent pesticide ?

A.11 DDT is called persistent pesticide because once applied in system it remain active for a very long time and also tend to accumulate in soil and animals.

Q.12 What is biomagnification?

A.12 The phenomenon of acquiring increasing levels of substance in the bodies of higher trophic level organism is called biomagnification.

Q.13 Name radioactive pollutants?

A.13 Uranium, Thorium and Radium are common radioactive pollutants.

Q.14 In which state nitrate pollution is reported as very serious problem?

A.14 Serious nitrate pollution is reported in Rajasthan and Punjab.

Q.15 What is worm composting?

A.15 Worm compositing is a good method to reduce organic waste converging into compost using Earthworms.